



**Grant Number:** 1K08AI067549-01A2 REVISED

**Principal Investigator(s):**  
JONATHAN H EPSTEIN, DVM

**Project Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

Winifred Zubin  
SENIOR RESEARCH SPECIALIST  
COLUMBIA UNIVERSITY  
CONSORTIUM FOR CONSERVATION MED  
460 WEST 34TH ST, 17TH FL  
NEW YORK, NY 10001

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 09/15/2007 – 08/31/2008

**Project Period:** 09/15/2007 – 08/31/2011

Dear Business Official:

The National Institutes of Health hereby revises this award (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to WILDLIFE TRUST in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release or other document that cites results from NIH grant-supported research must include an acknowledgment of NIH grant support and disclaimer such as "The project described was supported by Grant Number K08AI067549 from the National Institute Of Allergy And Infectious Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Allergy And Infectious Diseases or the National Institutes of Health."

Award recipients are required to comply with the NIH Public Access Policy. This includes submission to PubMed Central (PMC), upon acceptance for publication, an electronic version of peer-reviewed, original research publications, resulting from research supported in whole or in part, with direct costs from National Institutes of Health. The author's final manuscript is defined as the final version accepted for journal publication, and includes all modifications from the publishing peer review process. For additional information, please visit <http://publicaccess.nih.gov/>.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Jackie F. Johnson  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

**SECTION I – AWARD DATA – 1K08AI067549-01A2 REVISED****Award Calculation (U.S. Dollars)**

Federal Direct Costs	\$121,250
Federal F&A Costs	\$9,700
Approved Budget	\$130,950
Federal Share	\$130,950
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$130,950</b>

**AMOUNT OF THIS ACTION (FEDERAL SHARE)** \$0

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
1	\$130,950	\$130,950
2	\$130,950	\$130,950
3	\$130,950	\$130,950
4	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

CFDA Number: 93.855  
 EIN: 1311726494A1  
 Document Number: KAI067549A  
 Fiscal Year: 2007

IC	CAN	2007	2008	2009	2010
AI	8467417	\$130,950	\$130,950	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

PCC: M32A B / OC: 415L / Processed: (b) (6) 03/06/2008

**SECTION II – PAYMENT/HOTLINE INFORMATION – 1K08AI067549-01A2 REVISED**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

**SECTION III – TERMS AND CONDITIONS – 1K08AI067549-01A2 REVISED**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- The restrictions on the expenditure of federal funds in appropriations acts to the extent those restrictions are pertinent to the award.
- 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at 'http://grants.nih.gov/grants/policy/awardconditions.htm' for certain references cited above.)

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

**Treatment of Program Income:**  
Additional Costs

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**SECTION IV – AI Special Terms and Conditions – 1K08AI067549-01A2 REVISED**

UNRESTRICTED: Funds included in this award for research involving live vertebrate animals at the following site: Programme on Infectious Diseases and Vaccine Sciences, ICDDR, BANGLADESH, are unrestricted in accordance with January 25, 2008 letter review and approval of interinstitutional agreement between The Wildlife Trust and Tufts-New England Medical Center, Inc from Division of Assurances, Office of Laboratory Animal Welfare (OLAW) . Supersedes Notice of Grant Award (NGA) dated 09/07/2007.

This award has been adjusted to reflect a 11 month initial budget period with no reduction to the approved funding level. The carryover authority provided in this award will allow use of unexpended funds throughout the project. Future year anniversary dates will be Aug 1 and the non-competing grant progress report will be due Jun 1.

This is a Modular Award without direct cost categorical breakdowns in accordance with the guidelines published in the NIH Grants Policy Statement, December 2003, see ([http://grants2.nih.gov/grants/policy/nihgps\\_2003/NIHGPS\\_Part12.htm#\\_Toc54600227](http://grants2.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part12.htm#_Toc54600227)), pages 217-219. Recipients are required to allocate and account for costs related to this award by category within their institutional accounting system in accordance with applicable cost principles.

This award includes funds for subcontract/consortium activity with International Center for Diarrheal and Disease Research , DHAKA, BANGLADESH and is budgeted as follows:

	-Yr	-Yr	-Yr	-Yr
Total Direct Costs	\$ 12000	\$ 12000	\$ 12000	\$ 12000
F&A Costs @ 8%(MTDC)	\$	\$	\$	\$
TOTAL COSTS	\$ 12000	\$ 12000	\$ 12000	\$ 12000

Consortiums are to be established and administered as described in the NIH Grants Policy Statement. This written agreement with the consortium must address the negotiated arrangements for meeting the scientific, administrative, financial, and reporting requirements for this grant.

Grants Management must be notified at least 3 months in advance of any anticipated administrative changes on this award (for example change of institution, sponsor, and/or any type of sabbatical or leave of absence).

This Career Award requires a minimum of (b) (4), (b) (6) be devoted to the research project.

The guidelines for this K award (see applicable Program Announcement at <http://www.niaid.nih.gov/ncn/training/k.htm>) state that your institution may supplement the NIH salary contribution up to a level that is consistent with your institution's salary scale; however, supplementation may not be from Federal funds unless specifically authorized by the Federal program from which such funds are derived. Because the salary amount provided by this award is based on the full-time institutional salary, no other PHS funds may be used for salary supplementation.

Please note that a concise statement from the awardee's sponsor must be included in the non-competing progress report. The statement should address the progress and performance and include information on the availability of support for the candidate's research project during the next budget period. The typed name, signature of sponsor, and date must appear at the end of the Progress Report Summary.

Awardees who conduct research involving Select Agents (see 42 CFR 73 for the Select Agent list; and 7 CFR 331 and 9 CFR 121 for the relevant animal and plant pathogens) must complete registration with CDC (or USDA, depending on the agent) before using NIH funds. No funds can be used for research involving Select Agents if the final registration certificate is denied.

## STAFF CONTACTS

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Howard A. England

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Cristina Casseti

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-496-8030

## SPREADSHEET SUMMARY

**GRANT NUMBER:** 1K08AI067549-01A2 REVISED

**INSTITUTION:** WILDLIFE TRUST

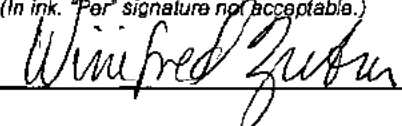
<b>Budget</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
TOTAL FEDERAL DC	\$121,250	\$121,250	\$121,250	\$121,250
TOTAL FEDERAL F&A	\$9,700	\$9,700	\$9,700	\$9,700
TOTAL COST	\$130,950	\$130,950	\$130,950	\$130,950

<b>Facilities and Administrative Costs</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
F&A Cost Rate 1	8%	8%	8%	8%
F&A Cost Base 1	\$121,250	\$121,250	\$121,250	\$121,250
F&A Costs 1	\$9,700	\$9,700	\$9,700	\$9,700

10123666

Int Application V 0 1 2006

Do not exceed character length restrictions indicated.

1. TITLE OF PROJECT (Do not exceed 81 characters, including spaces and punctuation.) <b>Risk for Future Outbreaks of Henipaviruses in South Asia</b>				
2. RESPONSE TO SPECIFIC REQUEST FOR APPLICATIONS OR PROGRAM ANNOUNCEMENT OR SOLICITATION <input type="checkbox"/> NO <input checked="" type="checkbox"/> YES (If "Yes," state number and title) Number: <del>PA-06-003</del> <b>106-512</b> Title: <b>Mentored Clinical Scientists Development Award (K08)</b>				
3. PRINCIPAL INVESTIGATOR/PROGRAM DIRECTOR		New Investigator <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes		
3a. NAME (Last, first, middle) <b>Epstein, Jonathan Harris</b>		3b. DEGREE(S) <b>DVM MPH</b>	3h. eRA Commons User Name <b>jepstein14</b>	
3c. POSITION TITLE <b>Senior Research Scientist, Veterinary Epidemiology</b>		3d. MAILING ADDRESS (Street, city, state, zip code) <b>The Consortium for Conservation Medicine Columbia University 460 West 34th st., 17th Floor New York, NY 10001</b>		
3e. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT				
3f. MAJOR SUBDIVISION				
3g. TELEPHONE AND FAX (Area code, number and extension) TEL: (b) (6) FAX: <b>212 380-4467</b>		E-MAIL ADDRESS: (b) (6)		
4. HUMAN SUBJECTS RESEARCH <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		5. VERTEBRATE ANIMALS <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes		
4b. Human Subjects Assurance No.		5a. If "Yes," IACUC approval Date <b>02-15-2005</b>	5b. Animal welfare assurance no. <b>A3415-01</b>	
4c. Clinical Trial <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		4d. NIH-defined Phase III Clinical Trial <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		
4a. Research Exempt <input type="checkbox"/> No <input type="checkbox"/> Yes		If "Yes," Exemption No.		
6. DATES OF PROPOSED PERIOD OF SUPPORT (month, day, year—MM/DD/YY) From <b>07/01/2007</b> Through <b>06/30/2011</b>		7. COSTS REQUESTED FOR INITIAL BUDGET PERIOD 7a. Direct Costs (\$) <b>\$121,250</b>		8. COSTS REQUESTED FOR PROPOSED PERIOD OF SUPPORT 7b. Total Costs (\$) <b>\$130,950</b> 8a. Direct Costs (\$) <b>\$485,000</b> 8b. Total Costs (\$) <b>\$523,800</b>
9. APPLICANT ORGANIZATION Name <b>The Consortium for Conservation Medicine</b> Address <b>Columbia University 460 West 34th st., 17th Floor New York, NY 10001</b>		10. TYPE OF ORGANIZATION Public: → <input type="checkbox"/> Federal <input type="checkbox"/> State <input type="checkbox"/> Local Private: → <input checked="" type="checkbox"/> Private Nonprofit For-profit: → <input type="checkbox"/> General <input type="checkbox"/> Small Business <input type="checkbox"/> Woman-owned <input type="checkbox"/> Socially and Economically Disadvantaged		
		11. ENTITY IDENTIFICATION NUMBER DUNS NO. <b>07-709-0066</b> Cong. District <b>8</b>		
12. ADMINISTRATIVE OFFICIAL TO BE NOTIFIED IF AWARD IS MADE Name <b>Jonathan Epstein</b> Title <b>Senior Research Scientist</b> Address <b>The Consortium For Conservation Medicine 460 W.34th St, 17th Floor New York, NY 10001</b> Tel: (b) (6) FAX: <b>212 380-4475</b> E-Mail: (b) (6)		13. OFFICIAL SIGNING FOR APPLICANT ORGANIZATION Name <b>Winifred Zubin</b> Title <b>Controller</b> Address <b>Wildlife Trust 460 West 34th st., 17th Floor New York, NY 10001</b> Tel: (b) (6) FAX: <b>212 380-4475</b> E-Mail: (b) (6)		
14. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.		SIGNATURE OF OFFICIAL NAMED IN 13. (In ink. Per signature not acceptable.) 		DATE <b>11/01/06</b>

**DESCRIPTION:** See instructions. State the application's broad, long-term objectives and specific aims, making reference to the health relatedness of the project (i.e., relevance to the **mission of the agency**). Describe concisely the research design and methods for achieving these goals. Describe the rationale and techniques you will use to pursue these goals.

**In addition**, in two or three sentences, describe in plain, lay language the relevance of this research to **public health**. If the application is funded, this description, as is, will become public information. Therefore, do not include proprietary/confidential information. **DO NOT EXCEED THE SPACE PROVIDED.**

Many emerging diseases are caused by zoonotic pathogens which spillover from wildlife reservoirs to humans following changes in demography, behavior or environment. Veterinarians can provide important input into research on emerging zoonoses, but specific training programs for these are lacking. The proposed training program will provide multidisciplinary training in molecular and serological diagnostic techniques and mathematical modeling of disease dynamics of a lethal zoonosis. Nipah virus (NiV) is a recently discovered, lethal, Class C potential bioterror pathogen with a case fatality rate of 40 - 79% in humans and for which no vaccines, nor clinically-proven therapies exist. Fruit bats (*Pteropus* spp.), have been identified as the natural reservoir for NiV and related viruses in Asia and Australia. Since 2001, NiV has caused five recognized outbreaks in Bangladesh and one in India. In contrast to Malaysia, where the virus first emerged, no intermediate animal host has been identified in Bangladesh, and there is evidence of direct bat-to-human transmission and person-to-person transmission.

The specific aims of this proposal are to: 1) Examine the distribution of NiV in flying foxes (*Pteropus giganteus*) in Bangladesh and bat migration among colonies by catching and testing bats for NiV using serological and molecular techniques, and satellite telemetry; 2) Test the hypothesis that seasonal NiV outbreaks in Bangladesh correspond to seasonal spikes in viral prevalence in fruit bat reservoirs during pregnancy and synchronous birthing, by conducting a longitudinal study within a bat colony in an area adjacent to a human NiV outbreak; and 3) Develop a parameterized predictive model for Nipah virus emergence in Bangladesh using data from this research to inform the model. I will co-analyse human epidemiological data with bat transmission data to identify specific temporal, spatial and contact risks for NiV spillover.

Results from this study can be used to inform public health policy for the prevention of Nipah virus outbreaks. Ultimately, I hope to create a model for identifying "hotspots" of high risk for NiV outbreaks in Bangladesh which can then be extrapolated to other countries where fruit bats occur such as India. This training program will provide a unique opportunity to develop my skills as a veterinary epidemiologist so that I can design and lead future research on the causes of zoonotic disease emergence.

PERFORMANCE SITE(S) (organization, city, state)

Columbia University: Consortium for Conservation Medicine & Mailman School of Public Health, New York  
International Center for Diarrheal and Disease Research, Dhaka, Bangladesh

Imperial College, London, UK

The Australian Animal Health Laboratory, Geelong, Australia

KEY PERSONNEL. See Instructions. Use continuation pages as needed to provide the required information in the format shown below. Start with Principal Investigator(s). List all other key personnel in alphabetical order, last name first.

Name	eRA Commons User Name	Organization	Role on Project
Epstein, Jonathan H.	(b) (6)	CCM/Columbia Univ.	Principal Investigator
Daszak, Peter	(b) (6)	CCM/Columbia Univ.	Primary Sponsor
Coulson, Timothy		Imperial College, London	Co-Mentor
Lipkin, W. Ian	(b) (6)	Columbia University	Co-Mentor

OTHER SIGNIFICANT CONTRIBUTORS

Name	Organization	Role on Project
Luby, Stephen P.	ICDDR,B	Consultant
Shaneaz Ali Khan	ICDDR,B	Field Assistant

Human Embryonic Stem Cells  No  Yes

If the proposed project involves human embryonic stem cells, list below the registration number of the specific cell line(s) from the following list: <http://stemcells.nih.gov/registry/index.asp>. Use continuation pages as needed.

If a specific line cannot be referenced at this time, include a statement that one from the Registry will be used.

Cell Line

Use this substitute page for the Table of Contents of Research Career Development Awards. Type the name of the candidate at the top of each printed page and each continuation page.

**RESEARCH CAREER DEVELOPMENT AWARD  
TABLE OF CONTENTS (Substitute Page)**

Page Numbers

**Letters of Reference\*** (attach unopened references to the Face Page)

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**Appendix** (Five collated sets. No page numbering necessary.)

Check if Appendix is included

Number of publications and manuscripts accepted for publication (not to exceed 5) 3

List of Key Items:

support letters; USDA permit; course description; ICDDR,B proposal; ethics certs

Note: Font and margin requirements must conform to limits provided in the Specific Instructions.

\*Include these items only when applicable.

**CITIZENSHIP**

U.S. citizen or noncitizen national       Permanent resident of U.S. (If a permanent resident of the U.S., a notarized statement must be provided by the time of award.)



**BUDGET FOR ENTIRE PROPOSED PROJECT PERIOD  
DIRECT COSTS ONLY**

BUDGET CATEGORY TOTALS		INITIAL BUDGET PERIOD <i>(from Form Page 4)</i>	ADDITIONAL YEARS OF SUPPORT REQUESTED			
			2nd	3rd	4th	5th
PERSONNEL: <i>Salary and fringe benefits. Applicant organization only.</i>						
CONSULTANT COSTS						
EQUIPMENT						
SUPPLIES						
TRAVEL						
PATIENT CARE COSTS	INPATIENT					
	OUTPATIENT					
ALTERATIONS AND RENOVATIONS						
OTHER EXPENSES						
CONSORTIUM/ CONTRACTUAL COSTS	DIRECT					
<b>SUBTOTAL DIRECT COSTS</b> <i>(Sum = Item 8a, Face Page)</i>						
CONSORTIUM/ CONTRACTUAL COSTS	F&A					
<b>TOTAL DIRECT COSTS</b>		121,250	121,250	121,250	121,250	
<b>TOTAL DIRECT COSTS FOR ENTIRE PROPOSED PROJECT PERIOD</b>						<b>\$ 485,000</b>

JUSTIFICATION. Follow the budget justification instructions exactly. Use continuation pages as needed.

A calendar year runs from November to November.

Salaried- personnel:

Jonathan Epstein is the Principal Investigator and will be spending (b) (6), (b) (4) per year of the project.

Non-salaried personnel:

Peter Daszak is the primary Sponsor of the project. He is the Executive Director of the Consortium for Conservation Medicine at Columbia University. He will be responsible for overseeing Dr. Epstein's doctoral training program, instructing him on paper and grant-writing, and facilitating his research activities. He will be spending (b) (6), (b) (4) per calendar year

Ian Lipkin is a Co-mentor and the Director of the Dawne L and Jerome Greene Infectious Disease Laboratory at Mailman School of Public Health, Columbia University. Dr. Lipkin is a virologist and will be overseeing Dr. Epstein's training in molecular and serological diagnostic techniques, and will provide in-kind support of reagents and materials related to PCR and ELISA. He will spend (b) (6), (b) (4) per year

Continued.....

Budget Page Justification (cont...)

Professor Timothy Coulson is a Co-mentor and Jonathan Epstein's PhD supervisor at Imperial College. He is a world-leader in the field of mathematical modeling, and will provide training for Dr. Epstein in disease modeling, beginning with the 3-week course "Advances in Ecology" in November, 2006. Dr. Coulson will spend (b) (6), (b) (4) per calendar year on this project.

Dr Stephen Luby MD is a consultant and the Head of Infectious Diseases and Vaccination Programme at the ICDDR,B. He is the PI on a large-scale research project on epidemiology of Nipah virus in Bangladesh, and will provide anonymous, non-identifiable data from his hospital-based surveillance, including data on contact rate between bats and humans, that Dr. Epstein will use to parameterize his models in **Specific Aim 3**. Dr. Luby will also provide logistical support to Dr. Epstein and the field team for bat surveillance, including some field equipment and storage for biological samples. He will spend (b) (6), (b) (4) calendar year on the project.

Dr Shaneaz Ali Khan DVM is a veterinarian hired through the CCM, working at the ICDDR,B under Dr Luby. He will assist Dr. Epstein with bat capture and sample collection, and lead the field team when Dr. Epstein is not in Bangladesh. Dr. Shaneaz has expertise in poultry disease and veterinary epidemiology. Dr. Epstein has trained Dr. Shaneaz in the safe capture, handling, and sampling of bats, as well as the safe handling and storage of biological samples for this project. Dr. Shaneaz is a full-time field assistant and will spend (b) (6), (b) (4) (b) (6), (b) (4) per year conducting bat surveillance.

Note: The budget applied for in this K08 will be supplemented for the cost of supplies, consumables, equipment, and per diem costs associated with working in Bangladesh; the cost of PCR and ELISA reagents at Columbia, and the sample testing at AAHL (SNT and viral isolation) by the Sponsor, Peter Daszak's core CCM funds from (b) (4) pending (b) (4) and if the K08 is awarded, then Dr. Epstein's salary from the EID grant and (b) (4) (b) (4)

**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Jonathan H. Epstein		POSITION TITLE Senior Research Scientist, Veterinary Epidemiology	
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Brandeis University, MA	BA	1996	Biology
Tufts University, Sch. Vet. Med., Grafton, MA	DVM	2002	Wildlife Med., Intl. Med.
Tufts University, School of Medicine, Boston, MA	MPH	2002	Epidemiology
Tufts University, Sch. Vet. Med., Grafton, MA	Cert Intl Med	2002	Zoonotic Diseases

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

**A. Positions and Honors****Positions and Employment**

- 2002 Public Health Externship, Division of Viral and Rickettsial Diseases, Centers for Disease Control and Prevention (CDC), Atlanta, GA
- 2002-2003 Veterinary Internship, Small animal emergency and critical care, Ocean State Vet. Spec., RI
- 2003 Veterinarian, small animal clinical medicine.
- 2003- Adjunct Faculty, Dept. Ecology, Environmental and Evolutionary Biology, Columbia Univ., NY
- 2006- Adjunct Faculty, Dept. of Epidemiology, Mailman School of Public Health, Columbia Univ, NY
- 2003- Adjunct Faculty, Tufts University School of Veterinary Medicine, Grafton, MA
- 2003- Senior Research Scientist, Consortium for Conservation Medicine, Columbia University, NY

**Other Experience and Professional Memberships**

- 1998- Member: American Veterinary Medicinal Association, American Association of Zoo Vets, Wildlife Disease Association, New York Academy of Sciences,
- 2003- Member, IUCN Veterinary Specialist Group
- 2004 Invited speaker, WHO, Emerging Zoonotic Diseases Working Group meeting
- 2004 Invited speaker, Merieux Foundation Conference on Emerging Viral Respiratory Pathogens
- 2004 Invited speaker, Swiss Re Executive Roundtable on Emerging Diseases
- 2004 Invited speaker, Royal Swedish Academy of Forestry and Agriculture: Ecology of Henipaviruses
- 2004 Invited speaker, Swedish University of Agricultural Sciences: Disease Emergence
- 2006- Member, IUCN Chiroptera Species Specialist Group; Advisory committee, Suffolk County Board of Public Health; Delta Omega Public Health Honors Society, International Association of Ecology and Health

**Honors**

- 2002 First recipient, Certificate of International Veterinary Medicine, Tufts University Sch. Vet. Med.

- 2002 Hills award for excellence in veterinary clinical nutrition
- 2002 Sylvia Mainzer award for outstanding achievement in the field of public health
- 2006 Inducted into Delta Omega Honor Society for Public Health (Alpha Rho Chapter – 1<sup>st</sup> alumni inductee; 1<sup>st</sup> Inaugural Keynote Speaker)

**B. Peer-reviewed publications (in chronological order)**

1. McCall, B.J., Epstein, J.H. & Annette, N., Potential human exposure to Australian bat Lyssavirus, Queensland, 1996-1999. *EMERGING INFECTIOUS DISEASES* 2000; 6: 259-264
2. Kaufman, G.E., Else, J., Bowen, K., Anderson, M. & Epstein, J.H. Conservation medicine in the veterinary curriculum. *ECOHEALTH* 2004; 1: S43-S49.
3. Daszak, P., Tabor, G.M., Kilpatrick, A.M., Epstein, J. & Plowright, R. Conservation Medicine and a new agenda for emerging diseases. *ANNALS OF THE NEW YORK ACADEMY OF SCIENCE* 2004; 1026: 1-11
4. Patz, J.A., Daszak, P., Tabor, G.M., Aguirre, A.A., Pearl, M., Epstein, J., Wolfe, N.D., Kilpatrick, A.M., Foufopoulos, J., Molyneux, D., Bradley, D.J. & Members of the Working Group Land Use Change and Disease Emergence. Unhealthy Landscapes: Policy Recommendations on Land Use Change and Disease Emergence. *ENVIRONMENTAL HEALTH PERSPECTIVES* 2004; 112: 1092-1098
5. Newman SH, Epstein JH, Schloegel LM. The nature of emerging zoonotic diseases: ecology, prediction, and prevention. *MEDICAL LABORATORY OBSERVER*. 2005 Jul;37(7):10-1, 14-6, 18-9.
6. Li W, Shi Z, Yu M, Ren W, Smith C, Epstein JH, Wang H, Crameri G, Hu Z, Zhang H, Zhang J, McEachern J, Field H, Daszak P, Eaton BT, Zhang S & Wang L-F Bats are natural reservoirs of SARS-like coronaviruses. *SCIENCE* 2005; 310: 676-679.
7. Pulliam J, Field H, Olival KJ & the Henipavirus Ecology Research Group (Epstein). An alternative explanation of Nipah virus strain variation. *EMERGING INFECTIOUS DISEASES* 2005; 11: 1978-1979
8. Daszak, P., Plowright, R., Epstein, J.H., Pulliam, J., Abdul Rahman, S., Field, H.E., Smith, C.S., Olival, K.J., Luby, S., Halpin, K., Hyatt, A.D. & the Henipavirus Ecology Research Group (HERG). The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum. In: Collinge, S.K. & Ray, C. (Eds.), *Disease Ecology: Community Structure and Pathogen Dynamics* Oxford University Press 2006; pp 186-201.
8. Epstein, J.H., Field, H.E., Luby, S., Pulliam, J., and Daszak, P. Nipah Virus: Impact, Origins, and Causes of Emergence. *CURRENT INFECTIOUS DISEASE REPORTS* 2006; 8: 59-65.
9. Epstein, J.H., Rahman, S.A., Zambriski, J.A., Halpin, K., Meehan, G., Jamaluddin, A.A., Hassan, S.S., Field, H.E., Hyatt, A.D., Daszak, P. & HERG. Feral cats (*Felis catus*) as possible vectors for Nipah virus. *EMERGING INFECTIOUS DISEASES* . 2006. 12: 1178-1179.
10. Breed, A.C., Field, H.E., Epstein, J.H., Daszak, P. Emerging henipaviruses and flying foxes - conservation and management perspectives. *BIOLOGICAL CONSERVATION*. 2006. 131: 211-220.

11. Epstein, J.H., McKee, J., Shaw, P., Hicks, V., Micalizzi, G., Daszak, P., Kilpatrick, A.M. & Kaufman, G. The Australian white ibis (*Threskiornis molucca*) as a reservoir of zoonotic and livestock pathogens. ECOHEALTH In press.
12. McLaughlin, A.B., Epstein, J.H., Prakash, V., Smith, C.S., Daszak, P., Field, H.E., and Cunningham, A.A. Plasma biochemistry and hematological values for wild-caught flying foxes (*Pteropus giganteus*) in India J. ZOO. WILD. MED. In press.
13. Halpin, K., Hyatt, A.D., Plowright, R.K., Epstein, J.H., Daszak, P., Field, H.E., Wang, L., Daniels, P., and the Henipavirus Ecology Research Group. Emerging viruses – coming in on a wrinkled wing and a prayer. JOURNAL OF CLINICAL INFECTIOUS DISEASES. (Accepted 10/06)

**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Peter Daszak		POSITION TITLE Executive Director, Consortium for Conservation Medicine	
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Bangor University (UK)	BSc. (hons)	1986	Zoology
University of East London (UK)	Ph.D	1994	Infectious Diseases

**A. Positions and Honors****Positions and Employment**

- 1989-1992 Research Assistant, University of East London
- 1993-1998 Senior Faculty Research Scientist, Kingston University
- 1999 Guest Researcher, Centers for Disease Control and Prevention (CDC)
- 1999-2001 Faculty Research Scientist, University of Georgia
- 2000- Honorary Research Associate, Institute of Zoology, UK
- 2001- Adjunct Faculty, Dept. Environmental & Population Hlth, Tufts Univ. School Vet. Medicine
- 2001- Adjunct Faculty, CERC, Columbia University & Institute of Ecology, University of Georgia
- 2001- Executive Director, Consortium for Conservation Medicine
- 2006- Adjunct Faculty, Dept. of Epidemiology, Mailman School of Public Health, Columbia Univ, NY

**Other Experience and Professional Membership**

- 2000 Keynote speaker Merieux Foundation Conference on Emerging paramyxoviruses, France
- 2002 National Academy of Sciences: testified before panel on infectious disease & climate change
- 2003 National Research Council: Reviewer, report on National Ecological Observatories Network
- 2002- United Nations Millenium Ecosystem Assessment: Lead Author, human infectious diseases
- 2003- NIH: ad hoc member, ZRG1 IDM-G 90 study section: Virology, Biodefense & Emerg. Diseases
- 2005- NIAID: ad hoc member, ZRG1 IRAP-Q study section
- 2004- Editorial Board, Conservation Biology (Blackwell); Founding Co-Editor *EcoHealth* (Springer)
- 2004-2005 National Research Council: Member, Committee on Future Needs in Veterinary Research
- 2004- Member of Scientific Committee, Diversitas (UNESCO-ICSU).
- 2005- International Standing Advisory Board, Australian Biosecurity Cooperative Research Center
- 2005 NIAID: Steering Committee, workshop on virus-host shifts & emergence of new pathogens
- 2006- Founding board of directors, treasurer, International Association of Ecology and Health

## Honors

- 1999 Meritorious service award, Centers for Disease Control and Prevention (CDC)
- 2000 Winner of the CSIRO silver medal for international collaborative research
- 2002 Daszak *et al.* (2000) *Science* paper cited by ISI as a "fast-breaking paper"
- 2003 6<sup>th</sup> Annual Lecturer in Medicine and Humanities, Texas A&M, 2003
- 2006 West Nile virus paper cited as "editor's choice", *Science* 311: 1675

## B. Peer-reviewed publications (selected from 101)

1. Ball SJ, Allen I & Daszak P Transfer of Extraintestinal stages of *Eimeria vermiformis* in the mouse. **JOURNAL OF PARASITOLOGY** 1990; 76: 424-425.
2. Ekobom A, Daszak P, Kraaz W & Wakefield AJ. Crohn's disease after *in utero* measles virus exposure. **LANCET** 1996; 348: 515-517.
3. Berger L, Speare R, Daszak P, et al. Chytridiomycosis causes amphibian population declines in the rain forests of Australia and Central America. **PROC. NATL ACAD. SCI, USA** 1998; 95: 9031-9036.
4. Daszak P Zoite migration during *Eimeria tenella* infection: parasite adaptation to host defenses. **PARASITOLOGY TODAY** 1999; 15: 67-72.
5. Daszak P & Cunningham AA Extinction by infection. **TRENDS IN ECOLOGY & EVOL.** 1999; 14: 279.
6. Daszak P, Berger L, Cunningham AA, Hyatt AD, Green DE & Speare R Emerging infectious diseases & amphibian population declines. **EMERGING INFECTIOUS DISEASES** 1999; 5: 735-748.
7. Daszak P, Cunningham AA & Hyatt AD Emerging infectious diseases of wildlife - threats to biodiversity and human health. **SCIENCE** 2000; 287: 443-449
8. Daszak P & Cunningham AA More on the ecological impact of fungal infections on wildlife populations. **PARASITOLOGY TODAY** 2000; 18: 404-405.
9. Daszak P, Cunningham AA & Hyatt AD. Conservation Conundrum. **SCIENCE** 2000 288: 2318
10. Daszak P The NIH-FIC Henipavirus group: Examining the role of anthropogenic changes in the ecology and emergence of Hendra and Nipah viruses. **JOURNAL OF CLINICAL VIROLOGY** 2003;28: S39-S40.
11. Mazzoni R, Cunningham AA, Daszak P et al. Emerging pathogen in frogs (*Rana catesbeiana*) farmed for international trade. **EMERGING INFECTIOUS DISEASES** 2003; 9: 995-998
12. Goldsmith CS, Whistler T, Rollin PE, Ksiazek TG, Rota PA, Bellini WJ, Daszak P, Wong KT, Shieh W-J & Zaki SR Elucidation of Nipah virus morphogenesis and replication using ultrastructural and molecular approaches. **VIROLOGY RESEARCH** 2003; 92: 89-98
13. Field H, Mackenzie J & Daszak P Novel viral encephalitides associated with bats (Chiroptera) - host management strategies. **ARCHIVES OF VIROLOGY** 2004; Suppl. 18: 113-121.
14. Hyatt AD, Daszak P, Cunningham AA, Field H & Gould AR Henipaviruses: Gaps in the knowledge of emergence. **ECOHEALTH** 2004; 1: 25-38.
15. Anderson PK, Cunningham AA, Patel NG, Morales FJ, Epstein PR & Daszak P Emerging infectious diseases of plants: Crop homogeneity, pathogen pollution and climate change drivers. **TRENDS IN ECOLOGY & EVOLUTION** 19: 535-544
16. Daszak P, Tabor GM, Kilpatrick AM, Epstein J & Plowright R Conservation Medicine and a new agenda for emerging diseases. **ANNALS NY ACAD. SCI.** 2004; 1026: 1-11.
17. Li W, Shi Z, Yu M, Ren W, Smith C, Epstein JH, Wang H, Crameri G, Hu Z, Zhang H, Zhang J, McEachern J, Field H, Daszak P, Eaton BT, Zhang S & Wang L-F Bats are natural reservoirs of SARS-like coronaviruses. **SCIENCE** 2005; 310: 676-679.
18. Daszak P Scott, D.E., Kilpatrick, A.M., Faggioni, C., Gibbons, J.W. & Porter, D. Chytridiomycosis does not cause population declines in long-term monitored amphibian populations at the Savannah River Site. **ECOLOGY** 2005; 86: 3232-3237.
19. Olival KJ & Daszak P The ecology of emerging neurotropic viruses **J. NEUROVIROL.** 2005; 11: 441-446
20. Kilpatrick AM, Kramer LD, Campbell S, Alleyne EO, Dobson AP & Daszak P West Nile virus risk

- and the bridge vector paradigm. **EMERGING INFECTIOUS DISEASES** 2005; 11: 425-429.
21. Wolfe ND, Daszak P, Kilpatrick AM & Burke DS. Bushmeat hunting, deforestation and prediction of zoonotic disease emergence. **EMERGING INFECTIOUS DISEASES** 2005; 11:1822-1827
  22. Pulliam J, Field H, Olival KJ & the Henipavirus Ecology Research Group (Daszak). An alternative explanation of Nipah virus strain variation. **EMERGING INFECTIOUS DISEASES** 2005; 11: 1978-1979
  23. Daszak, P, Plowright R, Epstein JH, Pulliam J, Abdul Rahman S, Field HE, Smith CS, Olival KJ, Luby S et al. The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum. In: Collinge S & Ray S, Eds. *Disease Ecology*. Oxford Univ. Press 2006; 186-201
  24. Epstein JH, Field HE, Luby S, Pulliam JRC, Daszak P. Nipah virus: Impact, origins and causes of emergence. **CURRENT INFECTIOUS DISEASE REPORTS**, 2006; 8: 59-65
  25. Kilpatrick AM, Kramer LD, Jones MJ, Marra PP & Daszak P. West Nile virus epidemics in North America are driven by shifts in mosquito feeding behavior. **PLoS BIOLOGY** 2006; 4: 606-610.
  26. Epstein JH, Rahman SA, Zambriski JA, Halpin K, Meehan G, Jamaluddin AA, Hassan SS, Field HE, Hyatt AD, Daszak P & HERG. Feral cats (*Felis catus*) as possible vectors for Nipah virus **EMERGING INFECTIOUS DISEASES** 2006; 12: 1178-1179.
  27. LeBreton M, Umlauf S, Djoko CF, Daszak P, Burke DS, Kwenkam PY & Wolfe ND. Rift Valley Fever in Goats, Cameroon. **EMERGING INFECTIOUS DISEASES** 2006; 12: 702-703.
  28. Mendelson JR, Lips KR, Gagliardo RW, Rabb GB, Collins JP, Diffendorfer JE, Daszak P *et al.* Policy Forum: Confronting amphibian declines and extinctions. **SCIENCE** 2006; 313: 48.
  29. Wang, L.-F., Shi, Z., Zhang, S., Field, H., Daszak, P., Eaton, B.T. A review of bats and SARS: virus origin and genetic diversity. **EMERGING INFECTIOUS DISEASES** in press.
  30. Kilpatrick, A.M., Chmura, A.A., Gibbons, D.W., Fleischer, R.C., Marra, P.P. & Daszak, P. Predicting the global spread of H5N1 avian influenza. **PROC. NATL. ACAD. SCI., USA** in press.
  31. Field, H.E., MacKenzie, J. and Daszak, P. Henipaviruses: emerging paramyxoviruses associated with fruit bats. **CURRENT TOPICS IN MICROBIOLOGY AND IMMUNOLOGY** in press.
  32. Halpin, K., Hyatt, A.D., Plowright, R.K., Epstein, J.H., Daszak, P., Field, H.E., Wang, L., Daniels, P.W. and the Henipavirus Ecology Research Group (HERG). Emerging viruses: coming in on a wrinkled wing and a prayer. **CURRENT INFECTIOUS DISEASES** in press.

### C. Research Support

#### ONGOING RESEARCH SUPPORT

5 R01 TW05869 Daszak

08/01/02-08/01/07

NIH/Fogarty International Center

Anthropogenic change & emerging zoonotic paramyxoviruses

This award is to investigate anthropogenic factors that drive emergence of Nipah and Hendra viruses in Malaysia and Australia.

Role: PI

(b) (4)

07/01/04-06/30/09

The goal of this grant is to provide second-stage core funding of the

(b) (4)

Role: PI



4 NO1 AI-25490 Kramer (PI)

10/01/02-10/01/09

NIH/NIAID

West Nile & pox viruses: ecology, pathogenesis & immunity

This subcontract provides partial salary for a postdoc to conduct field studies, mathematical modeling and analysis of the ecology of West Nile virus in the USA.

Role: Subcontractee

Kilpatrick (PI)

09/01/05-08/30/10

National Science Foundation/National Institutes of Health: Ecology of Infectious Diseases program

Predicting spatial variation in West Nile virus transmission

This project is to assess the interaction between vector populations, reservoir host populations and West Nile virus across an urban-to-rural human density gradient in the northeastern USA.

Role: Co-PI

COMPLETED RESEARCH SUPPORT (Selected projects during last 3 years)

DEB 02133851 Collins (PI)

10/01/03 -09/30/06

National Science Foundation

Emerging diseases of wildlife: Threats to amphibian conservation

This project was to assess the role of environmental factors and emerging diseases on the global decline of amphibian populations.

Role: PI on subcontract

IBN 9977063 Collins (PI)

09/15/99 -05/15/03

National Science Foundation

Host-Pathogen Biology and the Global Decline of Amphibians

The goal of this project was to assess the role of environmental factors leading to disease emergence and the global decline of amphibian populations.

Role: PI on subcontract

HSD 0525216 Daszak (PI)

10/15/05-10/14/06

National Science Foundation: Human and Social Dynamics

Collaborative Research: Socio-Economic and Environmental Drivers of Emerging Diseases

National Science Foundation

This project was to use a database and GIS approach to analyze patterns of human EID emergence and produce a broad risk assessment.

Role: PI

**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.

Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME W. Ian Lipkin		POSITION TITLE Jerome L & Dawn Greene Professor of Epidemiology; Professor of Neurology and Pathology	
eRA COMMONS USER NAME (b) (6)			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Sarah Lawrence College, Bronxville, NY Rush Medical College, Chicago, IL	B.A. M.D.	1974 1978	Liberal Arts Medicine

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

**A. Positions and Honors.*****Positions and Employment***

- 1977-78 Clinical Clerk, Institute of Neurology, Queen Square, London, UK  
 1978-79 Intern in Medicine, Presbyterian Hospital, University of Pittsburgh, Pittsburgh, PA  
 1979-81 Resident in Medicine, University of Washington, Seattle, WA  
 1981-84 Resident in Neurology, University of California, San Francisco, CA  
 1984-90 Postdoctoral Fellow (Michael Oldstone & Floyd Bloom), Scripps Research Institute, La Jolla, CA  
 1990-02 Asst. Professor (1990-93), Assoc. Professor (1993-96), Professor (1996-02), Neurology; Anatomy & Neurobiology; Microbiology & Molecular Genetics, University of California Irvine, Irvine, CA  
 1996-97 Sabbatical Professor, Institut für Virologie und Immunbiologie, Universität Würzburg, Germany  
 1996-02 Adjunct Professor, Neuropharmacology, The Scripps Research Institute, La Jolla, CA  
 2000-02 Louise Turner Arnold Professor of Neuroscience, University of California Irvine, Irvine, CA  
 2002- Jerome L. and Dawn Greene Professor of Epidemiology; Director, Jerome L and Dawn Greene Infectious Disease Laboratory, Mailman School of Public Health; Professor of Neurology and Pathology, College of Physicians & Surgeons; Columbia University, New York, NY  
 2003- Principal Investigator and Scientific Director, Northeast Biodefense Center, Region II NIAID Regional Center of Excellence for Biodefense and Emerging Infectious Diseases

**Other Experience and Professional Memberships**

American Board of Internal Medicine, 1981; American Board of Psychiatry and Neurology, 1986; National MS Soc Advisory Committee on Fellowships, 1991-94; PI and Co-Director, UCI-Markey Program in Human Neurobiology, 1994-99; Founding Chair, Scientific Advisory Board, Cure Autism Now Fdn, 1998-2000; Advisory Board, 1<sup>st</sup> Intl Conf on Emerging Zoonoses, 1996; Organizer, Keystone Symp on Infections of the Nervous System, 1998; NCI/NIAID Blue Ribbon Panel on New Approaches to Identifying Infectious Etiologies

of Chronic Disease, 1999; Bio-Centric Operations, US Joint Warfighting Center (bioterrorism), 1999; Organizer, NIAID Blue Ribbon Panel on Neurovirology, 2000; Organizer, Banbury Conf on Microbiology, Immunology and Toxicology of Autism and Other Neurodevelopmental Disorders, 2000; Organizer, Infectious Etiologies of Neuropsychiatric Disorders, World Congress Biol Psychiatry, Berlin, 2001; Organizer, FASEB Snowmass Conf Microbial Pathogenesis, 2002; NCI Blue Ribbon Panel, Microbial Infection and Human Cancer, 2002; Scientific Advisory Board, 454 Life Sciences Corp, 2003; WHO SARS Lab Network, 2003; External Reviewer, Board of Scientific Counselors, NIMH, 2003; Founding Chair, Emerging Infectious Diseases Discussion Group, NY Academy of Sciences, 2003; WHO Lab Network, 2004

### **Honors**

National MS Soc Postdoc Fellow, 1984; Silver Medal for Claret (Amateur) Sonoma County Fair, 1985; NINDS Clinical Investigator Development Award, 1987; National Alliance for Research in Schizophrenia and Depression (NARSAD) Young Investigator Award, 1991; Pew Scholar Biomedical Sciences, 1991; State-of-the-Art Lecturer, American Soc Virology, 1997; Lecturer, XXist Collegium Internationale Neuropsychopharmacologicum (CINP), 1997; Lecturer, 50<sup>th</sup> Anniversary NIAID/NIH, 1998; Visiting Professor, Japanese Health Sci Fdn, 1999; Visiting Bruenn Professor, Columbia Univ 2000; Commencement Speaker, Sarah Lawrence College, 2000; ASM/Waksman Fdn Lecturer, 2001; Ellison Medical Fdn Senior Scholar in Global Infectious Diseases, 2002; Distinguished Lecturer, Institute of Genomics and Bioinformatics, UC Irvine, 2003; Special Advisor for Scientific Research and International Cooperation in the Fight Against SARS, People's Republic of China, 2003; Advisory Board, Guangzhou Ctr Biomedicine and Health, 2003; Dalldorf Research Physician NYS Dept of Health, 2003; Fellow, NY Academy of Sciences, 2003

### **B. Selected peer-reviewed publications (in chronological order).**

- Lipkin WI, Parry G, Kiprov D, Abrams D (1985) Inflammatory neuropathy in homosexual men with lymphadenopathy. *Neurology* 35, 1479
- Panitch HS, Francis GS, Hooper CJ, Messing RO, Lipkin WI (1985) Immunologic studies in patients with acquired immune deficiency syndrome. *Ann NY Acad Sci* 437, 413
- Lipkin WI, Battenberg ELF, Bloom FE, Oldstone MBA (1988) Viral infection of neurons can depress neurotransmitter mRNA levels without histologic injury. *Brain Res* 451, 333
- Lipkin WI, Carbone KM, Duchala CS, Narayan O, Oldstone MBA (1988) Neurotransmitter abnormalities in Borna disease. *Brain Res* 475, 366
- Lipkin WI, Travis GH, Carbone KM, Wilson MC (1990) Isolation and characterization of Borna disease agent cDNA clones. *Proc Natl Acad Sci USA* 87, 4184
- Briese T, de la Torre JC, Lewis A, Ludwig H, Lipkin WI (1992) Borna disease virus, a negative-strand RNA virus, transcribes in the nucleus of infected cells. *Proc Natl Acad Sci USA* 89, 11486
- Briese T, Schneemann A, Lewis AJ, Park Y, Kim S, Ludwig H, Lipkin WI (1994) Genomic organization of Borna disease virus. *Proc Natl Acad Sci USA* 91, 4362
- Schneider PA, Schneemann A, Lipkin WI (1994) RNA splicing in Borna disease virus, a non-segmented, negative-strand RNA virus. *J Virol* 68, 5007
- Solbrig MV, Koob GF, Fallon JH, Lipkin WI (1994) Tardive dyskinesic syndrome in rats infected with Borna disease virus. *Neurobiol Dis* 1, 111
- Schneider PA, Hatalski CG, Lewis AJ, Lipkin WI (1996) Biochemical and functional analysis of the Borna disease virus G protein. *J Virol* 71, 331

- Schwemmle M, De B, Shi L, Banerjee A, Lipkin WI (1997) Borna disease virus P-protein is phosphorylated by protein kinase C $\epsilon$  and casein kinase II. *J Biol Chem* 272, 21818
- Schwemmle M, Salvatore M, Shi L, Lee C, Lipkin WI (1998) Interactions of the Borna disease virus P, N, and X proteins and their functional implications. *J Biol Chem* 273, 9007
- Hatalski CG, Hickey WF, Lipkin WI (1998) Humoral immunity in the central nervous system of rats infected with Borna disease virus. *J Neuroimmunol* 1998:90:128
- Hatalski CG, Hickey WF, Lipkin WI (1998) Evolution of the immune response in the central nervous system during experimental Borna disease. *J Neuroimmunol* 90, 137
- Hornig M, Weissenböck H, Horscroft N, Lipkin WI (1999) An infection-based model of neurodevelopmental damage. *Proc Natl Acad Sci USA* 96, 12102
- Briese T, Jia X-J, Huang C, Grady LJ, Lipkin WI (1999) Identification of a Kunjin/West Nile-like flavivirus in brains of New York encephalitis patients. *Lancet* 354, 1261
- Jia X-J, Briese T, Jordan I, Rambaut A, Chi HC, Mackenzie JS, Hall RA, Scherret J, Lipkin WI (1999) Genetic analysis of the West Nile New York 1999 encephalitis virus. *Lancet* 354, 1971
- Weissenböck H, Hornig M, Hickey WF, Lipkin WI (2000) Microglial activation and neuronal apoptosis in Bornavirus infected neonatal Lewis rats. *Brain Pathol* 10, 260
- Solbrig MV, Koob GF, Parsons LH, Kadota T, Horscroft N, Briese T, Lipkin WI (2000) Increased sensitivity to psychostimulants following CNS viral injury: potential vulnerability for drug addiction. *J Neurosci* 20, RC104
- Jordan I, Briese T, Fischer N, Lau J, Lipkin WI (2000) Ribavirin inhibits West Nile virus replication and cytopathic effect in neural cells. *J Infect Dis* 182, 1214
- Walker MP, Schlaberg R, Hays AP, Bowser R, Lipkin WI (2001) Absence of echovirus sequences in brain and spinal cord of ALS patients. *Ann Neurol* 49, 249
- Lipkin WI, Hornig M, Briese T (2001) Borna disease virus and neuropsychiatric disease. *Trends Microbiol* 9, 295
- Solbrig MV, Koob GF, Lipkin WI (2002) Key role for enkephalinergic tone in cortico-striatal-thalamic function. *European J Neurosci* 16, 1
- Solbrig MV, Schlaberg R, Briese T, Horscroft N, Lipkin WI (2002) Neuroprotection and reduced microglial proliferation in ribavirin treated bornavirus infected rats. *Antimicrob Agents Chemother* 46, 2287
- Briese T, Rambaut A, Pathmajeyan M, Bishara J, Weinberger M, Pitlik S, Lipkin WI (2002) Phylogenetic analysis of a human isolate from the 2000 Israel West Nile virus epidemic. *Emerg Infect Dis* 8, 528
- Zhai J, Briese T, Dai E, Wang X, Pang X, Du Z, Liu H, Wang J, Wang H, Guo Z, Chen Z, Jiang L, Zhou D, Han Y, Jabado O, Palacios G, Lipkin WI, Tang R (2004) Real-time polymerase chain reaction for detecting SARS coronavirus, Beijing, 2003. *Emerg Infect Dis* 10, 300
- Hoffman KL, Hornig M, Yaddanapudi K, Jabado O, Lipkin WI (2004) A murine model for neuropsychiatric disorders associated with group A  $\beta$ -hemolytic streptococcal infection. *J Neurosci* 24,1780

Hornig M, Chian D, Lipkin WI (2004) Neurotoxic effects of postnatal thimerosal are mouse strain-dependent. *Mol Psychiatry* 9, 833

Briese T, Rambaut A, Lipkin WI (2004) Analysis of the medium (M) segment sequence of Guaroa virus and its comparison to other orthobunyaviruses. *J Gen Virol* 85, 3071-3077

Qiao M, Mundrigi A, Bernard KA, Palacios G, Zhou ZH, Lipkin WI, Jake Liang TJ (2004) Induction of sterilizing immunity against West Nile virus by immunization with West Nile virus-like particles produced in insect cells. *J Infectious Dis.* 190 (2004): 2104-2108

Domingo C, Palacios G, Jabado O, Reyes N, Niedrig M, Gascon J, Cabrerizo M, Lipkin WI, Tenorio A.. Use of a short fragment of the C-terminal E gene for detection and characterization of two new lineages of dengue virus 1 in India. *J Clin Microbiol.* 2006 Apr;44(4):1519-29.

Williams BL, Yaddanapudi K, Kirk CM, Soman A, Hornig M, Lipkin WI. Metallothioneins and zinc dysregulation contribute to neurodevelopmental damage in a model of perinatal viral infection. *Brain Pathol.* 2006 Jan;16(1):1-14.

Briese T, Bird B, Kapoor V, Nichol ST, Lipkin WI. Batai and Ngari viruses: M segment reassortment and association with severe febrile disease outbreaks in East Africa. *J Virol.* 2006 Jun;80(11):5627-30.

Palacios G, Briese T, Kapoor V, Jabado O, Liu Z, Venter M, Zhai J, Renwick N, Grolla A, Geisbert TW, Drosten C, Towner J, Ju J, Paweska J, Nichol ST, Swanepoel R, Feldmann H, Jahrling PB, Lipkin WI. MassTag polymerase chain reaction for differential diagnosis of viral hemorrhagic fever. *Emerg Infect Dis.* 2006 Apr;12(4):692-5.

**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Timothy Coulson		POSITION TITLE Senior Lecturer in Population Biology, Department of Biological Sciences.	
eRA COMMONS USER NAME			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
University of York, UK Imperial College (Silwood Park campus), UK	Bsc (Hons) Ph.D	1987-90 1994	Biology Biology

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

**A. Positions and Honors**

1989 Research assistant for George Adamson. Kora National Park, Kenya  
 1990 Research assistant. Kafue Lechwe project, Zambia  
 1994 – 1997 Postdoctoral researcher, Institute of Zoology, London.  
 1997 – 2000 Research Fellow, Institute of Zoology, London.  
 2000 – 2003 Research Fellow, Large Animal Research Group, Dept. Zoology, Cambridge University.  
 2003 – 2004 Lecturer in Population Biology, Dept. Zoology, Cambridge University  
 2004 – Current Senior Lecturer in Population Biology, Dept. Biological Sciences, Imperial College

**Other Experience and Professional Membership**

1998 Joint convenor of European Science Foundation workshop on *Environmental change and vertebrate population dynamics*, Cambridge  
 1999 Joint convenor of Darwin Initiative workshop on biodiversity management in Ethiopia  
 1999 - 2006 Invited participant in three NCEAS (National Center for Ecological and Analytical Synthesis) working groups, Santa Barbara: *Stochastic Demography* (meetings 2004, 2005, 2006), *Large Vertebrate Population Dynamics* (meetings 2001, 2002, 2003) and *Managing Variability* (1999)  
 2001 - Editorial board, *Proceedings of the Royal Society of London, B*  
 2002 – 2005 Editorial board, *Ecology Letters*  
 2002 - 2005 Member of the Roster of Reviewers for the Research Council of Norway  
 2003 - Invited participant and speaker at the Clim-Pop workshop on Understanding the impact of climate change on the population dynamics of vertebrates, France.  
 2003 - Invited keynote speaker at Ecological Society of America annual meeting, Savannah, Georgia  
 2003 - Member of NERC peer review college  
 2003 - 2006 Editorial board, *Journal of Evolutionary Biology*  
 Reviewer for the following journals (selected from 26 journals):  
*Science, Nature, PNAS, Ecology, TREE, Proc. Roy. Soc. B, Oryx, Journal of Applied Ecology*

**B. Selected peer-reviewed publications (in chronological order)**

(Publications selected from 53 peer-reviewed papers and book chapters)

1. Coulson, T., Albon, S. D., Guinness, F. E., Pemberton, J. M., & Clutton-Brock, T. H. Population substructure, local density and calf winter survival in red deer. *ECOLOGY* 1997; 78: 852-863.
2. Grenfell, B.T., Wilson, K., Finkenstädt, B.F., Crawley, M.J., Coulson, T.N., Murray, S., Clutton-Brock, T.H. & Albon, S.D. Noise and determinism in synchronised sheep dynamics. *NATURE* 1998; 394: 674-677.
3. Stuart, G.R., Boussinesq, M., Coulson, T.N., Elson, L. & Bradley, J.E. Onchocerciasis modulates the immune response to mycobacterial antigens. *CLINICAL AND EXPERIMENTAL IMMUNOLOGY* 1999;117: 517-523.
4. Grenfell, B.T., Finkenstädt, B.F., Wilson, K. Coulson, T.N. & Crawley, M.J. Reply- Nonlinearity and the Moran effect. *NATURE* 2000; 406: 847.
5. Catchpole, E.A., Morgan, B.J.T., Coulson, T.N., Freeman, S.N. & Albon, S.D. Factors influencing Soay sheep survival. *APPLIED STATISTICS* 2000; 49: 453-472.
6. Paul, R.E.L., Coulson, T.N. Raibaud, A. & Brey, B.T. Erythropoietic sex determination in malaria parasites. *SCIENCE* 2000; 287: 128-131.
7. Coulson, T., Catchpole, E.A., Albon, S.D., Morgan, B.J.T., Pemberton, J.M., Clutton-Brock, T.H., Crawley, M.J. & Grenfell, B.T. Age, Sex, Density, Winter Weather and Population crashes in Soay sheep. *SCIENCE* 2001; 292: 1528-1531.
8. Coulson, T., Mace, G.M., Hudson, E.J. & Possingham, H. The use and abuse of population viability analysis. *TREE* 2001;16: 219-221.
9. Balmford, A., Clegg, L. Coulson, T. & Taylor, J. Why conservationists should heed Pokemon. *SCIENCE* 2002; 295: 2967.
10. Coulson, T., Lindstrom, J. & Cotgreave, P. Seeking new recruits. *SCIENCE* 2002; 295: 2023-2024.
11. Clutton-Brock, T.H., Coulson, T., Milner-Gulland, E.J., Thomson, D. and Armstrong, H.M. Sex differences in emigration and mortality affect optimal management of deer populations. *NATURE* 2002; 415: 633-637.
12. Coulson, T. Predicting the future and saving species. *TREE* 2003; 18: 14-15.
13. Coulson, T., Kruuk, L.E.B., Tavecchia, G., Pemberton, J.M. and Clutton-Brock, T.H. Estimating selection on neonatal traits in red deer using elasticity path analysis. *EVOLUTION* 2003; 57: 2879-2892.
14. **Milner-Gulland, E.J., Bukreeva, O.M., Coulson, T., Lushchekina, A.A., Kholodova, M.V., Bekenov, A.B. & Grachev, Iu. A. Reproductive collapse in a harem-breeding ungulate. *NATURE* 2003; 422: 135.**
15. Hallett, T.B., Coulson, T., Pilkington, J.G., Clutton-Brock, T.H., Pemberton, J.M. and Grenfell, B.T. Why large-scale climate indices appear to explain ecological processes better than local weather. *NATURE* 2004; 430: 71-74.
16. Stenseth, N.C., Chan, K-S., Tavecchia, G., Coulson, T., Mysterud, A., Clutton-Brock, T.H. and Grenfell, B.T. Modelling non-additive and non-linear signals from climatic noise in ecological time series: Soay sheep as an example. *PROC. ROY. SOC. B* 2004; 271: 1985-1993.
17. Coulson, T., Rohani, P. and Pascual, M. Skeletons, noise and population growth: the end of an old debate? *TREE* 2004; 19: 359-364.
18. Clutton-Brock, T.H., Coulson, T. and Milner, J.M. Red deer stocks in the Highlands of Scotland. *NATURE* 2004; 429: 261-262.

19. **Coulson, T., Guinness, F.E., Pemberton, J.M. and Clutton-Brock, ECOLOGY**
20. Catchpole, E.A., Morgan, B.J.T. and **Coulson, T.N.** (in press) Conditional methodology for individual case-history data. APPLIED STATISTIC

### Ongoing Research Support

(b) (4) Coulson 1/15/2004 – 6/15/2007  
Faculty Research Initiative  
Awarded to provide seed funds for doctoral student research on wildlife population dynamics  
Role: PI

### Completed Research Support

National Environment Research Council (NERC) Coulson 6/1/2003 – 5/31/2006  
Postdoctoral research Award  
Award to fund doctoral student to work on long-term individual time series categorisation, rescue and analysis.  
"Preserving and disseminating Long-term Individual-based Time Series (LITS) data"  
Role: PI

Biotechnology and Biological Sciences Research Council (BBSRC) Coulson 6/1/2003 – 5/30/2006  
Linking Evolutionary and Ecology dynamics  
Award for three years of postdoctoral research on population dynamics of Soay sheep.  
Role: PI

(b) (4) Coulson 1/1/2003 - 7/31/2003  
Ecology and wildlife management award  
Management of red deer in Scotland  
Award to draft management protocols for red deer in Scotland  
Role: PI

(b) (4) Coulson 6/1/2000 – 8/31/2000  
Early Career Project grant  
Funding for project on social behaviour in radiated tortoises at Institute of Zoology  
Role: PI

(b) (4) Coulson 4/1/2000 – 3/31/2000  
Funding for project entitled "Historical data retrieval and imputation for Soay sheep"  
Role: PI



**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Stephen P. Luby, MD		POSITION TITLE Head, Programme on Infectious Diseases and Vaccine Sciences	
eRA COMMONS USER NAME			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Creighton University, Omaha, NE	B.A.	1981	Philosophy
University of Texas, Southwestern Medical School, Dallas, TX	M.D.	1986	Medicine
University of Rochester—Strong Memorial Hospital, Rochester, NY	Residency	1986-1989	Internal Medicine
Centers for Disease Control and Prevention, Atlanta, GA	Fellowship	1990-1992	Epidemiology
Centers for Disease Control and Prevention, Atlanta, GA	Fellowship	1991-1993	Preventive Medicine

**A. Positions and Honors****Positions**

- 1981-1982: Computer programmer, Pulmonary laboratory, Hartford Hospital, Hartford, CT
- 1986-1989: Internal medicine resident, Strong Memorial Hospital, Rochester, NY
- 1989-1990: Attending physician, Emergency Division, The Genesee Hospital, Rochester, NY
- 1990-1992: Epidemic Intelligence Service Officer, South Carolina Department of Health, Columbia, SC
- 1992-1993: Preventive medicine resident, Malaria Branch, Centers for Disease Control and Prevention
- 1993-1998: Assistant professor, epidemiology, Aga Khan University, Karachi, Pakistan
- 1998-2004: Medical epidemiologist, Foodborne and Diarrheal Diseases Branch, Centers for Disease Control and Prevention, Atlanta, GA
- 2004 –present: Head, Programme on Infectious Disease and Vaccine Sciences, ICDDR, Centre for Health and Population Research, Dhaka, Bangladesh

**Honors**

- Outstanding Teaching Award, Aga Khan University, Karachi, Pakistan-(1996)
- HIV/AIDS Prevention Shield, Sindh, Pakistan, Government of Sindh, (2001).
- Senior author on Alexander D. Langmuir Prize winning manuscript for most outstanding manuscript submitted by an Epidemic Intelligence Service Officer, Center for Disease Control, (2001).
- Senior author on Manuscript awarded the Nakano Citation for an outstanding scientific paper published in 2003, National Centers for Infectious Diseases, Centers for Disease Control (2004).
- First author on Nakano Award Manuscript, National Centers for Infectious Diseases, Centers for Disease Control, 2005
- Favourite paper in infectious diseases, 2005. Lancet Infectious Diseases, December 2005

- First author on Nakano Award Manuscript, National Centers for Infectious Diseases, Centers for Disease Control, 2006
- Shepard Award, (Centers for Disease Control and Prevention, Best Paper in the Prevention and Control Category 2006, First author)

**B. Peer-reviewed publications (selected from 102)**

1. **Luby S**, Jones J, Horan J. A large salmonellosis outbreak associated with a frequently penalized restaurant. *Epidemiology and Infection*, 1993; 110:31-39.
2. **Luby S**, Jones J, Dowda H, et. al. A large outbreak of gastroenteritis caused by diarrheal toxin producing *Bacillus cereus*. *Journal of Infectious Diseases*. June 1993, 167:1452-1455.
3. **Luby S**, Jones J. An outbreak of Salmonella enteritidis from locally produced Grade A eggs, South Carolina. *Southern Medical Journal*. December 1993, 86(12):1350-1353.
4. **Luby S**, Jones J, Horan J. Using CD4 counts to evaluate the stages and epidemiology of HIV infection in South Carolina public clinic patients. *American Journal of Public Health*. March 1994, 84(3):377-381.
5. **Luby S**, Kazembe P, Redd S, Ziba C, Nwanyanwu O, Hightower A, Franco C, Chitsulo L, Wirima J, Olivar M. Clinical signs for the diagnosis of anemia in African children, *Bulletin of the World Health Organization*. 1995 73:477-482.
6. Redd S, Kazembe P, **Luby S**, Nwanyanwu O, Hightower A, Ziba C, Franco C, Olivar M. Clinical algorithm for the treatment of *Plasmodium falciparum* malaria in children. *Lancet*. 1996 347:223-227.
7. **Luby S**, Qamruddin C, Shah A, Omair A, Pasha O, Khan AJ, Hoodbhoy F, McCormick J, Fisher-Hoch S. The relationship between therapeutic injections and high prevalence of hepatitis C infection in Hafizabad, Pakistan. *Epidemiology and Infection*. 1997, 119:349-356.
8. Siddiqui R, **Luby S**. Discitis following surgery for prolapsed intervertebral discs at a hospital in Pakistan. *Infection Control and Hospital Epidemiology*. 1998, 19(7):526-529.
9. Paul R, Patel A, Mirza S, Fisher-Hoch S, **Luby S**. Expansion of epidemic dengue viral infections to Pakistan. *International Journal of Infectious Diseases* 1998, 2(4):197-201.
10. Altaf A, **Luby S**, Ahmed AJ, Zaidi NA, Khan AJ, Mirza S, McCormick J, Fisher-Hoch S. Outbreak of Crimean-Congo haemorrhagic fever in Quetta, Pakistan: Contact tracing and risk assessment. *Tropical Medicine and International Health*. 1998, (11):878-82.
11. Pasha O, **Luby S**, Khan AJ, Shah A, McCormick J, Fisher-Hoch S. Household members of hepatitis C virus infected people in Hafizabad, Pakistan: Infection by injections from health care providers. *Epidemiology and Infection*. 1999 Dec; 123(2): 515-518
12. Khan AJ, **Luby SP**, Fikree FF, Karim A, Obaid S, Dellawala S, Mirza S, Malik T, Fisher-Hoch S, McCormick JB. Injections and Hepatitis B and C transmission in Peri-Urban Karachi, Pakistan. *Bulletin of the World Health Organization*. 2000; 78(8):956-963.
13. **Luby S**, Agboatwalla M, Raza A, Sobel J, Mintz ED, Baier K, Hoekstra RM, Rahbar MH, Hassan R, Qureshi SM, Gangarosa EJ. Microbiologic effectiveness of hand washing with soap in an urban squatter settlement, Karachi, Pakistan. *Epidemiology and Infection*. 2001 Oct;127(2):237-44.
14. Brooks JT, Rowe SY, Shillam P, Heltzel DM, Kamm K, Hannah EL, Hunter SB, Puhr ND, Slutsker L, Hoekstra, RM, **Luby SP**. *Salmonella* Typhimurium infections transmitted by chlorine-pretreated clover sprout seeds. *American Journal of Epidemiology*. 2001 154(11):1020-8.
15. Dunne EF, Angoran-Biene YH, Kamelan-Tano Y, Sibailly T, Monga B, Kouadio L, Roels TH, Wiktor SZ, Lackritz EM, Mintz ED, **Luby S**. Is Drinking Water in Abidjan, Côte d'Ivoire, Safe for Infant Formula? *Journal of the Acquired Immune Deficiency Syndromes*. 2001 Dec; 28(4):393-8.
16. Quddus A, **Luby S**, Rahbar, Pervaiz Y. Neonatal tetanus: mortality rate and risk factors in Loralai District, Pakistan. *Int J Epidemiol*. 2002 Jun;31(3):648-653.
17. Olsen SJ, Blastula SC, Magnano AR, Landrigan C, Holland BH, Tauxe RV, Mintz ED, **Luby S**. Outbreaks of typhoid fever in the United States, 1960-1999. *Epidemiol Infect*. 2003;130:13-21.

18. Mujeeb SA, Malik MA, Altaf A, Shah SA, **Luby S**. Infection control practices in clinical laboratories in Pakistan. *Infection Control and Hospital Epidemiology*. February 2003; 24(2):141-2.
19. Mujeeb SA, Malik MA, Altaf A, Hutin Y, **Luby S**. Recycling of injection equipment in Pakistan. *Infection Control and Hospital Epidemiology*. 2003 Feb; 24(2):145-6.
20. Usman HR, Akhtar S, Rahbar MH, Hamid S, Moatter T, **Luby SP**. Injections in health care settings: a risk factor for acute hepatitis B virus infection, Karachi, Pakistan. *Epidemiology and Infection*. 2003 Apr;130(2):293-300.
21. Hutin Y, **Luby S**, Paquet C. A large cholera outbreak in Kano City, Nigeria: The importance of hand washing with soap and the danger of street vended water. *J Water Health*. March 2003; 1:45-52.
22. **Luby SP**, Agboatwalla M, Painter J, Altaf A, Billhimer W, Hoekstra RM. Effect of Intensive Handwashing Promotion on Childhood Diarrhea in High-Risk Communities in Pakistan: A Randomized Controlled Trial. *JAMA*. 2004 June 2, 291(21): 2547-2554.
23. Parviz S, Chotani R, McCormick J, Fisher-Hoch S, **Luby S**. Rabies deaths in Karachi, Pakistan: fruits of ineffective post-exposure treatment. *Int J Infect Dis*. 2004 Nov;8(6):346-352.
24. **Luby S**, Hoodbhoy F, Jan A, Shah A, Hutin Y. Long term improvement in unsafe injection practices following community intervention. *International Journal of Infectious Diseases*. 2005 Jan;9(1):52-59.
25. Crump JA, Otieno PO, Slutsker L, Keswick BH, Rosen DH, Hoekstra RM, Vulule JM, **Luby SP**. Household based treatment of drinking water with flocculant-disinfectant for preventing diarrhoea in areas with turbid source water in rural western Kenya: cluster randomised controlled trial. *BMJ*, doi:10.1136.38512.618681.E0 (published 26 July 2005).
26. **Luby SP**, Agboatwalla M, Feikin DR, Painter J, Billhimer W, Altaf A, Hoekstra RM. Effect of handwashing on child health: a randomised controlled trial. *Lancet*. July 15, 2005; 366:225-33.
27. Epstein JH, Field HE, **Luby S**, Pulliam JRC, Daszak P. Nipah virus: Impact, origins and causes of emergence. *Current Infectious Disease Reports*, 2006; 8:52-58.
28. Daszak, P, Plowright R, Epstein JH, Pulliam J, Abdul Rahman S, Field HE, Smith CS, Olival KJ, **Luby S**, Halpin K, Hyatt AD, & (HERG). The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum. In: Collinge S, Ray S, editors. *Disease Ecology: Community structure and pathogen dynamics*. Oxford University Press; 2005,247-63.
29. **Luby SP**, Rahman M, Hossain MJ, Blum LS, Husain NM, Gurley E, Khan R, Ahmed B, Rahmin S, Nahar N, Kenah E, Comer JA, Ksiazek TG. Foodborne Transmission of Nipah Virus, Bangladesh. *Emerging Infectious Diseases*. In Press.

## C. RESEARCH SUPPORT

### ONGOING RESEARCH SUPPORT

Nipah Virus Transmission in Bangladesh

9/1/05 – 4/1/07

NIH/ International Centres for Tropical Disease Research

Objective : Identify outbreaks and investigates routes of transmission to infected persons with Nipah virus infection in Bangladesh in 2006/7.

Role: PI

Surveillance for hospitalization and death due to pneumonia, meningitis and sepsis in Dhaka, Bangladesh

National Vaccine Program Office

10/01/05 – 10/01/07

Objective : To pilot and evaluate a hospital based model of assessing disease burden of vaccine preventable diseases.

Role: PI

Burden of pneumococcal and Hib disease in children in Bangladesh

Pneumococcal ADIP/Hib Initiative

04/01/04 – 12/31/2007

Objective : To determine burden of Hib and pneumococcus include pneumococcal serotype specific burden in children under age 5 years in Bangladesh

Role: PI

#### COMPLETED RESEARCH SUPPORT

Long-term neurologic and functional outcome in patients with Nipah virus encephalitis

Centers for Disease Control and Prevention

06/2005-12/2006

Objective: To assess the long term neurologic function and sequelae of Nipah survivors

Role: Co-Investigator

Assessing shock treatment of tubewells

UNICEF

09/01/2004 – 12/31/2004

Objective: Evaluate if standard treatment of tubewells with high dose chlorine after flooding in Bangladesh measurably improves microbiological contamination.

Role: PI

Assessing and improving drinking water quality following flooding

UNICEF

07/01/2005 – 12/31/2005

Objective: Evaluate if methods for water quality assessments and interventions to improve water quality were effective.

Role: PI

(b) (4)

March 2001 – March 2004

(b) (4)

Objective: To evaluate the efficacy of a novel combined flocculant disinfectant water treatment in reducing diarrhea among children living in the Guatemala highlands.

Role : Principle Investigator

(b) (4)

October 2001 – December 2004

Objective: To evaluate the effect of handwashing promotion with soap on diarrhea, acute respiratory disease, and impetigo among children living in squatter settlements of Karachi, Pakistan.

Role: Principle Investigator

(b) (4)

(b) (4)

June 2002 – February 2005

Objective: To evaluate the efficacy of a combined flocculant disinfectant versus treatment with chlorine bleach of highly turbid drinking water in rural Western Kenya.

Role: Co-Principle Investigator

(b) (4)

July 2002 – June 2005

Objective: To evaluate the efficacy of a flocculent disinfectant in reducing arsenic and improving microbiological safety in families using tube well water contaminated with high levels of arsenic in Matlab, Bangladesh

Role: Principle Investigator

(b) (4)

January 2003 – July 2004

Principal Investigator/Program Director (Last, First, Middle): Epstein, Jonathan H.

Objective: To evaluate the combined effect of improving home water treatment and hand hygiene on diarrhea incidence among children living in squatter settlements in Karachi, Pakistan.

Role: Principle Investigator

(b) (4)

November 2003 – November 2005

Objective: Evaluate if a school based handwashing promotion program in rural eastern China has a measurable effect on diarrhea and respiratory disease.

Role: Co-Principle Investigator

Improving Private Practitioner Sick Child Case Management in Two Urban Communities In Karachi, Pakistan and in a peri-urban area.

(b) (4)

November 1997 – December 1998

Objective: To implement and evaluate a program among private health care providers to base diagnose and treatment more in line with WHO Integrated Management of Childhood Illness guidelines.

Role : Principle Investigator

**BIOGRAPHICAL SKETCH**

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.  
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Shanaez Ali Khan		POSITION TITLE Veterinarian, Field Team Leader	
eRA COMMONS USER NAME			
EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)			
INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Chittagong Government Veterinary College, Chittagong, Bangladesh	DVM	2002	Biochemistry, epidemiology
Dhaka College, Dhaka, Bangladesh	BS	1997	Biology

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

**A. Positions and Honors**

## Positions

2003 Clinical training in reproductive diseases, Chittagong, Bangladesh  
 2004 Clinical medicine intern, Madras Veterinary College, Chennai, India  
 2005 Veterinary Officer (D.Net – Development through network access)  
 2005-2006 Scientific Officer, avian disease surveillance project  
 2006- Field Team Leader, Nipah virus bat surveillance project

## Professional Affiliations

2002 - Member, Bangladesh Veterinary Council

## Honors

1997 First division ranking, Dhaka College, Dhaka  
 2002 First class honors, Chittagong Govt. Vet. College.  
 2006 Certification in avian disease epidemiology, Chittagong Veterinary College

**B. Publications**

1. S.K.M.A. Islam, M.A. Hoque, M.M. Hassan, M.R. Alam, M.B. Hossain, K.Roy, T. Ferdushy, S.A. Khan, A.K.M. Saifuddin. A cross-sectional study followed by a field trial of combination of triclabendazole plus lavamizole and combination of sulphonamides against gastrointestinal parasites and coccidiosis of goats respectively at Wireless Colony, Pahartali, Chittagong, Bangladesh. 2006. *Pakistan Journal of Biological Sciences* (Accepted: 245 – PJBS – 2K6)

**PHS 398/2590 OTHER SUPPORT****Daszak, Peter****ACTIVE**

<p>1 R01 Kilpatrick (PI)          Dates: 8/01/02-08/01/06          NIH/Fogarty International Center          Anthropogenic change &amp; emerging zoonotic paramyxoviruses          This award is to investigate anthropogenic factors that drive emergence of Nipah and Hendra viruses in Malaysia and Australia.          Role: PI</p>	<p>Dates 10/25/06 – 07/01/11          Annual Direct Costs: \$286,000</p>	
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OVERLAP (summarized for each individual)**Daszak, Peter****ACTIVE**

<p>1 R01 TW05869-01 Daszak (PI)          Dates: 8/01/02-08/01/06          NIH/Fogarty International Center          Anthropogenic change &amp; emerging zoonotic paramyxoviruses          This award is to investigate anthropogenic factors that drive emergence of Nipah and Hendra viruses in Malaysia and Australia.          Role: PI</p>	<p>Dates 08/01/02 – 08/01/07          Annual Direct Costs: \$286,000</p>	
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OVERLAP (summarized for each individual)**Daszak, Peter****ACTIVE**

<p>VKR 101184-81 Daszak (PI)          (b) (4)          The goal of this grant is to provide second-stage core funding of the Consortium for          (b) (4)          Role: PI</p>	<p>Dates of Approved/Proposed Project          07/01/04-06/30/09          Annual Direct Costs          \$1,000,000</p>	
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OVERLAP (summarized for each individual)

**Pending Support**

<p>1 R01 AI068067-01A1 Luby (PI) NIAID</p> <p>The aim of this project is to understand the ecology of Nipah Virus in Bangladesh by studying the mechanisms of spillover from bats to humans and of infection among people through active surveillance.</p>	<p>Dates of Proposed Project 07/01/07 - 06/30/12</p> <p>Annual Direct Cost: \$499,500</p>	
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OVERLAP (summarized for each individual)



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## RESOURCES

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**FACILITIES:** Specify the facilities to be used for the conduct of the proposed research. Indicate the performance sites and describe capacities, pertinent capabilities, relative proximity, and extent of availability to the project. If research involving Select Agent(s) will occur at any performance site(s), the biocontainment resources available at each site should be described. Under "Other," identify support services such as machine shop, electronics shop, and specify the extent to which they will be available to the project. Use continuation pages if necessary.

Laboratory:

The Greene Lab at Columbia occupies approximately [REDACTED] (b) (4)

[REDACTED] The laboratory proper includes isolated areas for work with cultured mammalian cells, radioactivity, recombinant DNA and BSL-3 infectious agents, as well molecular epidemiology using real time PCR. Training for ELISA and PCR testing will happen here.

Clinical:

N/A

Animal:

N/A

Computer:

CCM has full computer facilities including broadband internet with access to Columbia University's server and databases (Web of Science). Dr. Epstein has use of a laptop computer for Bangladesh field sites. Printer, scanner, and fax are also available.

Office:

Dr. Epstein has a private office at CCM with computer and internet.

Other:

ICDDR,B The [REDACTED] (b) (4) of the Immunology Unit at ICDDR,B contains 3 biohazard safety hoods for processing of biological samples and for maintaining sterile conditions for lymphocyte and antibody isolation. Other equipment include, thermal cyclers, cryostat, microtome, liquid nitrogen and -70C freezers.

**MAJOR EQUIPMENT:** List the most important equipment items already available for this project, noting the location and pertinent capabilities of each.

Greene Lab: Equipment includes a phosphorimager, on-line thermal cyclers, HPLC, flow cytometer for bead-based immunologic and molecular assays (Luminex), DNA microarray analysis system (Axon Instruments GenePix Pro), DNA sequencer (ABI 310 Gene Analyzer), scintillation counter, darkroom, freezers and refrigerators, cryostat, brightfield and fluorescent microscopes, spectrophotometer, gel documentation system. Core facility equipment in close proximity include a confocal microscope, luminometer, FACS, amino acid analyzer, DNA and protein sequencers, Agilent APCI mass spectrometer dedicated to PCR/MS technology development, Affymetrix GeneChip System, and commercial and Columbia-developed software programs for bioinformatics analyses.

Resources cont...

The Australia Animal Health Laboratory:

All work to be conducting using select agents will be performed within the BSL-4 laboratories at the Australian Animal Health Laboratory, Geelong, Australia under the direction of Dr Alex. D. Hyatt (**See letter of support, Appendix**). The laboratories are fully certified and have US Public Health Service approved animal welfare assurance (**assurance number A 5399-01**). The Australian Animal Health Laboratory (AAHL) is the largest and one of the most sophisticated laboratories in the world and has an international reputation in the area of emerging BSL-4 pathogens. AAHL is the only laboratory globally that regularly conducts large and small animal experiments with BSL-4 pathogens. In addition to approximately (b) (4) of BSL-3 lab space, the facilities include not only flexible film isolators and one BSL4 laboratory (approximately (b) (4) meters) but also (b) (4) in which animals infected with BSL-4 agents can be handled safely. AAHL has developed extensive protocols and training procedures to ensure that personnel working with zoonotic BSL-4 agents such as Hendra and Nipah viruses can do so in safety. The laboratory employs approximately 30 engineering staff specifically to ensure safe and continuous operation of the secure facilities which far exceed the physical-plant infrastructure of a typical state-of-the-art biological research facility.

**I. Introduction to Revised Application.**

(b) (5)







## K08 candidate and research description

### 1. The Candidate

#### Candidate's background

I graduated Tufts University's School of Veterinary Medicine in 2002, after completing a four-year combined Doctor of Veterinary Medicine and Masters of Public Health degree program. I was the first graduate of Tufts to receive a certificate in International Veterinary Medicine, a program designed to develop students' ability to conduct international research. While at Tufts, I was required to write grants to fund my projects, act as a lead investigator, present my work at professional scientific meetings, and publish my results. I completed three international research projects which related to public health and wildlife management. In 2002, I received the Sylvia Mainzer Public Health Achievement Award and the Hill's award for excellence in small animal clinical nutrition. Since graduating from Tufts, I have continued to pursue international research opportunities that relate to zoonotic diseases. I have just become the first alumni of Tufts Medical School to be inducted into the Delta Omega Honors Society for Public Health. I was invited to give the first inaugural keynote speech at the induction ceremony in October.

My combined DVM /MPH program allowed me to find my niche studying zoonotic diseases. In 1999, during my first summer break as a graduate student, I had what I consider a pivotal experience. I traveled to Australia to study Australian Bat Lyssavirus (ABLV) under Dr Hume Field, a veterinary epidemiologist with the Queensland Department of Public Health. ABLV is lethal zoonotic rhabdovirus carried by fruit bats which emerged in 1996 in Australia, a country previously free of rabies or related viruses. I divided my time between analyzing trends in human exposure to ABLV and working in the field catching and sampling fruit bats for a prevalence study. I co-authored a paper on my analysis of Queensland's human exposures to Australian Bat Lyssavirus which was published in *Emerging Infectious Diseases* (1). For my next research project, in 2000, I returned to Australia, and worked with Dr Jeffrey McKee at the University of Queensland, designing and conducting a study which assessed the potential risk of disease transmission from Australian White Ibis (*Threskiornis molucca*) to people and food production animals in Queensland. I collaborated with local government officials and ecologists to combine a disease survey with a behavioral study of ibis and their interactions with humans, cattle, poultry, and each other. This was my first experience with public policy and presented many challenges, including dealing with of the public perception of wildlife population control. The report I produced for the Ibis Management Coordination Group (IMCG) has been used to help guide policy in Queensland. I have since submitted this as a first author paper that is in press with *Ecohealth* (2). This was an excellent learning experience and has served me well in my current work.

In my final year of vet school, I traveled to Kenya for my Master's thesis project, where I worked with the Kenya Wildlife Service and the Office for African Unity which runs a multinational rinderpest eradication campaign. I conducted a feasibility study for the re-introduction of the endangered Mountain Bongo (*Tragelaphus eurycerus isaaci*) to the forests of Mount Kenya. For this project I examined endemic bovine diseases and conducted a habitat suitability assessment. I developed health recommendations for bongo translocation from the US to Kenya. Finally, I successfully applied for an EID externship and spent six weeks at the Centers for Disease Control and Prevention (CDC), working with Charles Rupprecht in the rabies group of the Division of Viral and Rickettsial Diseases. Here, I developed and conducted a survey of rabies and Feline Leukemia virus vaccination practices.

These experiences have shaped my interest and honed my skills in epidemiology. They have also helped me to develop a synergistic approach to public health by examining zoonotic diseases from the perspectives of both humans and animals. In my current role as Senior Research Scientist for the Consortium for Conservation Medicine, I help plan, co-ordinate and conduct research on the ecology of zoonotic diseases and the underlying causes of emergence. The goal of this work is to identify risk factors related to zoonotic disease emergence and ultimately to predict and prevent outbreaks in humans and animals. My main duties are to conduct research and co-ordinate field studies as part of an NIH/NSF – funded project investigating the ecology of Nipah virus in Malaysia and now Bangladesh. In October, 2005 I began a PhD program at Imperial

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College, London that will provide training in disease ecology and modeling in conjunction with mentored training in molecular diagnostic techniques at Columbia University's Mailman School of Public Health under Ian Lipkin. I have already begun learning and performing PCR techniques and ELISA tests. I have tested bat serum samples from my first field trip to Bangladesh with an ELISA protocol for NiV developed by the Australian Animal Health Laboratory (see section C.1. Preliminary data for Specific Aim1).

My Masters in Public Health curriculum included the following relevant courses in epidemiology and biostatistics: Epidemiology; Biostatistics; Regression Methods: Standard & new approaches; and Infectious Disease Epidemiology. Epibiostatistics was included in my veterinary curriculum. By April of 2007, I will have completed a three-week intensive course in ecological modeling, as well as a second course in advanced statistics at Imperial College, as per my training plan.. My current position has given me greater experience in how to plan and conduct collaborative multidisciplinary research. It has also allowed me to begin my development as an independent scientist. I hold adjunct faculty positions at Tufts University at both the Cummings School of veterinary medicine and the Medical School, and Columbia University in the Department of Ecology, Evolution, and Environmental Biology and the Department of Epidemiology at the Mailman School of Public Health. I also sit on two advisory panels in the International Union on the Conservation of Nature: the Veterinary Specialist Group and now the Chiroptera Species Specialist Group.

My aim is to expand my skills through a solid program of research towards a PhD that combines molecular techniques and theoretical aspects of disease ecology. Understanding emerging zoonoses requires an understanding of molecular diagnostics, epidemiology and ecology. This training program will allow me to be immersed in each of these disciplines and give me the perfect grounding for a career as an independent research scientist. After this program I will be able to develop and implement my own collaborative research projects, compete for major grants (R01), and help develop *in situ* diagnostic facilities in developing countries.

#### **Career goals and Objectives:**

I believe there is a strong role for veterinarians in Public Health, especially in the field of emerging zoonoses. More and more transdisciplinary programs are emerging at leading universities as they recognize the need for these types of collaborative training programs. My long-term career goals are to develop new research programs on zoonotic pathogens that help establish veterinarians as key members of research teams in public health. I would also like to eventually help develop a cutting edge training program for future health scientists through the partners of the Consortium. We are in an age when new infectious diseases seem to be emerging repeatedly, many of these caused by zoonotic pathogens(3). Emerging zoonotic diseases impact human and animal health, causing mortality, morbidity and often significant economic hardship. For example, Nipah virus first emerged in Malaysia and Singapore where it infected over 270 people and had a case fatality rate of around 40%. It moved from fruit bats to pigs, where culling and subsequent farm closures resulted in the loss of over one million pigs, of over 300 million dollars (US) to the Malaysian economy and 36,000 jobs(4). Understanding the emergence of Nipah virus in Malaysia requires an understanding of viral dynamics in bats and pigs, understanding the management of pig farms and the human behavior within and around these farms. Thus, to deal with the key threat of emerging zoonoses, there has been an increasing effort to undertake a multi-disciplinary approach that integrates human and animal health, epidemiology and ecology. Veterinarians are uniquely poised to provide expertise in the epidemiology of infectious diseases in free-ranging and domestic animal populations.

My immediate goals are to receive advanced training in the ecology of emerging zoonotic diseases, specifically mathematical modeling, and to further my skills in molecular diagnostic techniques. While at the CDC, I saw the important role that molecular epidemiology plays in understanding disease processes. I would like to learn to use and refine molecular diagnostic tests and serological assays so that I have the ability to set up *in situ* diagnostic capabilities when collaborating in developing countries, if there are none already available. Mathematical modeling has become a useful and sophisticated epidemiological tool for testing hypotheses on how pathogens move within and between populations or species. In my experience with Nipah virus work, modeling has greatly contributed to our understanding of the pathogen's dynamics in both pig and bat populations in Malaysia. I have chosen to work on Nipah virus emergence in Bangladesh because it is a significant threat to public health there, and I find the details surrounding its emergence in Malaysia and Bangladesh fascinating. It has emerged repeatedly in Bangladesh over the past 5 years and has a markedly different epidemiology than the Malaysian outbreak, having no clear animal amplifier host and evidence for

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human-to-human transmission, which gives it pandemic potential. There is now also evidence that it is a food-borne pathogen. I aim to develop my ecology and molecular epidemiological skills through training at Columbia University, and Imperial College and in collaboration with the ICDDR,B.

Because of the institutional partnerships within the Consortium for Conservation Medicine at Columbia University I can draw on a multitude of scientific experts from various fields for my program. As a base, I have registered as an external PhD candidate at Imperial College, which is a research-based PhD, to learn ecological and mathematical disease modeling from one of the foremost ecologists in the field, Professor Tim Coulson. This arrangement will provide didactic training in the form of short courses in statistics and disease modeling, and allow me the freedom to devote substantial time to laboratory studies and data analyses. I will receive training in advanced molecular techniques (real time PCR, ELISA) in Dr Ian Lipkin's lab at the Mailman School of Public Health, and take an advanced statistics courses at Columbia University, which is allied to the Consortium. Finally, I will develop my epidemiological skills by designing field studies in Bangladesh under the mentorship of Dr. Stephen Luby which will be implemented by a team of veterinary scientists that I have trained in the safe capture and handling of *Pteropus* species. I have also been contributing to planning for the next human outbreak where domestic animal surveillance will be a priority. Logistics for the field studies will be coordinated by Dr. Luby and me through the International Diarrheal Diseases Research Center, Bangladesh.

This training program includes courses in research design, ecology, and biostatistics as well as practical field and laboratory work. I aim to use this program to develop my career by studying the driving forces behind zoonotic disease emergence. Ultimately, I would like to advance the field of public health by developing predictive and preventative approaches based on advanced surveillance techniques, predictive disease modeling and techniques for better understanding the causes of disease emergence; and to contribute to the development of transdisciplinary graduate training programs in public health.

#### **Career Development Activities during Award Period**

##### **Rationale and Need.**

Emerging Infectious Diseases (EIDs) are a major threat to public health causing mortality, morbidity and economic loss (5-7). Recent work suggests that around 75% of emerging diseases are zoonotic. One of the most devastating emerging diseases in recent history, HIV, has animal origins (8). The recent emergence of Hendra virus, Nipah virus, SARS coronavirus and others highlights the ability of new agents to emerge in the background of changing relationships between wildlife reservoirs and human populations (9,10). SARS emerged primarily due to the trade in live wildlife species for food in Asia, coupled with high volume of international travel, which led to its global spread (11). Nipah and Hendra viruses seem to have emerged due to the close relationship between livestock (pigs and horses respectively), humans and their fruit bat reservoir hosts (12,13). The importance of these public health threats, and the potential bioterrorism significance of many zoonotic EIDs has led to significant programs within NIH to fund research on biodefense and EIDs (NIH PA 04 119 - Biodefense and Emerging Infectious Disease Research Opportunities).

Because of the zoonotic skew to emergence, modern approaches to EID research require an understanding of animal pathology and often involve hands-on animal work to study them. Understanding how and why these diseases emerged is a complex challenge that requires an understanding of human, livestock and wildlife population behavior, pathogen dynamics within these hosts and the demographic and environmental changes that ultimately drive emergence (10). This is essentially an ecological approach that requires collaboration between disciplines to achieve results. Both NIH and NSF have recognized the need for multidisciplinary research in disease ecology. The joint NSF/NIH "Ecology of Infectious Diseases" RFA (RFA-TW-01-004) is one example. NSF funds other multidisciplinary collaborative research on disease ecology through its IRCEB, Biocomplexity and other programs.

Veterinarians are trained to consider health on a population scale, as with domestic herds and free-ranging wildlife. They can collect biological samples and apply epidemiologic principles to test hypotheses on pathogen dynamics in natural systems. Despite the good fit for veterinarians in studying zoonotic EIDs, traditional veterinary curriculums do not offer training in ecological and epidemiological techniques such as disease modeling and population dynamics. Likewise, there is little focus on surveillance of wildlife, or on the molecular biological techniques (PCR, microarrays etc.) used in modern day surveillance for EIDs. Further training for DVMs usually involves either research in laboratories on molecular techniques, or research on wildlife or livestock diseases. However, few programs encompass both areas of research, focused on an



important emerging disease. The need for increased veterinary training in emerging disease issues has been highlighted within reports and documents from NIH, NIAID, CDC, the National Research Council, WHO, FAO and a number of other leading agencies. In fact, **the 2005 National Research Council report "Critical Needs for Research in Veterinary Science"** (National Academy of Sciences, 2005), **specifically recommended that NIH programs "include a specific focus....on integrated veterinary research" and provide for "additional veterinary researchers...trained to alleviated the [public health] demands"**.

The Consortium for Conservation Medicine (CCM) is a partnership between The Cummings School of Veterinary Medicine at Tufts University, Johns Hopkins Bloomberg School of Public Health, The University of Wisconsin's Nelson Institute for Environmental Studies, the University of Pittsburgh School of Public Health, the National Wildlife Health Center (USGS) and an ecological research organization, Wildlife Trust. It is based at Columbia University, NY. CCM staff includes veterinarians, ecologists, mathematical modelers, epidemiologists and field technicians, all of whom work on a range of emerging diseases. All senior staff (including myself) hold appointments at the School of Public Health or Dept of Ecology, Evolution and Environmental Biology at Columbia University. In particular, there is a strong relationship with Ian Lipkin's lab (Greene Infectious Disease Laboratory) at the Mailman School of Public Health, which provides access to state-of-the-art molecular biology. A number of multidisciplinary disease ecology projects are currently held by the CCM, including: NIH/NSF grant (R01 TW05869 "Anthropogenic change & Emerging Zoonotic Paramyxoviruses,") that uses mathematical modeling, molecular epidemiology, and experimental infections to study Nipah virus emergence: A 7-year project on the Ecology of West Nile virus (subaward from NIAID contract # N01-AI-25490 – Laura D. Kramer, NY State Dept. of Health, PI) to study transmission of West Nile virus among bird, mosquito and mammal populations across a series of sites in Washington DC to Maryland; An IRCEB award from NSF on emerging diseases and population declines of amphibians (DEB-02133851); a 5-year foundation grant to study zoonotic diseases carried by wildlife imported into the USA; and a new (2006) 5-year NIH/NSF Ecology of Infectious Disease award "Predicting Spatial Variation in West Nile Virus Transmission". The CCM is one of the few institutions to have been awarded two NIH/NSF EID awards and Dr Epstein's mentor (Dr Daszak) is a PI on one and a co-PI on the other (the lead PI is based at CCM). There are also a range of other projects, including over 30 research projects on wildlife population dynamics conducted abroad. An R01 will be submitted jointly with the International Diarrheal Disease Center, Bangladesh in November, to conduct studies on Nipah virus in humans and animals in the region. Finally, the CCM has access to considerable core funding via foundations and an endowment that will ensure full support of this project (consumables, travel and support staff). Dr. Daszak is committed to the continuing educational development of each of the scientists employed at CCM. This environment provides a perfect opportunity for providing this much-needed training to help achieve my career goals.

**Program Goals. The goal of this training program is to develop Dr. Epstein's skills in molecular epidemiology, statistical analyses, and disease modeling and integrate these into an ecological study of Nipah virus emergence.** This training program is also designed to further develop Dr Epstein's ability to lead collaborative research on emerging infectious disease ecology, and will have strong mechanisms of support for each of the major facets of his proposal: integrated wildlife and human epidemiology, molecular and serological testing, modeling, and disease ecology. At the end of this program, Dr Epstein will have acquired the technical and managerial skills necessary to be an independent researcher in the broad field of public health. In addition to preparing this grant proposal, we have submitted an R01 grant with collaborators at the ICDDR,B in Bangladesh and the CDC in Atlanta. Columbia's Consortium for Conservation Medicine (CCM) has a network of scientists to provide mentoring and support that will help him succeed in his training goals. One of the goals of the CCM ([www.conservationmedicine.org](http://www.conservationmedicine.org)) is to foster collaborative training and education programs that integrate veterinary, medical and ecological sciences. The CCM executive director, Dr Daszak, is Dr Epstein's primary mentor and will oversee his overall research training, and provide training in grant- and paper-writing. Dr. Epstein has already published two first-authored papers since beginning his PhD, including review of Nipah virus, and co-authored three other papers in 2006 under Dr. Daszak's mentorship, including a paper in *Science* on the discovery of bats as the likely natural reservoir for SARS-like coronaviruses (14). CCM associate, Dr Lipkin, will oversee the training in molecular and serological techniques at the Greene Lab, Columbia University. Dr Coulson will be Dr Epstein's primary thesis advisor in the Department of Biology at Imperial College, and will supervise training in disease and ecological modeling.

This is a strong supervising team that has already shown dedication to providing training for Dr Epstein in the disciplines of disease ecology, molecular epidemiology, and public health policy.

**The PhD Training Program.** The research interests of the Department of Biological Sciences at Imperial span the widest spectrum of modern life sciences ranging from whole organism research to molecular analysis and post-genomic science. Particular strengths include research in ecology, immunology and infection, biomolecular structure, function and bioinformatics, membrane structural biology, biophysics, molecular cell biology, neurobiology and plant and microbial sciences. Dr Tim Coulson's lab focuses on ecological modeling and has expertise on host-pathogen dynamics. Dr Epstein enrolled in this UK program for two major reasons: 1) Imperial's prestigious program is a research-only PhD. This will allow him to complete both the international fieldwork and laboratory-based component of his PhD, while completing didactic coursework at both Columbia University and Imperial College. Dr. Epstein will take the following courses and seminars at Imperial College and Columbia to provide further education in biostatistics and ecology: Statistics and generalized linear modeling; Advances in Ecology, and Applied Regression Analysis and seminars in Research Design, Research Design for Social Sciences & Medicine; SPSS; and Thesis Development and Writing (See Appendix).

2) Dr Coulson's unique expertise in modeling of population and disease dynamics will provide much-needed training that is not available at Columbia University. Dr. Epstein has planned for regular and substantial contact time with Dr. Coulson, in New York, during which he will construct and refine SIR models, taking into account new data as it is available; attend departmental seminars; statistically analyze field data throughout the four years, and develop integrated models of bat and human Nipah virus dynamics based on fieldwork done in Bangladesh. In order to address the concerns about the demanding travel schedule proposed in the previous submission, Dr. Coulson has agreed to visit CCM to work with Dr. Epstein on modeling and data analysis twice per year for 5 days, as well as participate in monthly video conferences. This will be the amount of travel for Dr. Epstein between London and New York. Dr. Epstein will have completed two three-week intensive courses at Imperial by April, 2007. Dr. Epstein will continue to meet with Dr. Coulson en route to or from Bangladesh in addition to their scheduled bi-annual meetings in New York and video conferences. In order to obtain a PhD degree, Dr. Epstein must take the selected courses and seminars listed above; pass a written and oral qualifying examination, and complete a dissertation (see timeline). The oral qualifying examination is in the format of a written research proposal that is then presented in seminar format and defended. Upon completion of these requirements, Dr. Epstein will graduate with a PhD in Biology

3) Dr Epstein's didactic and applied training in molecular epidemiology has begun and is being provided by Dr Ian Lipkin, a professor at the Mailman School of Public Health, Columbia University. Dr. Lipkin has trained six graduate students and more than 20 post-doctoral fellows since 1990. Dr Lipkin's group is a very active mixture of post-docs and PhD students, working on advanced molecular techniques applied to emerging infectious agents. These include genomics of West Nile virus and SARS-associated coronavirus, development of Luminex bead and advanced PCR assays, microarrays and phage-nanowire hybrid sensors. Dr Epstein has been working in the Greene lab for three days per week for the last 4 months. Under Dr. Lipkin's supervision he has developed primers, performed RNA extractions, and run conventional PCR amplifications from bat tissue samples. He has also been provided reagents for the Nipah virus ELISA test by the Australian Animal Health Laboratory (something not commonly done) and has successfully tested sera from his first sample collection in January in Bangladesh. Dr Epstein will continue to dedicate 3 days per week to utilize PCR and serology techniques to test biological samples from Bangladesh. Drs. Luby and Epstein will arrange batch shipments of samples to the Greene lab every 6 months for the duration of the project.

Dr Epstein has already completed courses in emerging disease ecology, infectious disease epidemiology, public health policy, biostatistics, and electives in zoonotic diseases, and GIS for his Masters in Public Health (see biosketch). As part of his training, he has also successfully completed the equivalent of the written qualifying examination, and given numerous invited public lectures on his research plan and previous work on Nipah virus and SARS ecology at Universities, to the World Health Organization, and Fondation Merieux. He has also gained experience drafting and publishing papers including a recent co-authored paper in *Science* on the discovery of bats as a likely reservoir for SARS in China. What remains is his research project and dissertation. Dr Epstein participates in departmental weekly seminars at the Department of Ecology, Evolution and Environmental Biology, regular seminars at the School of Public Health and participation in the CCM's

weekly journal club. The CCM program group is highly interactive, and he participates in regular meetings with his mentor and co-mentors, as well as with other graduate students in the program. In addition, the complete interdisciplinary team (The Henipavirus Ecology Research Group, [www.henipavirus.org](http://www.henipavirus.org)) associated with the Bangladesh project conducts monthly conference calls and will meet every six months and at professional meetings to review and discuss the project.

#### Four Year Timeline

I have significantly reduced the amount of travel necessary for me over the remainder of my PhD through the following changes: 1) we have created and trained a field team led by a veterinarian (**see key personnel, biosketches and budget justification**) that will conduct the majority of the remaining sample collection from bats in accordance with my study design; 2) I have reduced the number of colonies to be sampled, and the frequency of sampling (**see Specific Aims 1 and 2**); and 3) removed specific aim 3, reducing field work even further. The field work component was the part that required the most time and was the one aspect for which I needed little further training. This now allows me to focus on the development and training aspects of the project: learning basic and advanced laboratory techniques, diagnostic testing of my samples; predictive modeling; and statistical analyses. I will continue to travel to London and Bangladesh, but much less frequently, as now Dr. Coulson and Dr. Luby have agreed to make two trips to CCM per year and participate in monthly video conferences, which allow me to spend greater amounts of time with my mentors in New York. I will still go to Imperial for short courses and seminars as required, during which time I will have significant face time with Dr. Coulson (he teaches the Advances in Ecology course). These meetings will become more and more important as I acquire data from the field collection.

#### Year One – Completed

Nov 2005 - Nov 2006. **New York.** Completed lit review; began PCR training. Extracted RNA from bat tissue samples and learned techniques for Taqman Real Time PCR. Met with co-mentors Drs Daszak, Coulson and Luby; designed initial modeling approach and planned logistics of bat sample collection in Bangladesh and sample export. **Bangladesh.** Collected samples from 99 bats at colony 1 (**Specific Aim 1**); identified other roosts Exported serum and swabs from Bangladesh to Columbia University. Identified and trained members of field team; Imported Nipah ELISA test kit to US from AAHL. Collected 115 samples from colony 2 (**Specific Aim 1**)

#### Year Two

Oct - Dec 2006

**London.** **Advances in Ecology at Imperial College (3 weeks)**; qualifying exam to progress from masters to doctorate work. **New York.** PCR and ELISA testing. Complete Ethical Conduct in Research Course; obtained first bat serology results.

Jan - March 2007.

**Bangladesh.** Work with field team to collect 100 bat samples from Colony 3 in the North (S.A. 1). Begin longitudinal survey. Place PTTs on 2 bats from colony 1. **London.** Integrate human outbreak data into model with Dr. Coulson, take Biostatistics course at Imperial College (3 weeks).

Mar – Jun 2007

**New York.** ELISA/ PCR training. Map and analyze bat movement data. Field team to collect 100 samples from colony 1 (longitudinal survey) and 4 (distributional survey).

Jun – Sept 2007.

**New York.** Attend course “**Applied Regression Analysis**” at Columbia Univ. Continue to Run PCR and ELISA tests; Field team to collect 100 samples from colony 1 and colony 5. Tim Coulson to visit CCM, review data analysis and refine models.

Sept 2007

**Bangladesh.** Join field team and Sample 100 bats from colony 1 and Colony 6. Place 2 more PTTs.

**Year Three**

- Oct – Dec 2007. **New York.** Run PCR and ELISA. Attend lab seminars. Field team to collect bat samples from colonies 1 and 7. Export samples to AAHL for viral culture and SNT.
- Jan – Mar 2008. **London.** Review thesis outline; give departmental seminar on dissertation. Submit progress report to Imperial College. Continue modeling and human data analysis with Dr. Coulson. **Bangladesh.** Sample 100 pregnant bats from colony 1 and 8 (end distributional survey). Export to AAHL for viral culture and SNT.
- Apr – Sept 2008. **New York.** PCR, and ELISA testing; lab seminars. Correlate longitudinal bat data with human incidence. Refine models. Field team to collect samples from colony 1. Further sample testing/ PCR and ELISA training. Meeting of mentors at CCM

**Year Four**

- Oct – Dec 2008. **London.** Review progress on modeling and analysis. **Bangladesh.** Join field team to collect samples from colony 1, place final 2 PTTs. Review ICDDR,B human data with Steve Luby.
- Jan - Sept 2009. **New York.** Progress meeting with Dr Coulson and other mentors at CCM. PCR and Serology testing; refine bat and human models. Field team to collect samples from colony 1. Conduct risk analyses, finalize models, run simulations.

**Year Five**

- Oct - Dec 2009. **New York.** Field team to collect final samples from colony 1. Continue testing at Lipkin lab and get results from AAHL
- Jan -Mar 2010. **New York.** Final collection of 100 samples from colony 1. End longitudinal study. Submit final batch of samples to AAHL; complete testing at Greene Lab.
- Mar-Jun 2010. Thesis-writing period. Submit Thesis in June. Oral defense.

**Training in Responsible Conduct of Research**

Dr. Epstein has completed an online training course offered by Columbia University (Center for Bioethics) in the responsible conduct of research (<http://www.ccnmtl.columbia.edu/projects/rcr/index.html>). Topics included: Conflicts of interest; Mentoring; Responsible authorship and peer review; Research misconduct; Collaborative science; Financial responsibility; Data acquisition and management; Animal care & use; Human subjects protections; and Environmental health and safety. The course included self-directed learning experiences employing fictional case studies and provided resources on the ethical challenges researchers face every day while offering guidance on best ethical practices. See appendix for certificates of completion.

**Training Beyond Doctoral Degree**

Dr. Epstein will receive additional training in biostatistics at the Mailman School of Public Health at Columbia. He will take a course entitled "Applied Regression Analysis (P8110)". These courses will provide relevant training for his proposed project and will build on his foundation in biostatistics that he received from his MPH program. In addition, Dr. Epstein is required to take three seminars at Imperial college: "Research Skill Development; Research Design for Social Sciences & Medicine; and SPSS. Finally, Dr Epstein will apply his training to compare NiV dynamics in Bangladeshi flying foxes to Malaysian flying foxes.

*Grantsmanship and Authorship.* The philosophy of the sponsor is to involve graduate students in all aspects of grant proposal and paper writing. Dr Epstein has had a major role in the writing and development of an R01 submitted to NIH to study the ecology of NiV in Bangladesh. In the past year he has gained substantial experience in writing grant applications, reports and papers from previous work conducted at Tufts Vet School and the CCM. He has prepared all IACUC protocols for this project, already drafted 4 papers on NiV work from Malaysia, and co-written 4 foundation applications. Dr Epstein has attended two of the annual meeting of the

grant holders of NSF/NIH "Ecology of Infectious Diseases" awards and presented work from the collaborative project in 2005. Dr Epstein was one of only 2 veterinarians in attendance. He will continue to attend these meetings, to gain experience in the way funding agencies work, and to allow him to network with other PIs. CCM core funding will be provided to support these activities.

## 2. Statement by Sponsor

**Dr Peter Daszak.** As Dr Jonathan Epstein's research sponsor, I enthusiastically support his application for a Mentored Clinical Scientist Development Award at the Consortium for Conservation Medicine, Columbia University. Dr Epstein is an outstanding example of a flexible thinker who can draw from the clinical discipline in which he was trained and apply it to solving problems on a larger scale. I have known Jon Epstein since his third year as a veterinary student at Tufts University, Mass, USA. He was organizing a conference for a student society for veterinarians interested in global issues and invited me to give a talk at his conference. I was instantly impressed by his maturity, passion for the field of emerging infectious disease ecology and by his skills in organizing this conference (I was better treated here than by some professional societies!). When I took over the directorship of the Consortium for Conservation Medicine, I met Jon again, who was now in his final year. He was clearly destined to be one of the best graduates of that school over the past few years. He is one of the few to complete the joint DVM with Masters in Public Health – a tough course that is well-suited to his current research field. At every chance during this course he opted to conduct research, working on Australian Bat Lyssavirus ecology in Australia (he co-authored a paper on this work in *Emerg. Infect. Dis.*), on zoonotic disease risk from ibis in Australia (a paper is now in press with *EcoHealth.*), on conservation and disease risk in Bongo in Africa and then as a research extern at the Centers for Disease Control and Prevention in Atlanta (Division of Viral and Rickettsial Diseases).

I hired Jon into the Consortium for Conservation Medicine after he spent a year of clinical training following graduation. He is now a senior program officer with responsibility for managing our research on Nipah, Hendra and other bat-borne zoonotic viruses. His work has included coordinating field activities, organizing field research teams that include Malaysian veterinarians and biologists, US graduate student ecologists, collaborating with virologists working under high biosecurity conditions, and designing and conducting his own research. He has been able to use his wide experience and skills to foster the collaboration between members of our large group and produce some excellent science (see his biosketch).

Jon would like to obtain a PhD to allow him to take the next step in his career, enabling him to apply for grants and fund his own line of research. In fact, he has already co-authored an NIH R01 grant application to fund a collaboration between the CCM and the ICDDR,B and the CDC. His proposed K08 research will allow him to develop his current work by modeling risk of emergence of henipaviruses in Bangladesh and learning new molecular diagnostic techniques. This has incredible relevance for public health globally. These are lethal viruses in humans and the type of research he is planning will help produce new strategies to predict and prevent outbreaks.

Jon is a unique person, mature, well-rounded, diplomatic, bright, a visionary and an excellent member of our team. He is a natural leader, but polite, modest and good-humored. His ability to understand new subjects and communicate outside his field has already led to him setting up much of the collaboration for the Bangladesh project on his own initiative. It also led to our paper on Chinese bats as a reservoir for SARS-like coronaviruses in *Science*, Nov 2005. Not only was Jon the first person to collect bats in China and test them for SARS, he initiated and set up the connection between CCM and the Chinese teams and made the first field trip to China. His public speaking skills are as good as most senior professors and his writing skills already at the level of a postdoc. I have worked for over 15 years in Universities in the UK and USA. Jon is simply the most impressive Ph.D student that I have worked with or even met during this time, and he is without doubt the most impressive graduate produced by Tufts during the last 5 years. I have no doubt that he is destined to become one of the leading infectious disease scientists of the future.

As Executive Director of the CCM, I am extremely committed to Jon's successful completion of his Ph.D program. **To make his program feasible, and to address previous critiques of this K08 proposal, I have committed CCM funds to support a field team in Bangladesh for 4 years under Jon's and Dr Luby's supervision to conduct the bulk of his field research.** I have also committed to hosting meetings of Jon's mentor team here in New York twice each year for the next four years. CCM support has also included funding his initial work in Bangladesh (2 field trips) and the purchase of an anesthesia machine to increase sampling

efficiency. Finally, I will continue to devote around 10% of my time to working on this project, mentoring Jon, helping plan and execute his program, helping edit papers and seeking funding for these activities.

**Because this is the final revision of this K08 proposal, I would like to draw the panel's attention to what makes Jon such an outstanding candidate, in my opinion.** First, he is a leading student from a community (veterinary scientists) at the center of the issue of emerging zoonotic diseases but which is seriously under-represented in public health research, public health agencies and in guiding policy on zoonotic diseases. Second, he is one of the most impressive veterinarians ever to graduate from Tufts (one of the top vet schools in the USA). He graduated with a DVM/MPH, a paper in *Emerging Infectious Diseases* and a burning desire to conduct research on emerging zoonoses. Third, he is a person with a track record of producing excellence if given the chance to flourish (e.g. his recent paper in *Science*). I respectfully urge the study section to grant him the opportunity that he so richly deserves to flourish as an independent researcher by supporting his K08 application.

**Co-mentor: Dr W. Ian Lipkin.** Dr W. Ian Lipkin is the Director of the Greene Infectious Disease Laboratory (GIDL) at Columbia's Mailman School of Public Health. His group is internationally recognized as one of the worlds leading viral discovery labs and as a center of excellence for the study of immune and microbial factors in neurologic and neuropsychiatric diseases. The Lipkin lab is supported by a NIAID Center contract for biodefense and emerging diseases, a range of other NIH, NIAID and foundation grants. Dr. Lipkin will help Dr Epstein develop his literature review and will oversee Dr Epstein's training in molecular diagnostic techniques and serology. He has also enthusiastically endorsed Dr Epstein's PhD training program (see letter of support included in this section). Dr Epstein will collect biological samples from the field, and with the appropriate import and export permits, he will bring them to the GIDL and conduct Real Time PCR and ELISAs. Dr. Lipkin will oversee Dr. Epstein's analysis of his results as well as the integration of SNT and viral isolation data from AAHL. Prior to field activities, Dr Lipkin and Dr Epstein will formulate a plan for sample storage and transport as to insure quality results from testing.

**Co-Mentor: Dr Timothy Coulson.** Dr Tim Coulson in the Department of Biological Sciences, Imperial College, London, will be Jon's faculty thesis advisor. He will share responsibility with myself in advising Jon's research activities. Dr Coulson will help Dr Epstein develop a literature review and provide instruction specific to ecological disease modeling. When the time comes for data analysis and the development of predictive models, Dr Coulson will oversee Jon's analyses.

I have every confidence that Jon will become a strong independent scientist. He has accomplished a lot for someone just three years removed from clinical medicine. Dr Epstein possesses the organizational, political, and interpersonal communication skills to be a project manager and someday head of his own laboratory. I have seen him interact with students, peers, and scientists at the highest level of their respective fields, and he is able to present ideas in a way that shows respect but commands authority. After spending time at the CDC as a veterinary student, Jon expressed interest in learning about molecular epidemiology, something with which he has had little training. This PhD program will provide that training for him, as well as ecology and disease modeling. In general, Dr Epstein is one of the most talented graduate students I have worked with, and has tremendous potential to become an accomplished independent scientist.

### **3. Environment and Institutional Commitment to the Candidate.**

#### **Description of the Institutional Environment.**

The Consortium for Conservation Medicine is an institutional partnership based at Columbia University, New York. There are 9 full-time research scientists at the CCM, which also shares space with one of its institutional partners, Wildlife Trust. Dr Epstein has frequent interaction with staff scientists who have diverse scientific backgrounds including ecology, epidemiology, molecular biology, wildlife biology and virology. At CCM, Dr Epstein has an office that is equipped with a separate phone and fax line, a laptop computer with high speed internet access (Both LAN and wireless), a printer/fax machine, and photocopier. There is storage space available for Dr Epstein's field equipment. Columbia's main campus as well as the Mailman School of Public Health are easily accessible by public transportation. Dr Epstein holds adjunct status at the Mailman School of Public Health. The CCM is part of the department of Ecology, Evolution, and Environmental Biology (E3B) and Dr Epstein also holds an adjunct faculty position in this department. Departmental seminars occur regularly, and Dr Epstein attends as often as possible. He also holds dual adjunct positions in the Department

Principal Investigator/Program Director (Last, First, Middle): Epstein, Jonathan H.

of Environmental Population and Health at Tufts University School of Veterinary Medicine and the Graduate Programs in Public Health at the Medical School. Tufts is one of CCM's six formal institutional partners – the others are Wildlife Trust (Columbia's CERC program), Johns Hopkins Bloomberg School of Public Health, The National Wildlife Health Center (USGS), The University of Pittsburgh's School of Public Health, and the University of Wisconsin's Nelson Institute for the Environment. The CCM is a WHO collaborating center for zoonotic emerging disease research, a partner in the Australian Biosecurity Cooperative Research Center, and has institutional connections to a range of global leaders in emerging disease research. Dr Epstein has and will continue to have access to the resources of all of these partner institutes, as needed.

The Jerome L. and Dawn Greene Laboratory at Columbia's Mailman School of Public Health will be available for Dr Epstein's use. Dr Ian Lipkin is the director of this lab and Dr Epstein's co-mentor. The Greene Lab occupies approximately 7,000 sq ft on the 18th and 19th floors of the Mailman School of Public Health. The laboratory proper includes isolated areas for work with cultured mammalian cells, radioactivity, recombinant DNA and BSL-3 infectious agents, as well molecular epidemiology using real time PCR. Equipment includes a phosphorimager, on-line thermal cyclers, HPLC, flow cytometer for bead-based immunologic and molecular assays (Luminex), DNA microarray analysis system (Axon Instruments GenePix Pro), DNA sequencer (ABI 310 Gene Analyzer), scintillation counter, darkroom, freezers and refrigerators, cryostat, brightfield and fluorescent microscopes, spectrophotometer, gel documentation system. Core facility equipment in close proximity include a confocal microscope, luminometer, FACS, amino acid analyzer, DNA and protein sequencers, Agilent APCI mass spectrometer dedicated to PCR/MS technology development, Affymetrix GeneChip System, and commercial and Columbia-developed bioinformatics software

Imperial College, London is one of the premier universities in the UK. The Department of Biological Sciences was formed in August 2001, by the amalgamation of the former Biology and Biochemistry departments together with the Biophysics section of the Physics department to form one of the largest departments of Biological Sciences in Europe, with about 97 academic staff, 250 research staff and 350 postgraduates. Dr Tim Coulson's lab is based at the NERC Center for Population Biology. The full facilities of Imperial College are available to the Center for Population Biology, including internet, libraries, and faculty.

#### **Consultants**

**Dr Stephen Luby** is the Head of the Program on Infectious Diseases and Vaccine Sciences at the International Center for Diarrheal Disease Research in Dhaka, Bangladesh. Dr Luby has been involved in investigating the most recent outbreaks of Nipah virus in Bangladesh and is the PI on an R01 proposal on which Dr Epstein is a co-author, about to be re-submitted to NIAID. Dr Luby has expressed enthusiastic support for Dr Epstein's PhD proposal and has already provided logistical support and local contacts for Dr Epstein during his field activities in Bangladesh. Dr. Luby will help Dr. Epstein coordinate field activities related to bat surveillance.

#### **Institutional Commitment to the Candidate's Research Career Development**

A letter of support is included from Drs. Lipkin and Luby indicating the progress that Dr. Epstein has made during the first year of his PhD training program. The Greene Lab and the ICDDR,B have been the main performance sites for this project so far. Dr Epstein has been granted access to both of these facilities for the duration of the project. In year one, Dr Hume Field (CCM associate) provided a field technician from his lab at Queensland Department of Primary Industries (DPI), Mr. Craig Smith, who is skilled in wildlife capture and restraint, with particular expertise in handling pteropodid bats. Mr. Smith has worked successfully with Dr Epstein in the past in Australia, China, and India, and together they successfully caught and sampled 99 bats from the project's first colony in Rajbari district. Funding for Mr. Smith was provided by the CCM and the NIH EID grant, which ends in July, 2007. In addition, the CCM and ICDDR,B have provided support for a part-time veterinarian and two field technicians during year one who have now become the full-time field team starting in year 2. This support will continue for the full period of the proposed K08 research (see Dr Daszak's letter of support). This team will aid Dr. Epstein in wildlife capture and sampling.

Dr Epstein will maintain his position of Senior Veterinary Epidemiologist at the Consortium for Conservation Medicine, and his adjunct faculty positions at both Columbia Mailman School of Public Health and Tufts, but his primary responsibility will be to conduct research related to his training project for no less than 75% of his time over the next 4 years. His remaining time will be used to continue with existing projects. The CCM is committed to supporting Dr Epstein's career development beyond the duration of his doctoral studies. The

CCM will provide full logistical and funding support for Dr Epstein's fieldwork. Specifically, 50% of Dr Epstein's salary is currently funded by an R01 grant to study Nipah virus in Malaysia. The remainder is made up from CCM core funds. The CCM has recently been awarded a 1-year, full-cost extension of its Ecology of Emerging Paramyxoviruses R01 grant by NIH and NSF, which will guarantee 50% of Dr. Epstein's salary for the next two years. We have also applied for an R01 to study Nipah virus in Bangladesh that will support 50% of his salary. If the K08 is funded, we will use these other funds to support Dr Epstein's fieldwork, including travel and testing costs.

#### 4. Research Plan

##### A. Statement of Hypotheses and Specific Aims

**This proposal aims to test the hypothesis that Nipah virus spillover between bats and humans is driven by spatial and seasonal variations of NiV shedding in bats.** Nipah virus (NiV) is a lethal zoonotic paramyxovirus (genus *Henipavirus*) carried by fruit bat reservoirs that emerged in Malaysia in 1998-9 and repeatedly in Bangladesh over the past five years. Many emerging zoonotic diseases have wildlife reservoirs, and studying their ecology is essential when trying to understand causes of emergence. Veterinarians are well-qualified to study emerging zoonotic viral diseases. However, among veterinarians only a small subset is trained in public health, work with exotic free-ranging wildlife and ecological techniques. The outcome of this program is to determine causes of viral spillover from bats to humans and produce a parameterized mathematical model that will inform the development of prevention and control strategies for this lethal virus. This program will provide me with training in laboratory diagnostic techniques and mathematical modeling – skills which are invaluable to my future career as an infectious disease epidemiologist.

##### My specific aims are to:

**1) Examine the distribution of NiV in flying foxes (*Pteropus giganteus*) in Bangladesh and host migration between colonies using serology, molecular techniques, and satellite telemetry.**

**Rationale.** Antibodies to henipaviruses have been found in pteropodid fruit bat species in Malaysia, Australia, Cambodia, Indonesia, and Thailand (13,15,16). There is also serologic evidence for Nipah virus infection in *P. giganteus* in India and Bangladesh (Epstein *et al* in prep, (17)). I will:

- a) Capture and test *P. giganteus* fruit bats for NiV infection at eight sites in Bangladesh – four colonies near human settlements that have experienced NiV outbreaks; and four colonies in sites that have not reported recent outbreaks of encephalitic disease. The colonies in outbreak zones will be paired with control colonies outside outbreak regions and at similar latitudes.
- b) Use satellite telemetry to study movement between fruit bat colonies in Bangladesh
- c) Use specific ELISA, and Taqman real-time PCR to screen samples for anti-NiV antibodies and NiV RNA. Samples will be sent to the Australian Animal Health Lab (AAHL) for confirmatory serology (SNT) and viral culture.

**2) Test the hypothesis that seasonal NiV outbreaks in Bangladesh correspond to seasonal spikes in viral prevalence in fruit bat reservoirs during pregnancy and synchronous birthing.**

**Rationale.** All five outbreaks of NiV infection in Bangladesh occurred between January and April, coinciding with both bat pregnancy and birthing in the region ((17-19)). Australian Flying foxes have been shown to aggregate during breeding and birthing (20), and fruit bats in Australia and Malaysia have shown seasonal variation in seroprevalence (see preliminary data). Experimental infections has shown Hendra virus (a related virus) in fetal and placental tissue (21). An increased density and number of infected bats that are under increased physiologic stress due to pregnancy and parturition may cause increased viral shedding within a colony. Synchronous birthing may then lead to massive contamination of the environment with birthing fluids which may pose increased risk for spillover of NiV to humans. I propose to:

- a) Capture, microchip label, band, and screen 100 bats for NiV antibodies every 12 weeks for three years (156 weeks) from one colony of *P. giganteus* proximal to a location from which human Nipah cases have originated and that is part of the enhanced surveillance program currently conducted by the ICDDR,B (see appendix).
- b) Sample fruit bats for NiV during periods of gestation, parturition, and lactation (using male bats as a physiologic control)



c) Compare colony size and composition during birthing periods and non-birthing periods.

### **3) Develop a parameterized predictive model for Nipah virus emergence in Bangladesh.**

**Rationale.** Mathematical modeling of zoonotic pathogen dynamics in wildlife reservoirs allows testing of theories on how viruses are maintained by reservoir hosts and how spill-over to humans may occur. I will use these techniques to test assumptions on NiV emergence in Bangladesh by:

- a) Developing and parameterizing an SIR model that describes the dynamics of NiV in bats
- b) Using models to determine the importance of spatial and temporal changes in viral prevalence in bats (e.g. due to gestation, parturition and synchronous birthing) and contact rates between bats, humans and domestic animals using human behavioral data collected by Steve Luby at ICDDR,B (See protocol in Appendix).

This program will allow me to develop my skills as a veterinary epidemiologist and researcher of zoonotic disease emergence. Nipah virus has direct public health significance both locally and globally. Understanding the ecology of zoonotic diseases is crucial for understanding what drives their emergence and for preventing future outbreaks. This research training program is an ideal model for my career development goals. Testing the above hypotheses may contribute to strategies for Nipah virus prevention in Bangladesh. The selected coursework is also a valuable component of this program.

## **B. Background, Significance, and Rationale**

### **B. 1. The significance of Nipah virus, an emerging paramyxovirus**

Over the past decade, two novel paramyxoviruses, Hendra virus (HeV) and Nipah virus (NiV), comprising a new genus *Henipavirus*, have emerged in Australia and South Asia respectively (12,17,22-25). These zoonotic viruses are carried by fruit bat (*Pteropus* spp.) reservoir hosts and are associated with high case fatality rates in humans (67% for HeV and 40%-78% for NiV) (13,25-27). Hendra virus first emerged in Australia in 1994; Nipah virus in Malaysia and Singapore in 1998, and in Bangladesh every year since 2001. In Malaysia, Nipah virus killed over 100 people (a case fatality rate of almost 40%), caused the collapse of the swine industry, the loss of over 1 million pigs, the closure of thousands of farms, and the loss of over \$350 million (USD) (28,29). Bangladesh continues to experience human outbreaks of Nipah virus encephalitis, the most recent occurring in the Tangail district in January, 2005 where infection spread directly from bats to humans via date palm juice (18). In humans, Nipah virus causes a febrile encephalitis and sometimes a respiratory illness (17,30,31). In Australia and Malaysia, these pathogens spilled over into the human population via domestic animal amplifier hosts (horses and pigs respectively) without evidence of human-to-human transmission. In Bangladesh, no intermediate animal host has been identified, human-to-human transmission occurs and outbreaks have been recognized annually between 2001 and 2005 – all occurring between the months of January and April (17). Human-to-human transmission in Bangladesh significantly increases the potential for Nipah virus to become a pandemic. The recent emergence of this novel paramyxovirus in two unconnected sites (Malaysia and Bangladesh) and the subsequent discovery of antibodies to henipaviruses in bats in several countries, suggest that NiV is geographically widespread in nature. In Malaysia, Nipah virus appears to be enzootic in both *Pteropus* species across the Peninsula (32). Henipaviruses potentially pose an important public health risk to humans and domestic animals wherever they occur in Pteropodid bats. Finally, the recent emergence of other related zoonotic henipaviruses and the preponderance of negative stranded RNA viruses as causes of emerging diseases suggest NiV is an excellent model for the emergence of new zoonoses.

### **B. 2. Underlying causes of NiV emergence in Malaysia**

In Malaysia, NiV appears to have initially moved from fruit bat reservoirs to pigs, in which it caused a respiratory infection and severe coughing, exposing pig farmers to infection (12). Three hypotheses for the underlying causes of its spillover from bats have been reported: 1) That recent intensification of pig farming in Malaysia allowed the virus to become enzootic in pigs on the index farm; 2) That El Nino-associated drought in Indonesia in the mid-1990s and anthropogenic fires forced NiV-positive fruit bats to migrate to Peninsular Malaysia and reach the index farm; and 3) that land-use change, hunting, and habitat degradation have altered fruit bat migration and behavior and increased their contact with livestock and humans (9,13,33,34). The emergence of NiV provides a case study illustration of anthropogenic factors contributing to three classic

steps of emergence described by Morse (35). Certainly, the presence of pig farms in *Pteropus* habitat led to introduction of NiV into pigs; the high pig densities seem to have enabled maintenance of viral transmission; and the transport of pigs to other regions led to dissemination of the virus to southern Malaysia and Singapore (36-38). However, this scenario is layered with complexity. Across their range, fruit bats have been subjected to habitat loss, habitat fragmentation, human encroachment, hunting pressures and other pressures that have reduced abundance of some species, brought others closer to human and domestic animal populations and altered the migration routes of most (10,39). This contrasts markedly with the emergence of NiV in Bangladesh, where no evidence of amplifier hosts has been found (see below), and human populations have become so dense and there is relatively little natural habitat remaining that there is a high rate of indirect contact between bats and people. In Bangladesh fruit bats live among human settlements and feed on common fruit crops eaten by people (40,41). **This study will focus on the dynamics of Nipah virus in bats and humans, and will identify key opportunities for Nipah virus to spillover into human or domestic animal populations.**

### B. 3. Nipah virus in Bangladesh

Five outbreaks of human NiV infection were recognized in Bangladesh between January and May 2001 – 2005, the most recent one occurring in Tangail District in north central Bangladesh (18,25). A total of 102 human cases of Nipah infection have been documented; 77 (76%) died. Similar to the outbreak in Malaysia, the disease caused fever and central nervous system symptoms, and a high case fatality rate in people (42). Fruit bats (*P. giganteus*) were the only wild animal with serologic evidence of infection (17). In Meherpur and Naogaon in 2003 serum samples were collected from 10 birds, 6 pigs, 2 shrews, 5 rodents and 56 bats including 44 *P. giganteus*. Antibodies against Nipah virus antigen was detected in 2 *P. giganteus* adult females. Serum specimens from all of the other animals were negative. In Goalando district in 2004, Of 92 *P. giganteus* captured, 14 (15%) had antibodies to Nipah virus in contrast to no detectable antibodies among 5 rodents, 40 shrews, 36 other small fruit bats, and 4 insectivorous bats (17).

There were, however, important differences between the multiple outbreaks in Bangladesh and the single outbreak in Malaysia and Singapore. First, in Bangladesh there was consistent evidence of person-to-person transmission of Nipah virus. This is important, because it suggests that NiV may have potential to spread within human populations and ultimately become pandemic. The outbreaks in Bangladesh happened independently of each other, suggesting several spillover events from bats to humans. In the first outbreak, in the Meherpur district, the index patient died six days after first developing symptoms. Five other persons in the household developed NiV disease 10 –18 days after the index case. Nine of the 13 NiV-infected people in this outbreak were relatives of the index case. Living with a person who had Nipah, was a risk factor for illness (OR 4.80, 95% CI 1.23, 18.8)(17). In the Naogon outbreak in January 2003, the head of one household became ill, followed two weeks later by his wife and three eldest daughters. All died of NiV infection. In the Faridpur outbreak between February and April 2004, the virus appears to have undergone four transmission cycles in people (Figure 2 (43)).

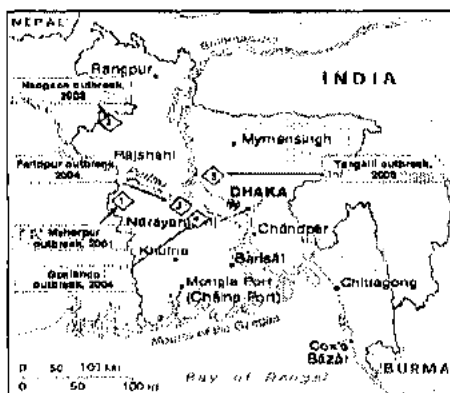


Figure 1. Map of Bangladesh showing locations of Nipah virus outbreaks from 2001 to 2005.

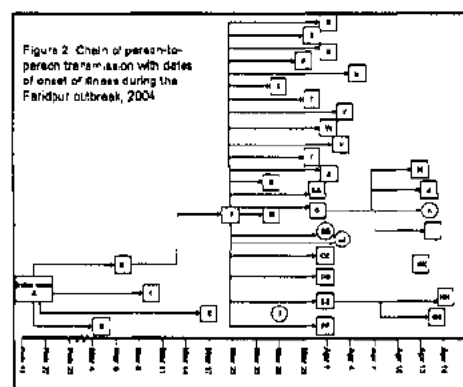


Figure 2. Person to person Nipah transmission in Faridpur, Bangladesh, 2004

**Second**, there is no evidence for livestock amplifier hosts between fruit bats and humans in the Bangladesh outbreaks. Pigs are uncommon in Bangladesh, though a pig herd was present in Meherpur two weeks before the outbreak. Contact with a sick cow was significantly associated with illness in the Meherpur outbreak (OR 7.89, 95% CI 2.2, 27.7) but the cow was not tested for Nipah virus, and so it is still unclear what role domestic animals play in Nipah virus transmission in Bangladesh (17). Therefore, it seems that the epidemiology of NiV in Bangladesh differs substantially from that in Malaysia in that: 1) It has spilled over repeatedly; 2) Spillover appears to be seasonal; 3) Spillover occurred without livestock amplifier hosts; and 4) there appears to have been human-to-human transmission. **My proposed work will investigate the factors involved in spillover, and produce a model of disease dynamics in reservoir hosts that directly informs risk of infection.** This is particularly important, given the potential of NiV in Bangladesh to spread within the human population.

#### **B. 4. Techniques for NiV surveillance**

My research proposal involves a large component of development of molecular and other epidemiology techniques for NiV surveillance. Here I describe available diagnostic tests for NiV.

##### **B. 4. a. Serology**

###### *Enzyme-linked Immunosorbent Assay (ELISA) and Serum Neutralization Test (SNT)*

Several serological tests have been used to detect antibodies to Nipah virus (21,44-46). ELISA tests have been used as initial screening tools to identify NiV reservoirs because they are safe to perform in a standard laboratory without high biosecurity provisions, reagents are available from reference labs, and they are highly specific and sensitive. There are three major types of ELISA tests used for Nipah virus: A comparative ELISA, an indirect ELISA, and a blocking ELISA (AAHL, unpublished; S. Abdul Rahman, unpublished;(46,47)) I will use a comparative ELISA developed and provided by AAHL. This ELISA protocol has a greater than 98% specificity compared to an earlier version used during the Nipah virus outbreak in Malaysia (AAHL, unpublished). It increases specificity by using a vero cell blocking antigen to decrease non-specific binding. All serum samples will be tested by SNT at AAHL to confirm ELISA results.

Serum-neutralization tests (SNTs) are considered the reference standard for henipavirus serology and are used to confirm ELISA test results, but require the use of purified virus and therefore need to be conducted under stringent biosecurity conditions (modified BSL-3 or BSL-4) (48,49). The SNT for Nipah virus is more sensitive and specific than the currently available ELISA tests (46) (**See Section G – Select Agents**).

##### **B. 4. b. Molecular Techniques**

*Conventional Polymerase Chain Reaction (PCR) and Real Time Taqman™ PCR.* Nipah virus contains a single-stranded RNA of about 18,000 nucleotides associated with the viral proteins of the replicative complex (the nucleoprotein (N), the phosphoprotein (P), and the polymerase (L)) enclosed by a lipid bilayer envelope containing the attachment protein (G) and the fusion protein (F) (50). Conventional polymerase chain reaction (PCR) is an amplification technique that can detect virus or viral RNA using reverse transcription. This standard technique uses primers of about 20bp in length to replicate viral RNA and the resultant product can be sequenced and compared to known viral RNA sequences for identification. PCR is a relatively simple, highly sensitive, and cost-effective technique (51).

Real Time Taqman™ reverse-transcriptase PCR tests are able to detect and characterize Nipah virus RNA in biological samples with high specificity and sensitivity. A Taqman RT-PCR method for NiV detection was developed by Guillaume et al. (50). This technique is sensitive, detecting viral RNA in concentrations as low as 1.2 pfu at 30ct. The technique was tested against Measles RNA and Hendra RNA and did not detect viral particles, signifying that the technique is also specific. Taqman RT PCR can also detect virus or viral RNA in serum samples, so it is ideal to use for screening bat and environmental samples.

PCR techniques are advantageous for several reasons: 1) biological samples are fixed and viral RNA is inactivated, allowing tests to be run safely in BSL-2 laboratories; 2) these techniques may detect virus or viral RNA present at very small quantities (Taqman RT PCR can detect Nipah virus or viral RNA at 1.2 pfu (50)); 3) PCR may detect virus or RNA at the time of infection, before antibodies are detectable through serological testing, 3) PCR using degenerate primers can detect viral RNA from related viruses, creating a less specific but more sensitive test than real time Taqman PCR than can be useful in identifying novel viruses, and 4) real-time PCR provides a very specific and rapid assay, which is a useful technique for epidemiological investigations. The major limitations of PCR techniques are the reproducibility of the electrophoretic band

patterns and the problem of DNA or RNA contamination (51). **Section D.1. Methods** describes how these techniques will be used in the context of the Specific Aims 1-2.

#### **B. 4. c. Viral Isolation**

Isolation of viruses is conducted by taking tissues, secretions, excretions, blood or other biological samples from infected hosts, preparing tissue homogenates, inoculating cell cultures and looking for resultant cytopathic effect (CPE) (52). NiV grows well in Vero cells, and CPE usually develops within 3 days (49). Viral isolation for NiV requires either enhanced BSL-3 or BSL-4. It has been used extensively in outbreak investigations to confirm NiV. NiV has been isolated from human tissues in Malaysia, Singapore, and Bangladesh; and pig and bat tissues in Malaysia (53-55). NiV was first isolated from bats by collection of urine from beneath bat roosts, and subsequently from swabs of fomites – specifically fruits that had been chewed by bats (54). Nipah virus RNA is stable for up to 25 days at a variety of temperatures in harvested porcine tissue (I. Pritchard, unpubl. obs.) and Nipah virus was recovered from *P. alecto* urine, lychee and mango juice at RT after 96 hours (56). This suggests that environmental contamination by Nipah virus-infected birthing tissues or fomites may be a risk factor for human and domestic animal infection.

#### **B. 5. Mathematical models of disease dynamics**

There is a long history of using models to understand the dynamics of disease and patterns of human infection (57-60). For directly transmitted diseases with one primary host and a short latent period (as I hypothesize for Nipah virus dynamics in Bangladesh), simple Susceptible-Infected-Recovered (SIR) models, which have few parameters, can be used to understand several aspects of virus transmission, including virus persistence through the calculation of  $R_0$ , threshold densities for persistence and amplification (for density dependent transmission), and the impact of changes in any of the host or pathogen dynamics (e.g. period of infectiousness, mortality rate from infection, etc.) (61). In addition, when combined with data on infection or serology from the field, these models can be used to estimate parameters such as the contact rate between individuals and the steady state seroprevalence; or steady state viral prevalence of a pathogen (61). These models can also be extended to multiple populations to consider the effects of movement between subpopulations on disease or species persistence (62,63). Finally, these models can be extended to consider disease transmission between multiple species (64,65) including spill-over of zoonotic pathogens from wildlife to humans (66).

#### **C. Preliminary Studies and Results**

I am currently hired under an NIH-funded project on “Anthropogenic changes and the emergence of novel zoonotic paramyxoviruses” (R01 TW05869) and with core foundation funding to the CCM. This large, multidisciplinary project has produced substantial preliminary data on the ecology, surveillance and modeling of Nipah and Hendra virus emergence. My role on this award is to conduct research on NiV emergence in Malaysia and help co-ordinate research between NiV and HeV groups. Below I report some of the preliminary data I have generated from my own work and in collaboration with other group members. I have conducted substantial components of each of the studies listed below, however I have not been directly involved in using diagnostic techniques or modeling – two skill sets which I propose to develop in this training program.

##### **C. 1. Specific Aim 1: Examine the distribution of NiV in *Pteropus giganteus* fruit bat reservoirs in Bangladesh and host migration between colonies**

###### *Distribution of Nipah virus in Pteropus giganteus in Bangladesh*

To demonstrate proof-of-concept, and as part of the initial work towards my Ph.D, I have identified 6 *Pteropus giganteus* colonies in three districts of Bangladesh, and have collected 214 samples from two populations, 99 from Rajbari, Bangladesh during January, 2006 and 115 from Chittagong in August, 2006. Rajbari is within 25km of the outbreak site in Faridpur and Chittagong is not associated with human cases of Nipah virus. I obtained CITES and USDA permits to import these samples from Bangladesh into the USA. I imported the positive and negative control sera and the ELISA reagents from our collaborators at AAHL, Australia. I have completed preliminary screening of the Rajbari serum samples and 14 of 99 (14%) samples were positive reactors on the ELISA. Antibodies to NiV have previously been found in flying foxes in another

region of Bangladesh (17), but this is the largest number of bats sampled from a single population and the first data from **Specific Aim 1**.

#### Presence of NiV in *P. giganteus* in India

In 2003, I led a field trip to Northern India to conduct a pilot study of NiV in *P. giganteus*. Flying foxes are common in this region and live in close association with humans. We captured 41 flying foxes using standard mist netting technique and collected blood and morphometric data. Serum was tested using a NiV indirect ELISA through collaboration with the Australian Animal Health Laboratory (Geelong, Aus). We found serologic evidence for NiV infection in *P. giganteus* in Northern India. These samples were sent to AAHL and tested by SNT. Twenty of thirty-nine (51%) had neutralizing antibodies to Nipah virus on SNT (Epstein et al, in prep). There have been confirmed outbreaks of Nipah virus in Siliguri, India, which is right on the Bangladesh border and within the region where human Nipah virus cases have occurred in Bangladesh (67). This finding provides evidence for a wide geographic range for henipaviruses in pteropodid bats on the Indian subcontinent; and illustrates the need for further study of NiV in this region.

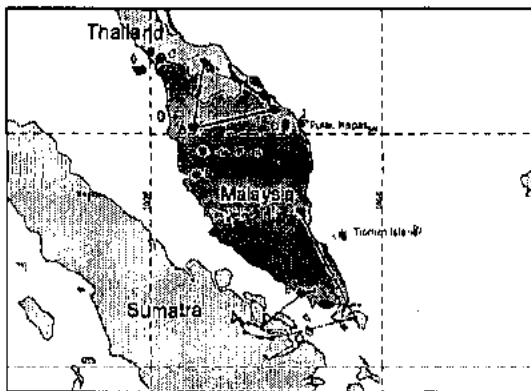
#### Distribution of Nipah virus in *Pteropus vampyrus* and *P. hypomelanus*, Malaysia

In Malaysia, we have identified NiV antibodies in several *P. vampyrus* colonies distributed throughout the Peninsula, including those roosting close to the index farm (Fig 3 and Table 1). Bats from colony "A", which is 50km from the index farm, have a seroprevalence of 54% (+/- 9%). The index farm is also only 50km from colony "B", which has a prevalence of 29% (+/- 17%). We found that *P. vampyrus* will fly over 50km per night as part of their normal foraging activities (see telemetry section below). Although we did not sample these bats, we found a *P. vampyrus* seasonal roost site within 4 km of the index farm. Thus infected bats from any of these roost sites could have fed on fruit at the index farm.

Location*	n	Positive**	%	SE
Leggong (A)	28	15	0.54	0.09
T. Memali (B)	7	2	0.29	0.17
Perlis (C)	7	1	0.14	0.13
K. Berang (D)	12	4	0.33	0.14
Benuat (E)	24	13	0.54	0.10
<b>Total</b>	<b>78</b>	<b>33</b>	<b>0.42</b>	<b>0.06</b>
Pulau Tioman (1)	25	59	.24	0.026
Pulau Kapas (2)	30	3	0.10	0.05

**Table 1.** Seroprevalence by species and colony location. Location letters correspond to *P. vampyrus* colonies; numbers to *P. hypomelanus* colonies in Fig 5. \*\*Positive samples tested by C-ELISA.

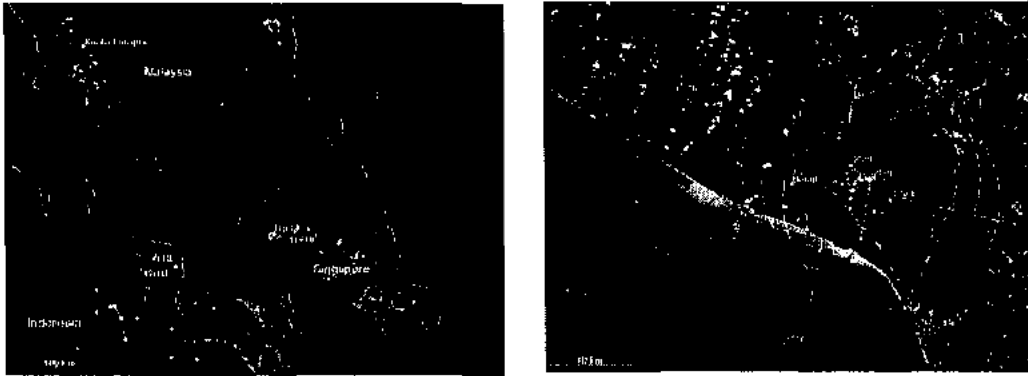
#### Satellite telemetry of Malaysian fruit bats



We used satellite telemetry (Figs. 4 and 5) to investigate the connectivity of NiV- and HeV-positive *Pteropus* colonies in Malaysia and Australia. In Malaysia I attached satellite transmitters to seven adult male *P. vampyrus*. Our group has done the same with four adult male *P. alecto* and six adult *P. scapulatus* in Australia. Telemetry data show *P. vampyrus* in Malaysia move over large distances (>200 km) within short periods of time (10 days) (10).

**Fig 4.** The distribution and seroprevalence of Nipah virus in free-ranging pteropodid bats throughout Peninsular Malaysia. The tracks represent flight paths of satellite-collared fruit bats. The time between points is 10 days.

Data from Malaysia show two bats that originated at the same location (A), reconvened at a roost hundreds of kilometers away in Thailand. These data suggest that single *Pteropus* colonies are part of a larger cohesive meta-population, effectively increasing the available number of bats for NiV to infect.



**Figure 5.** Digital satellite photos of: LEFT: Peninsular Malaysia showing two flying foxes that have traveled between Benut, Malaysia and Sumatra; and RIGHT: local foraging patterns of a collared male flying fox in Benut from September, 2005.

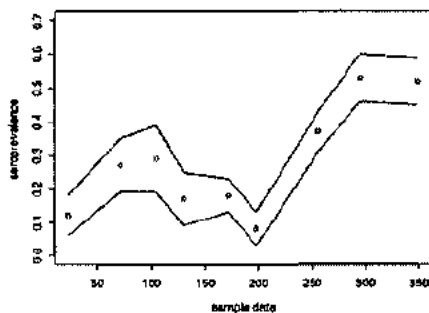
**Specific Aim 1 will allow me to better understand Nipah virus distribution and dynamics in *Pteropus giganteus* by fusing knowledge of viral prevalence and spatial distribution with migration between colonies and long-range movements.**

**C. 2. Specific Aim 2: To determine how reproductive stress in adults and viral dynamics in juveniles affect overall viral prevalence in bat populations.**

*Fruit bat reservoirs of Hendra virus*

We have conducted a 3-year longitudinal survey of Grey-headed flying foxes (*Pteropus poliocephalus*) and Black flying foxes (*P. alecto*) in Australia. It reveals an average anti-HeV antibody seroprevalence of approximately 30 percent (Fig 3) and low (<1%) viral prevalence (68).

**Fig 6.** Hendra virus (HeV) seroprevalence in Grey-headed and Black fruit bats over time (days from commencement of study). The hollow points are the point estimates of seroprevalence for *P. alecto* and *P. poliocephalus* combined (R. Plowright, unpublished).



We have also sampled Little red flying foxes (*P. scapulatus*) in the Northern Territory, Australia. Adults had HeV seroprevalence (ELISA >1:5) of approximately 20%, while pups had a 56% seroprevalence (n=790). In a second population, cumulative seroprevalence for HeV was 7.5% (ELISA >1:5). High seroprevalence in juveniles may reflect a spike in viral prevalence during or just after the birthing season, as juveniles represent a naïve population.

*Prevalence and distribution of Nipah virus in Malaysian Fruit bats*

Our preliminary investigations demonstrate wide distribution of Nipah virus (NiV) in Malaysian fruit bat populations (*P. vampyrus* and *P. hypomelanus*) and seasonal variation in seroprevalence in Variable flying foxes (*P. hypomelanus*) (32). The seroprevalence of Nipah virus in *P. vampyrus* is 42% (+/- 6%) n=172. In order to study seasonal variation in *P. hypomelanus*, we collected samples from 50 bats every 3 months for 36 months at a colony from which Nipah virus was previously isolated (54). We collected serum, urine, throat swabs and tested the serum for antibodies to Nipah virus, and the urine and oral swabs for viral antigen. So far, no virus has been isolated from this population (Abdul Rahman *et al.*, *in prep*). We also surveyed feral cat populations to see whether spillover from bats to cats was occurring, however all cats tested negative for exposure (10). A significant increase in seroprevalence occurred between October 2003 and January, 2004 and June and August 2004, perhaps indicating active viral circulation (Figure 7). The sample collection was completed in October, 2006 and final results are pending.

In experimental infections performed at AAHL, CSIRO, Australia, we have used Taqman RT-PCR to demonstrate Hendra viral antigen in oral and rectal samples, blood, and urine after viral inoculation in *P. alecto* (69). Detection of viral genome using PCR was comparable between urine and blood. Opportunity for detection peaked 10-13 days after inoculation, with the range for detection being 10-16 days. Rectal swabs were similar to throat swabs, with peak detection occurring before day 8, and the range being less than 8 days. Following Nipah virus inoculation of 50,000 TCID<sub>50</sub> into *P. vampyrus*, viral RNA was detected in both the throat and rectum (Halpin, Pers. Com.). These data provide information on routes of excretion. Our group was able to isolate virus from placental and fetal tissues of experimentally infected bats, demonstrating that virus is also excreted in birthing fluids (21,70). In Bangladesh, annual outbreaks of Nipah virus encephalitis in people have been reported from 2001 to 2005. All of these outbreaks have occurred between January and March. **This has led to the hypothesis that Nipah virus outbreaks may be seasonal in bats.**

### C. 3. Specific aim 3: To develop a parameterized model to determine whether temporal variation in NiV prevalence or contact rates with humans drive NiV spillover to humans.

#### Preliminary results from Malaysia.

We modeled the dynamics of NiV at the index pig farm (site of the first human case) for NiV in Ipoh, Malaysia. This was a 30,000-head operation, raising weaners and porkers for distribution, resulting in a high turnover of susceptibles. Fruit orchards surrounded this farm and, in some cases, fruit trees are planted adjacent to pigsties. We have identified a fruit bat roost approximately 4 km from the index farm (10), and seropositive bats have been found roosting within 50km of the index farm (32). Our findings support the hypothesis that NiV spillover from bats to pigs occurred via ingestion of contaminated fruit spat in pigsties (33). We hypothesized that NiV was maintained enzootically in this densely-populated farm. This is supported by the finding that human cases of NiV first occurred around the index farm over 12 months prior to the initial epidemic rise in cases. We developed an SEIR model of the dynamics of Nipah virus on pig farms in Malaysia,

parameterized with data on pig population dynamics and NiV-related morbidity and mortality from the original outbreak at the index farm and with data on pig management techniques from a very similar farm that is still in operation in Malaysia (Fig 8).

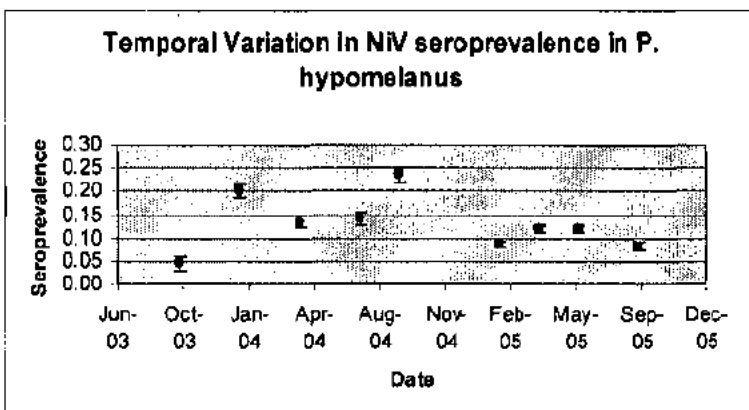


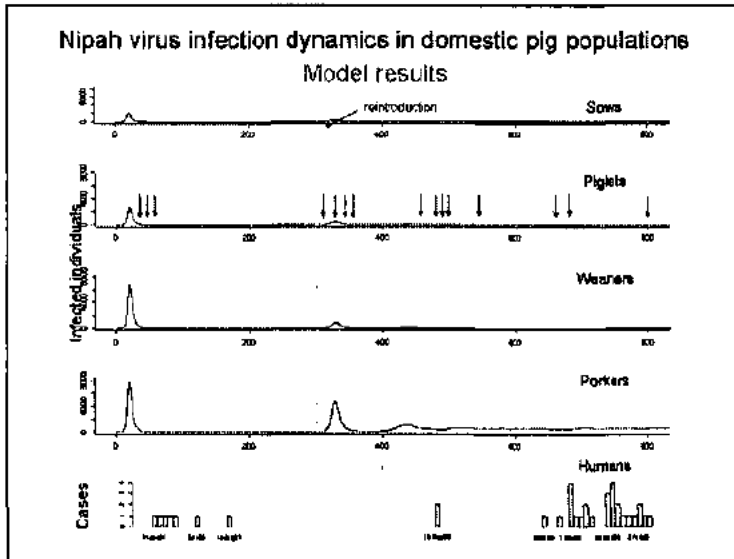
Fig 7. Seroprevalence of Nipah virus at different times in *P. hypomelanus* from a single colony on Tioman Island, Malaysia.

$$R_0 = \beta S \left( \frac{1}{\mu + \alpha_s} + \frac{\rho b}{(d_p + \rho)(d_p + \mu + \alpha_p)(g + d_p)} + \frac{\rho g b}{(d_w + \rho)(d_w + \mu + \alpha_w)(g + d_p)d_w} \right)$$

Fig 8. SEIR model calculating  $R_0$  for NiV on a large pig farm (parameterized according to data from the index farm).

Our analyses demonstrate that if NiV has an  $R_0$  of 6 or higher (comparable to suggested values for measles at community population levels), long-term persistence of Nipah virus occurs at farms the size of the index farm (Pulliam et al. submitted). However, this occurs only when rapid, compartmentalized production of porkers and weaners is practiced. The maximum likelihood fit for  $\beta$  (the transmission coefficient) corresponds with an  $R_0$  value of approximately 16.9. Figure 9 shows a simulation of Nipah virus infection in each age class, and illustrates that porkers and weaners, groups that have very high turnover rates on large farms, were key to maintaining Nipah virus infection over time once it had spilled over from bats. The human epidemic curves follow a similar patterns, reflecting exposure to pigs on the index farm.

These data support the hypothesis that intensification of pig farms and high-turnover management is one of



**Fig 9.** When separated by age class, piglets and porkers, both groups with high turnover and a high fraction of susceptibility, show infection patterns that mirror the human epidemic curves.

maintain itself unless one or more of the following three conditions exist: 1) a metapopulation structure exists for the bats 2) the virus has a latency period or persistent infection or 3) there is loss of immunity. Our current working hypothesis is that the little reds act as the primary reservoir for HeV, maintaining active infection at low overall prevalence due to their frequent migration between colonies (i.e. the metapopulation structure). This may be the case for other flying fox species. The *P. vampyrus* telemetry data (Section C. 1) suggest that single flying fox colonies are part of a larger metapopulation, rather than discrete, closed populations. This effectively increases the number of susceptible individuals that can be exposed to Nipah virus in wild bat populations and supports an SIR model of disease dynamics. *Pteropus giganteus* lives in colonies of variable size, but it is unknown whether migration occurs between colonies. I will determine whether *P. giganteus* colonies are part of a metapopulation structure using satellite telemetry (Specific Aim 1), and modify the model accordingly. I will focus on determining the effects of adult viral prevalence and juvenile viral dynamics on spillover to humans.

#### D. Research Design and Methods

There are crucial aspects of Nipah virus ecology and epidemiology that remain unknown. First, we do not understand how Nipah virus is transmitted between bats in Bangladesh nor what the prevalence of Nipah virus is in bats (**specific aim 1**); **Second**, it is unknown how frequently the virus moves from bats to people or if there is a seasonality to infection in bats or people (**specific aim 2**); **Third**, we have little, if any, information on how to predict spill-over of NiV into human populations, and if these predictions can be applied to other NiV outbreaks (**specific aim 3**). In this section, I outline rationale and methods to address these key issues

##### D. 1. Specific Aim #1: Determine the distribution of NiV in *Pteropus giganteus* and host migration between colonies.

###### Rationale.

It has been demonstrated that fruit bats carry henipaviruses in other regions of South Asia (13,15-17). In Bangladesh, bats with antibodies to NiV were captured in Meherpur and Naogaon in 2003 and in Goalando district in 2004 (17). However, it is unknown how widespread the virus is in Bangladesh. It is unknown if NiV is present only at the sites where human cases were observed, or if it is widespread throughout the country. Furthermore, it is unknown if there is regular migration of bats between colonies in Bangladesh, or even

the key reasons for the emergence of NiV in Malaysia. **Although the behavior of NiV in Bangladesh appears to be substantially different, our preliminary data demonstrates proof of concept for modeling approaches to understanding spill-over risks for NiV.**

Additionally, analysis of the index farm data suggest that there may have been at least two spillover events from bats to pigs, the first causing the initial small cluster of human cases in early 1997, and a short outbreak in the pig population which quickly burned out, while the subsequent introduction of NiV took off in the pig population due to an increase in susceptible individuals (Fig 9. (71)).

##### Modeling of HeV dynamics in fruit bats

We constructed an SIR model of Hendra virus (HeV) dynamics in little red flying foxes (*P. scapularis*). Our work indicates that in a closed population of these bats, with no spatial structuring and a short period of infection, HeV could not



between Bangladesh and neighboring countries; and how this will affect the dynamics of NiV in these populations. I will be able to use evidence for wide geographical presence of NiV infection in bats, long-range migratory data, and biological data on population dynamics and structure to parameterize predictive models for Nipah emergence in the region.

#### *Methods.*

**Location and sample size.** In order to characterize NiV in its natural fruit bat host, I will compare antibody and viral prevalence between eight different colonies in two different categories: 1) 4 colonies located within 10km of a hospital or clinic under enhanced Nipah virus encephalitis surveillance by the ICDDR,B where Nipah virus outbreaks have occurred; and 2) 4 colonies near villages that have not had recorded outbreaks of NiV and that are outside the region of Nipah virus outbreaks. Outbreak locations will be paired with non-outbreak colonies by latitude. **The total number of bats sampled for this Specific Aim: 800. I have decreased the original number of study sites from 12 colonies to 8 colonies to make the study more feasible, while still providing substantial and valuable data; and to limit the expense from a larger sample size.** In response to reviewers' comments from the first submission, I have conducted sample size calculations with a power analysis to determine the optimal number of bats that I should sample at each site for Specific Aim 1 (72). As a result, I have increased the sample size from 30 bats to 100 bats at each site which will allow me to detect differences in seroprevalence between sites of about 20% (i.e from 30% to 50%) with 95% confidence and with 80% precision. Their seroprevalence range is derived from data from *P. hypomelanus* on Tioman Island, where seroprevalence increased from 20% to 60% in two months (see preliminary data section). I have revised my proposed anesthesia protocol to increase the number of bats that I can process in one session from 10-12 to 15-20 (**see section F Chemical Restraint**), making these target numbers more easily achievable. I will be able to sample 300 bats per site via urine samples as described by Chua (54). This will allow me to detect virus in the colony, assuming that approximately 1% of animals are viremic and there is population size of up to 10,000 bats. I will record each bat's weight, age, sex, physical condition, and pregnancy or lactation status. I will try to catch a representative sample that includes adult males and females, as well as juvenile males and females so that I can compare infection status across age and sex groups. I will aim to have at least 40 juveniles per sampling site, which will allow me to compare differences in seroprevalence of 30% or more between adults and juveniles within or between colonies; or between juvenile populations in different colonies. This is also within the range of seroprevalence found on Tioman Island. Age-structured analysis of viral exposure will provide information about recent viral circulation.

**Fruit bat capture.** Capture and sampling techniques have been approved by IACUC (# 04-08). Fruit bats will be captured using large (30' x 30') mist nets made locally in Dhaka that are suspended by rope between two bamboo poles mounted in trees. The net will be positioned across an open area either adjacent to a colony or in an established flyway near a colony. This technique has been successfully used in each of our catching expeditions in Bangladesh. Bats will be captured at roosting sites when returning from feeding (~ between 1AM and 5 AM). Duration of trapping will depend on the capture rate. A maximum of 20 bats will be caught per trapping period, which is an optimal number for our bat field staff of three people to process. Bats will be placed in a pillowcase and hung from a branch or post until samples are collected. Bats are not held for more than 6 hours including processing and recovery from anesthesia. Bats will be released at the roost site once they are recovered from anesthesia.

**Sample Collection and Transport.** For both human and animal safety, we will anesthetize fruit bats using Isoflurane gas (73). Isoflurane is optimal because the bats are induced and recovered rapidly with minimal anesthetic and because the sampling is non-invasive. Bats will be under anesthesia for 10 minutes, and released within 6 hours of capture. Two sets of three swabs will be taken from *Pteropus giganteus*: throat, urogenital tract, and rectal. 300 swabs from pooled urine will be collected from underneath four fruit bat roosts as described previously (54). During birthing periods, 300 swabs of birthing fluids will be collected from under two roost sites and tested. One set of samples will be stored in Trisol fixing solution to extract nucleic acid for molecular techniques, and the other will be placed in a cryotube with viral transport medium [1X Hank's balanced salt solution (ICN Biomedicals, Inc., USA), 1% bovine albumin, pH 7.4] containing amphotericin B (15 µg/ml), penicillin G (100 units/ml) and streptomycin (50 µg/ml). All samples for PCR and viral isolation will be stored at -70C using dry ice (available daily from the ICDDR,B). 3.0 ml of blood will be collected from the

radial artery or vein using a 23 gauge needle and 3cc syringe. Blood will be inserted into a 3.0 ml Vacutainer tube with serum clot activator and allowed to settle. This yields between 1.0 and 1.5 ml of clean serum. Serum will be extracted using a pipette gun and disposable pipette tips and aliquoted into two cryotubes. One set of samples will be sent to the Greene Laboratory at Columbia for serology and molecular testing and AAHL for viral isolation and SNT; and the other set will remain at the ICDDR,B in Dhaka, Bangladesh.

**Animal Identification.** All fruit bats will be banded on the first phalanx of digit I, using stainless steel thumb bands (Size #4, Gey Band & Tag Co, PA, USA) stamped with a unique serial number and via a microchip inserted subcutaneously between the scapulae (Avid Microchip, LA, USA) which has a serial number read by a hand-held scanner. Bats recaptured within the same session will be released, but bats recaptured in a subsequent trapping session will be re-tested to measure changes in infection or immune status over time.

**Serology and molecular testing.** I will perform ELISA and PCR tests at the Greene Lab under co-mentor Dr. Ian Lipkin's supervision. All serum samples will be sent to AAHL, CSIRO for confirmatory SNT testing

**ELISA** See Section B.4.a. for ELISA description. I will use a comparative ELISA (AAHL), which is > 98% specific to Nipah virus, (compared to a previous ELISA) however, it is possible that it may still cross-react to other unknown henipaviruses, which is why serum neutralization tests will also be conducted on all serum samples. The test was validated using pig serum and had a >70% sensitivity and >95% specificity when compared to SNT. This ELISA has also been used on human, horse, and fruit bat serum and matched SNT. Serum neutralization tests are more specific than any current ELISA tests and are considered the gold standard for serology testing (49). Positive pig sera for controls and MAb (11E11) have been obtained from AAHL for use in my training program under USDA permit 66770 (see Appendix). One of the limitations of the current ELISAs is that it will only react to serum IgG, not to serum IgM. This means that the ELISA will not react to serum from bats at the early stages of infection that have rising IgM titers. This is an important sub-set of animals as they may be more likely to still have virus in their urine or saliva and thus their swabs would be candidates for viral isolation. In mid-2007, reagents specific for IgM and IgG will be available from AAHL, making the ELISA more sensitive (Halpin, Pers. Comm.). These reagents will be provided to me when available (see Hyatt letter, Appendix) and I will re-test ELISA non-reactive samples with an IgM-specific ELISA and compare results to the SNT. Samples that react to an IgM ELISA and are SNT positive will be targeted for viral isolation.

**Conventional PCR and Taqman real time PCR.** PCR is particularly useful as a screening tool because the inactivation of viral RNA as part of the extraction process means it can be safely performed for agents like Nipah virus in any laboratory (50). There are advantages to using both conventional PCR and Taqman real-time PCR for the purposes of addressing Specific Aims 1-3. Taqman rtPCR is highly sensitive and specific, and uses smaller amplicons than conventional PCR, which allows for faster results in the detection of Nipah virus RNA. Taqman rtPCR is, however, so specific that if another henipavirus is present in the sample, the test will not detect it. Conventional PCR will allow me to design and use degenerate primers that will detect both Nipah virus and also other henipaviruses that may be present in pteropodid bats. The discovery of both Nipah virus and Tioman virus in *P. hypomelanus* demonstrated that it is possible for pteropodid bats to carry multiple paramyxoviruses concurrently (74).

I will prioritize urine samples for both PCR tests, as Nipah virus was most readily detected in animal urine in experimental studies and from bats in the field (75-77). I will use both conventional PCR using degenerate primers and Taqman™ RT-PCR as described by Guillaume (50). For conventional PCR, I will derive degenerate RNA primers using conserved sequences using the 7 complete genomes (18,246 bp) and 3 partial genomes from human and pig isolates of NiV and one partial fruit bat NiV genome (11,200 bp), all available on GENBANK (<http://www.ncbi.nlm.nih.gov/blast/>). These will be matched with the 3 sequences for HeV from humans and horses (2 of which are full genomes of 18,234 bp) and the paramyxovirus phylogenetically most closely related to the henipaviruses, Tupaia virus from a tree shrew in Bangkok (78). Two full genome sequences of Tupaia virus (17,904 bp) have been published. Conserved sequences will be identified using Clustal X (66) and MacClade (<http://macclade.org/macclade.html>) and targeted for use in assay development.

For real time Taqman PCR, I will use the following primers as described by Guillaume: Forward primer (Ni-NP1209 5' GCAAGAGAGTAATGTTTCAGGCTAGAG3') and the reverse primer (Ni-NP1314

5'CTGTTCTATAGTTCTTCCCCTTCAT3') to amplify a 105bp fragment. I will use the fluorescent probe NIP1248Fam 5'TGCAGGAGGTGTGCTCATTGGAGG3'. I will acquire RNA primers from a commercial lab (e.g. MWG Biotech, Inc (High Point, NC) for conventional PCR and TIB MOLBIOL, LLC, (Adelphia, NJ ) for Taqman primers) and will perform my own RNA extraction before running the PCR assays. I will use the RNA extraction kit (QIAamp Viral RNA Mini Kit, Qiagen Inc., Valencia, CA, USA) for RNA extraction, following the manufacturer's instructions.

**SNT and Viral culture.** All bat serum samples will be sent to AAHL for serum neutralization tests to confirm ELISA results. PCR positive samples will be cultured at AAHL under BSL 4 conditions. I will compare ELISA and SNT results in my analyses to determine the relative sensitivity and specificity of the ELISA test I am using. CSIRO AAHL conducts its diagnostic tests under a management system that complies with the requirements of AS/NZS ISO9002:1994 (Certificate number 7868). AAHL is a NATA accredited laboratory for veterinary testing (Accreditation number 13546), complying with the requirements of AS ISO/IEC 17025 (1999). The assays listed below are maintained under this NATA accreditation.

**Satellite Telemetry** I will place satellite transmitters on 6 fruit bats to measure the long-range movements of these flying foxes and the rate of migration between colonies and deduce whether these colonies are acting as a metapopulation within which NiV circulates endemically. I will place three satellite collars (20 gram battery powered Platform Transmitting Terminals (PTT)– Microwave Telemetry, MD, USA) onto adult male and female *P. giganteus* at two different colonies using techniques developed on our Australian and Malaysian projects (10)((79)x PTTs will be attached to a 1.4mm leather collar using a contact adhesive reinforced with nylon thread stitched at the brace points of the PTT and sealed with epoxy resin. Collars will be placed around the neck and secured using two brass rivets. Collars are designed to hold the PTT in place between the shoulders of the fruit bat allowing sufficient girth to prevent strangulation but to prevent the collar from slipping over the bat's head; even if the bat grows (Collars can transmit for 1-2 years depending on the frequency of signal transmission). I will use a duty cycle of 10 hour transmission every 5 days. This will provide long-lat locations for the bats both during roosting and feeding activities over time. Transmitters are equipped with "mortality sensors" that transmit a VHS signal in the event that there is no motion on the collar for a prolonged period of time. We will attempt to recover transmitters using a VHS receiver to determine reasons for loss of collars. In addition, we will print contact information and a message in Bengali to return collars to ICDDR,B if found. I used this approach in Malaysia, and it led to the return of a lost collar in 2004. All collared fruit bats will be mature healthy male or female adults for which the PTT will be less than 3-5% of the total body weight. Females should be able to accommodate the additional weight of the transmitter as their pups can weigh up to 30% of their body weight while still clinging to them (40).

**Analysis** Data collected from various fruit bat colonies will be analyzed for differences in seroprevalence and viral prevalence between locations (**Specific Aim 1**) and between the different sampling points in the longitudinal study (**Specific Aim 2**). I will use Chi Square analysis (assuming binomial error) will be used to test differences between prevalence in colonies and subgroups of bats (e.g. sex, age, pregnancy status) and between point prevalences in my longitudinal study. Data from disease surveys and movement studies will be incorporated into a predictive causal model (**Specific Aim 3**) that will describe disease dynamics in bats and risk for NiV spillover into human populations through bat excreta. For long-range movement studies. PTTs will be located using the Argos Service (Collecte Localisation Satellites, French Space Agency, France) and corrected for location error, then home range analysis will be performed using the Kernal analysis method available in the Home Range Extension in ArcView 3.2 (ESRI, USA).

#### **Expected challenges and solutions.**

**Seroprevalence.** Using antibody prevalence data to estimate pathogen exposure over a period of time has been criticized for two key reasons. First, studies of IgG antibody prevalence only show past exposure, without providing information on when the infection was acquired (80). For example an adult bat testing positive for NiV in the fall of 2005 could have been exposed in 2005 or in the prior year. Second, and perhaps less of a concern with Nipah virus in bats, exposure estimates based on antibody prevalence data are generally underestimates, because they do not include individuals that die of infection. Death may occur before generation of antibodies or before capture and sampling.

The longitudinal study overcomes these challenges as follows. First, rather than using a single estimate of prevalence to calculate exposure, I will use the fraction of sampled individuals that **change** from antibody-negative to antibody positive over a period of time (Incidence). Second, I will calculate exposure separately for each age-class (e.g. juveniles vs. adults). Third, disease-caused mortality appears to be rare, and laboratory infections did not cause any morbidity (K. Halpin, unpublished data), so my study should not underestimate disease prevalence. I cannot control for immigration/emigration of individuals. This may create the appearance of either an increase or decrease of seroprevalence. The availability of an IgM specific Nipah ELISA (from AAHL, mid-2006) will increase the sensitivity of my surveys as I will be able to detect recently infected bats that may not yet have developed IgG antibodies.

**Telemetry.** The expense of each PTT limits the number that can be deployed, and I recognize that these collared animals may not be perfectly representative, but I am confident that they will be illustrative of local and long-range movements, as was our experience in Malaysia and as has been the case with other satellite telemetry studies (79,81)

## **D. 2. To determine how reproductive stress in adults and viral dynamics in juveniles affect overall viral prevalence in bat populations.**

### *Rationale.*

Human Nipah virus outbreaks in Bangladesh have occurred *both before and after* periods of birthing in bats, suggesting that transmission from adult bats to humans prior to birthing is important. Adult *P. giganteus* may become immune-suppressed during periods of physiologic stress such as pregnancy, parturition, and lactation, leading to a spike in viremia (82). Hendra virus has been isolated from *P. poliocephalus* fetal and placental tissues in nature, and both Hendra and Nipah virus have been isolated from bat urine and saliva (21,54,77)(Halpin, unpublished data). Birthing is a communal phenomenon in pteropodid bats (40). Pregnant females will aggregate into a maternity roost, and undergo parturition *en masse* (40). Because birthing occurs in large numbers environmental contamination with infected tissues becomes more likely. Furthermore, the increase in number of newborns and the immigrant female (or male) population will increase the proportion of immunologically naive individuals (once maternal antibodies disappear) within a population and ultimately will allow an increase in viral prevalence. I will test the hypothesis that increases in overall viral prevalence are due to changes in adult viral incidence against the null hypothesis that spikes in viral prevalence occur only with the introduction of susceptible juveniles.

### **Methods**

Longitudinal surveillance will be conducted on one colony within 20 km of a confirmed NiV outbreak site. **The total number of bats tested for this Aim: 1,200.** Data collected from this colony will be used to determine the seasonal dynamics of NiV infection in *P. giganteus*. Having the colony near a site of previous human Nipah virus infection will allow me to analyze data from bats in light of human epidemiology. The colony will be included with those in Specific Aim 1. I have conducted sample size calculations and power analyses to determine how many bats I will need to sample so that I will be able to detect changes in seroprevalence between two time points. I will sample **100 bats, every twelve weeks for three years (156 weeks)**. In the previous revision of this proposal, I extended the period of the survey to three years to improve the quality of the analysis – specifically to be able to compare any apparent trends from one year to two others, which will strengthen the conclusions drawn from patterns seen in any single year. Each bat will be captured, banded, micro-chipped, and screened for NiV infection using serology, PCR, and viral culture where indicated (**see methods, D.1**). During birthing periods, 300 samples of amniotic fluids and fetal tissues will be collected from the ground beneath a roost and screened using PCR. This sample size will allow me to detect virus or viral antigen assuming that 1% of the population is viremic at the time of sampling. Samples that test positive for NiV on PCR will be submitted to AAHL for viral isolation. I will document the pregnancy and birthing periods within *P. giganteus* populations around of villages that had documented cases of Nipah virus. I will also record the proportion of pregnant females captured from each population in my study. This data will be integrated with human serology data collected by the ICDDR,B under their enhanced surveillance program. In response to reviewers' comments, I have hired a veterinarian and two field technicians through support from CCM and the ICDDR,B that have assisted me with bat capture and sampling (**see budget justification and key personnel**). When I am not in Bangladesh, they will collect samples from this colony to ensure continuity of data in the longitudinal survey and increase my ability to focus on the training elements of this proposal

within the timeline set for my PhD. Samples will be collected during key times of year including pregnancy (Oct – Feb), birthing (Approx. Jan - April), and lactation (Approx. May-Aug). The total number of bats sampled for this specific aim will be (1,200).

**Bat Identification:** (See section D.1 – animal identification) Each bat will be banded and chipped in the longitudinal study. Recapture with identification will allow me to follow changes in antibody titer of individuals.

**Analysis:** Data collected from the longitudinal survey will be analyzed using Chi-square analysis (assuming binomial error) to detect differences in seroprevalence between sample times. Data will then be categorized into birthing period and non-birthing period and those categories will be tested for differences. Changes in seroprevalence over time will be used as a surrogate for incidence. I will test for statistically significant differences between viremic bats based on age, sex, and pregnancy or lactation status. I will also analyze human serological data collected by ICDDR,B and conduct correlation analyses to detect correlation between human outbreaks and changes in seroprevalence of bats over time.

**Potential challenges and solutions:** Viral isolation from biological samples may be difficult – particularly if the viremic period in bats is short, and the frequency of sampling is not high enough to capture viremic individuals. I will use short-term temporal changes in seroprevalence as a proxy for current presence of virus within a colony. I will also collect urine at each colony I sample and every time I sample the colony that is part of the longitudinal survey in order to increase my chances of detecting virus within a population. In the event that virus is not readily isolated, PCR results, which are very sensitive, will be used as a measure of viral infection. Although the presence of viral RNA does not necessarily mean an animal is viremic, this information will be compared to viral culture results, and the IgM ELISA, which will provide an indication of early stage infection. This technique may pick up viral RNA in sero-negative (or sero-positive) individuals. I will also use Taqman PCR to quantify viral RNA and compare it to a bat's antibody titer to better understand how seropositivity relates to viral status, something which is poorly understood. Seasonal variation in seroprevalence for the population will be used to assess changes in the proportion of infected individuals and this data will be used in the disease models.

#### **D. 4. To develop a parameterized model to determine whether temporal variation in NiV prevalence or contact rates with humans drive NiV spillover from bats to humans.**

##### *Rationale.*

Models have been used to describe host-pathogen dynamics, and can be used to predict disease emergence based on variability in contact rates, duration of infectiousness, or other factors. Modeling is therefore a useful tool for epidemiologists, and something at which I would like to become more adept. Modeling was not part of my previous training either in veterinary school or in my Masters program. This proposed training program would provide me the opportunity to train under Dr Tim Coulson at Imperial College, who has specific expertise in ecological and disease modeling (83-85). **I will use models to answer the following questions: 1) What are the key factors related to Nipah virus persistence in a closed bat population; 2) How do birth rate, death rate, and population size affect the steady-state viral prevalence,  $I^*$ , and seroprevalence,  $R^*/N$ , of Nipah virus in bats; 3) what is the threshold density ( $N_t$ ) for emergence of Nipah virus in bat populations; and 4) how do changes in viral prevalence and bat-human contact rates drive spillover into humans.**

I will estimate periods of maximal viral prevalence in bat populations of a given size using data collected in the field. The models will be used in conjunction with statistical correlation tests to answer the question of whether seasonal variation in prevalence in bats is linked to human outbreaks. By understanding what environmental and anthropogenic factors influence seroprevalence,  $R^*/N$  in bats, I hope to find a link between human activity (contact rate between humans and bats,  $\beta$ ) and spillover. Finally, I will use long-term prevalence data from *Pteropus hypomelanus* in our Malaysia NiV project to explore similarities or differences in Nipah virus dynamics (seasonality) between pteropodid bats in Bangladesh and Malaysia. Insights gained from the integration of the field collected data and predictive models will be useful in managing public health policy in Bangladesh.

##### *Methods.*

I will collect data to parameterize a Susceptible-Infected-Recovered (SIR) model (Fig. 10) for NiV dynamics

in fruit bats, where  $\beta$  is the rate at which susceptible individuals encounter infected individuals and become infected,  $N (=S+I+R)$  is the population size,  $b$  is the per capita birth rate,  $\delta$  is the per capita death rate in the absence of disease,  $\mu$  is the per capita death rate due to infection, and  $r$  is the rate of recovery ( $=1/\text{infectious period}$ ). In this model, transmission is density dependent, and as a result, higher densities of fruit bats will lead to higher Nipah virus transmission.

I assumed that birth and death rates were equal ( $b=d$ ) so that the population size was constant. I assumed that there was no mortality to infection ( $\mu=0$ ) (68). I used this model to derive expressions for the reproductive ratio of the virus  $R_0 = \beta N/r$ , the steady state number of infected individuals,  $I^* = (N-1)/\delta r$ , the steady state number of recovered individuals,  $R^* = r/\beta$ , the threshold density,  $N_t = r/\beta$ , and the steady state seroprevalence,  $R^*/N = r/\beta N$ .

**Fig. 10 (Left)** – A standard SIR model for infectious disease dynamics

### Sensitivity and elasticity of the model

I estimated the sensitivity of each of these model outputs to variability in measured parameter values by calculating elasticities (e.g.  $dI^*/dx_i$ ) for each model parameter  $x_i$ . I used parameter values estimated from the literature, or a range of values for difficult to estimate parameters (e.g.  $\beta$ ). I used estimates of birth and death rates of *P. giganteus* based on data published on Australian flying foxes (86). I used estimates of the rate of recovery ( $r$ ) from experimental infections with HeV and NiV (77) (Halpin, et al, unpublished data). We will be able to refine these estimates using data from experimental NiV infections with *P. vampyrus* under our R01 grant in early 2006, which will provide information for a species closely related to *P. giganteus*.

The parameter values I used for the sensitivity analysis were as follows:  $r = 0.5$  (duration of infection = 2 weeks);  $N = 10,000$ ;  $\beta = 0.1 - 5$  (little is known about actual contact rate in the wild);  $b$  and  $\delta = \text{mortality rate} = 0.02 / \text{wk}$  (86). The resulting elasticities were as follows:

$$\left[ \frac{dI^*}{d\delta} \quad \frac{dI^*}{dN} \quad \frac{dI^*}{dr} \right] = \left[ \left| -\frac{N-1}{(\delta+r)^2} \right| \quad \left| \frac{1}{\delta+r} \right| \quad \left| -\frac{N-1}{(\delta+r)^2} \right| \right] [37000 \quad 2.7 \times 10^{-5} \quad 37000] \quad \text{eq. 1}$$

$$\left[ \frac{dR^*}{dr} \quad \frac{dR^*}{d\beta} \right] = \left[ \left| -\frac{r}{\beta^2} \right| \quad \left| \frac{1}{\beta} \right| \right] [2 - 8.0 \times 10^{-4}; \quad 10 - 0.2] \quad \text{eq. 2}$$

( $\beta = 0.1$  to  $5$ )

$$\frac{dR_0}{dN} \quad \frac{dR_0}{d\beta} \quad \frac{dR_0}{dr} = \left[ \left| \frac{\beta}{r} \right| \quad \left| \frac{N}{r} \right| \quad \left| -\frac{1}{r^2} \right| \right] [5 - 250; \quad 50,000; \quad 2,500] \quad \text{eq. 3}$$

( $\beta = 0.1$  to  $5$ )

$$\frac{dN_t}{d\beta} \quad \frac{dN_t}{dr} = \left[ \left| -\frac{r}{\beta^2} \right| \quad \left| \frac{1}{\beta} \right| \right] [50 - 0.02; \quad 10 - 0.2] \quad \text{eq. 4}$$

( $\beta = 0.1$  to  $5$ )

$$\frac{d\left(\frac{R^*}{N}\right)}{dr} \quad \frac{d\left(\frac{R^*}{N}\right)}{d\beta} \quad \frac{d\left(\frac{R^*}{N}\right)}{dN} = \left[ \left| \frac{1}{\beta N} \right| \quad \left| \frac{r}{-\beta^2 N} \right| \quad \left| \frac{r}{-\beta N^2} \right| \right] [0.001 - 50,000; \quad 0.005 - 0.2; \quad 5.0 \times 10^{-8} - 2.0 \times 10^{-10}] \quad \text{eq. 5}$$

( $\beta = 0.1$  to  $5$ )

From equation 1, it is clear that the steady state fraction of the population that is viremic is approximately equally sensitive to variation in the death rate and the recovery rate but relatively insensitive to population size,  $N$ . The steady fraction of recovered or immune individuals (eq. 2) is a lot more sensitive to contact rate than recovery rate. In contrast,  $R_0$  is much more sensitive to the recovery rate than the contact rate, beta, or population size (eq. 3). The threshold density ( $N_t$ ) is more sensitive to recovery rate than contact rate (eq. 4). The steady state seroprevalence,  $R^*/N$  (eq. 5) is equally sensitive to population size and contact rate and a lot more sensitive to those two parameters than recovery rate. From this sensitivity analysis it is apparent that it will be important to obtain information on recovery rate through experimental infections and at least an order of magnitude estimate of beta to understand Nipah emergence (see section. D.2.).

**E. Human subjects:** Not applicable. According to the "Protection of Human Subjects" (45 CFR Part 46) definitions, I will not be obtaining data through intervention or interaction with an individual nor obtaining any identifiable private information. Anonymous, non-identifiable data will be provided to me by S. Luby, ICDDR,B for use in modeling transmission from bats to humans.

## **F. Vertebrate animals**

### **1. Detailed description of animal use.**

**All work with vertebrate animals will be conducted in Bangladesh.**

**Fruit bat capture.** Capture and bleeding techniques have been approved by IACUC (# 04-08). Fruit bats will be captured using a mist net described in section D.1. The net system is manned by two people during the entire capture period, and bats are removed from the net as soon as they become entangled to minimize stress and prevent injury. In my experience, a maximum of 15-20 bats can be safely held and processed by a team of three people per trapping period using gas anesthesia. Duration of trapping will depend on the capture rate. Bats are placed into a pillowcase and hung from a branch or post until samples are collected. Bats are held for a maximum of six hours.

### **Chemical restraint.**

Based on revised sample size calculations that have increased the per site sample size to 100 bats, I will use isoflurane and a portable vaporizer (manufacturer) to restrain bats). Isoflurane has been shown to be safe and effective short-term chemical restraint for Pteropodid bats in the field (73). Isoflurane has allowed me to successfully sample 100 bats in about 5-7 days. A portable isoflurane vaporizer has been purchased by The CCM for use on this project (Harvard Apparatus, MA, USA). Bats will be under anesthesia for 10-12 minutes, and recovery is determined by presence of palpebral and withdrawal reflexes, as well as biting reflex. Bats are kept in a quiet, cool place while waiting to be processed and while recovering from anesthesia. Bats are given mango juice orally by syringe prior to release. Bats are released at their site of capture and are allowed to climb into a tree where they can either rest or fly.

**Sample Collection.** Bats will be anesthetized prior to sampling.

**Bats:** Two sets of three swabs will be taken from *Pteropus giganteus*: throat, urogenital tract, and rectal. 3.0 ml of blood will be collected from the radial artery or vein using a 23 gauge needle and 3cc syringe.

### **Animal Identification**

Bats will be banded on the first phalanx of digit I, using stainless steel thumb bands (size #4 Gey Band & Tag Co, PA, USA) stamped with a unique serial number (Kunz, pers. com). A veterinary microchip (AVID Identification Systems, LA) carrying a unique ID number will be implanted subcutaneously between the scapulae according to manufacturer's instruction. These ID numbers can be retrieved using a microchip reader (AVID). This allows for two means of animal identification: the thumb bands can be viewed from a distance, allowing for crude censusing of marked bats using binoculars; and the microchip insures animal ID for collecting accurate recapture data in the event that the thumb band is lost.

**Satellite Telemetry:** Satellite transmitters placed on 6 fruit bats will allow us to measure the long-range movements of these flying foxes and the rate of migration between colonies and deduce whether these colonies are acting as a meta-population for NIV to exist endemically within. I will place three satellite collars (20 gram battery powered Platform Transmitting Terminals (PTT)— Microwave Telemetry, MD, USA) onto adult male and female *P. giganteus* at two different colonies using techniques developed on our Australian and Malaysian projects (10)(Smith, unpublished). PTTs will be attached to a 1.4mm leather collar using a contact adhesive reinforced with nylon thread stitched at the brace points of the PTT and sealed with epoxy resin. Collars will be placed around the neck and secured using two brass rivets. Collars are designed to hold the PTT in place between the shoulders of the fruit bat allowing sufficient girth to prevent strangulation but to prevent the collar from slipping over the bat's head; even if the bat grows (Collars can transmit for 1-2 years

depending on the frequency of signal transmission). I will use a duty cycle of 10 hour transmission every 5 days. This will provide long-lat locations for the bats both during roosting and feeding activities over time. Transmitters are equipped with "mortality sensors" that transmit a VHS signal in the event that there is no motion on the collar for a prolonged period of time. We will attempt to recover transmitters using a VHS receiver to determine reasons for loss of collars. In addition, we will print contact information and a message in Bengali to return collars to ICDDR,B if found. I used this approach in Malaysia, and it led to the return of a lost collar in 2004. All collared fruit bats will be mature healthy male or female adults for which the PTT will be less than 3-5% of the total body weight. Females should be able to accommodate the additional weight of the transmitter as their pups can weigh up to 30% of their body weight while still clinging to them (40).

## **2. Justify use of animals, choice of species, numbers to be used.**

Species and number used in study:

Fruit bats (*Pteropus giganteus*): 2,000

Pteropodid bats are the putative reservoir for henipaviruses. The sample size (100 bats) was chosen to be able to detect both the presence of antibodies to Nipah virus in a colony of up to 10,000 bats at an assumed seroprevalence of 10% with a 95% confidence interval and a difference in seroprevalence of 30% between two time points or populations (14,72).

**3. Provide information on veterinary care.** Animals will receive emergency veterinary care if necessary. There is no specific veterinary care that is appropriate for this project, nor are clinical veterinary facilities included as a performance site, as animals will be released within hours of capture.

## **4. Procedures for ensuring animal comfort, lack of distress, pain, or injury.**

**Bats:** Bats will not be held longer than 6 hours. In my experience, bats tolerate this period well and there have been no clinical adverse effects seen in any of the bats captured and sampled in Malaysia and Bangladesh. Mist nets will be attended during capture periods, and bats will be extracted from the net as soon as they become entangled. This will minimize stress and prevent injury from entanglement. Bats will be placed in pillowcases and hung from tree branches while awaiting processing and during recovery. The pillowcases are sufficiently porous as to allow for ventilation. The enclosed environment seems to calm the bats, as they do not struggle once inside, but they hang quietly. Bats are protected from extreme heat or cold while under anesthesia, and lubrication is used on their eyes to protect them from injury. Bats are monitored by a veterinarian during all stages of capture, processing, and release. Bats are kept in a cool place while in the pillowcases. Prior to release, bats will be syringe-fed fruit juice to accommodate any hypoglycemia from capture.

We have placed collars on captive Australian flying foxes and observed them for two months. These bats were free to forage at night and tolerated the collars well (C. Smith, pers. comm.). In Malaysia we have had a flying fox carrying a transmitter for seven months. Tidemann and Nelson report Grey-headed flying foxes carrying transmitters for up to a year (87).

**5. Euthanasia:** To date, there has been no mortality of fruit bats in CCM's or collaborator's work related to Nipah virus. More than 1,000 bats representing seven species of *Pteropus* have been captured for projects in Malaysia, India, and Australia. In the event of injury to an animal that results in pain and suffering, and reasonable veterinary care is unavailable, the animal will be euthanized by Dr Epstein or a trained veterinary officer using ketamine injected intramuscularly 37.5mg/kg (88) and sodium pentobarbital injected intravenously at a dose of 1.0ml per 5kg injected intravenously. This protocol is in accordance with the AVMA euthanasia report (2001).

## **G. Select Agent Research**

### **1. Identify the Select Agent(s) to be used in the proposed research.**

Nipah virus is an overlap select agent regulated by both HHS and USDA. I will not be working with Nipah virus in my proposed activities; however, serum neutralization testing and viral culture of my samples will be performed under BSL 4 conditions at the Australian Animal Health Laboratory.



## 2. Provide the registration status of all entities\* where Select Agent(s) will be used.

- If the performance site(s) is a foreign institution, provide the name(s) of the country or countries where Select Agent research will be performed.

The Australian Animal Health Laboratory (AAHL), located in Geelong Australia, is the largest and one of the most sophisticated biosecurity laboratories in the world and has an international reputation in the area of emerging BSL-4 pathogens. Our laboratory has been subcontracted for an NIH (NIAID) award to work on select agents (PI: Broder, Christopher, C.) and as such, we are currently approved and have been site-visited by NIAID/CDC staff and have supplied the necessary documentation as described in 42 CFR Part 73.

## 3. Provide a description of all facilities where the Select Agent(s) will be used.

All work to be conducting using select agents will be performed within the BSL-4 laboratories at the Australian Animal Health Laboratory, Geelong, Australia under the direction of Dr Alex. D. Hyatt. The laboratories are fully certified and have US Public Health Service approved animal welfare assurance (assurance number A 5399-01). The Australian Animal Health Laboratory (AAHL) is the largest and one of the most sophisticated laboratories in the world and has an international reputation in the area of emerging BSL-4 pathogens. AAHL is the only laboratory globally that regularly conducts large and small animal experiments with BSL-4 pathogens. In addition to approximately 2800 square meters of BSL-3 lab space, the facilities include not only flexible film isolators and one BSL4 laboratory (approximately 40 square meters) but also two animal rooms (approximately 140 square meters) in which animals infected with BSL-4 agents can be handled safely. AAHL has developed extensive protocols and training procedures to ensure that personnel working with zoonotic BSL-4 agents such as Hendra and Nipah viruses can do so in safety. The laboratory employs approximately 30 engineering staff specifically to ensure safe and continuous operation of the secure facilities which far exceed the physical-plant infrastructure of a typical state-of-the-art biological research facility.

### BIOHAZARD

Nipah virus is known to cause outbreaks with high case fatality rates and there are no vaccines available for this agent, although ribavirin has been shown to be somewhat successful in treating clinical cases (36% reduction in mortality) (Chong HT et al. 2001 Treatment of Acute Nipah virus Encephalitis with Ribavirin Ann. Neurol 49: 810-3). Nipah virus is classified as a BSL-4 agent. The work proposed in my K08 application will involve two aspects: field work and laboratory work. Field work involves the highest risk of being infected by NiV, while handling bats, their blood samples or their excreta. As a qualified veterinarian with a great deal of experience working with wildlife species, I take great care in the field to limit the risk of accidental exposure. I have been working specifically with *Pteropus* bats that carry NiV in Malaysia for the past 4 years under Dr Daszak's R01 without incident. We have strict procedures for handling bats and working with samples from them as they are secured in the field and transported to the lab. In the field in Bangladesh, I will also adhere to the biohazard safety procedures at the ICDDR,B (Dr Luby's institution). While in the field I utilize full personal protective equipment when handling bats. This includes coveralls, a face shield, nitrile gloves, and a P100 respirator. I wear nitrile gloves under leather welding gauntlets and safety glasses or a face shield when handling bats and nitrile gloves and a respirator when drawing blood from anesthetized bats. All field clothing and equipment is disinfected using Virkon disinfectant. All biological waste from field surveys is disposed of in the appropriate container (sharps box or an autoclave bag) and will be autoclaved at the ICDDR,B. I have been vaccinated for rabies – another clinically significant virus that some bats carry. I have my titer regularly checked, and carry booster injections with me in the field. I also have continual access to a supply of ribavirin, should any accidental exposure to bat fluids occur.

### Field safety protocol

Our procedures to deal with bites, needle-sticks etc. are as follows: The wound is washed thoroughly with soap and water to clean away dirt and debris, then vigorously scrubbed with a sterile gauze bandage and benzalkonium chloride for 5 minutes. If bleeding, pressure is applied with a sterile bandage for until bleeding has stopped. If the wound continues to bleed, medical attention at the nearest hospital is sought. The bat from which the bite or exposure originated is identified, and the samples collected from it labeled on the data

sheet that these were involved in an exposure. If possible, the bat is euthanized under anesthesia and its brain is submitted for RFFT (rabies) testing at ICDDR,B. Blood samples are taken and submitted for rapid testing using ELISA for anti-NiV IgG and IgM. Swabs are also taken and submitted for rapid PCR testing for NiV. Our procedures require that the person potentially exposed reports to a major hospital within 24 hours to have wound examined and receive a rabies booster (single vaccine dose given intramuscularly as per CDC protocols). We also request a liver profile to make sure that baseline liver values are within normal limits. We then expect to begin a prophylactic (preventative) ribavirin course according to the published protocol for Nipah virus infection (Chong et al. 2001). All field technicians will be required to wear the same personal protective equipment, and undergo the same training as I have, and adhere to the same protocols in the case of exposure.

The laboratory work is significantly low risk. I have been working in Dr Lipkin's lab at Columbia University for approximately 6 months now, and have been trained in, and follow biohazard safety protocols. I have registered with the federal registry for research on select agents. We will not attempt viral culture. The serum will be heat inactivated prior to shipping (i.e. will be non-infectious on arrival in the USA). I will be extracting RNA and working only with RNA for PCR (i.e. a non-infectious procedure).

## H. References

1. McCall, BJ, Epstein, JH, Neill, AS, Heel, K, Field, H, Barrett, J et al. Potential exposure to Australian bat lyssavirus, Queensland, 1996-1999. *Emerging Infectious Diseases* 2000;6:259-264.
2. Epstein, JH, McKee, J, Shaw, P, Hicks, V, Micalizzi, G, Daszak, P et al. The Australian White Ibis (*Threskiornis molucca*) as a reservoir of zoonotic and livestock pathogens. *Ecohealth* 2006;(accepted 10,2006).
3. Taylor, LH, Latham, SM & Woolhouse, MEJ. Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences* 2001;356:983-989.
4. Mohd Nor, MN, Gan, CH & Ong, BL. Nipah virus infection of pigs in peninsular Malaysia. *Rev Sci Tech* 2000;19:160-5.
5. Binder, S, Levitt, AM, Sacks, JJ & Hughes, JM. Emerging infectious diseases: Public health issues for the 21st century. *Science* 1999;284:1311-1313.
6. Lederberg, J, Shope, RE & Oakes, SCJ. Emerging Infections: Microbial Threats to Health in the United States. in Washington, D.C.:Institute of Medicine, National Academy Press; 1992.
7. Smolinski, MS, Hamburg, MA & Lederberg, J. Microbial Threats to Health: Emergence, Detection, and Response in Washington D.C.:The National Academies Press; 2003.
8. Hahn, BH, Shaw, GM, De Cock, KM & Sharp, PM. AIDS - AIDS as a zoonosis: Scientific and public health implications. *Science* 2000;287:607-614.
9. Daszak, P, Cunningham, AA & Hyatt, AD. Anthropogenic environmental change and the emergence of infectious diseases in wildlife. *Acta Trop* 2001;78:103-16.
10. McLaughlin, AB, Epstein, JH, Prakash, V, Smith, CS, Daszak, P, Field, HE et al. Plasma biochemistry and hematological values for wild-caught flying foxes (*Pteropus giganteus*) in India. *Journal of Zoo and Wildlife Medicine* Submitted April, 2005.
11. Guan, Y, Zheng, BJ, He, YQ, Liu, XL, Zhuang, ZX, Cheung, CL et al. Isolation and characterization of viruses related to the SARS coronavirus from animals in Southern China. *Science* 2003;302:276-278.
12. Chua, K, Bellini, W, Rota, P, Harcourt, B, Tamin, A, Lam, S et al. Nipah virus: A recently emergent deadly paramyxovirus. *Science* 2000;288:1432-35.
13. Field, H, Young, P, Yob, JM, Mills, J, Hall, L & Mackenzie, J. The natural history of Hendra and Nipah viruses. *Microbes and Infection* 2001;3:307-314.
14. Health, ABoA. Livestock Disease Surveys: A Field Manual for Veterinarians in Canberra:Commonwealth of Australia; 1982.
15. Johara, MY, Field, H, Rashdi, AM, Morrissy, C, van der Heide, B, Rota, P et al. Nipah virus infection in bats (order Chiroptera) in peninsular Malaysia. *Emerging Infectious Diseases* 2001;7:439-441.
16. Olson, J, Rupprecht, C, Rollin, P, An, U, Niezgod, M, Clemins, T et al. Antibodies to Nipah-like virus in bats (*Pteropus lylei*), Cambodia. *Emerging Infectious Diseases* 2002;8:987-8.
17. Hsu, VP, Hossain, MJ, Parashar, UD, Ali, MM, Ksiazek, TG, Kuzmin, I et al. Nipah virus encephalitis reemergence, Bangladesh. *Emerg Infect Dis* 2004;10:2082-7.

18. Luby S., Rahman M., Hossain MJ., Blum LS., Husain NM., Gurley E. et al. Foodborne Transmission of Nipah Virus, Bangladesh. *Emerg Infect Dis* 2006;12.
19. Bates, PJJ & Harrison, DL. *Sub-Order MEGACHIROPTERA: Family Pteropodidae: Old World Fruit Bats*. In: Bates, P. J. J. & Harrison, D. L., editors. *Bats of the Indian Subcontinent* Kent, England: Harrison Zoological Museum; 1997. p.13-15.
20. Eby, P. Seasonal Movements of Gray-Headed Flying-Foxes, *Pteropus-Poliocephalus* (Chiroptera, Pteropodidae), from 2 Maternity Camps in Northern New-South-Wales. *Wildlife Research* 1991;18:547-559.
21. Halpin, K, Young, PL, Field, HE & Mackenzie, JS. Isolation of Hendra virus from pteropid bats: a natural reservoir of Hendra virus. *J Gen Virol* 2000;81:1927-32.
22. Chandha, MS, James A. Comer, Luis Lowe, Paul A. Rota, Pierre E. Rollin, William J. Bellini et al. Nipah virus-associated Encephalitis Outbreak, Siliguri, India. *Emerging Infectious Diseases* 2006;12:235-240.
23. Chew, MHL, Arguin, PM, Shay, DK, Goh, KT, Rollin, PE, Shieh, WJ et al. Risk factors for Nipah virus infection among abattoir workers in Singapore. *Journal of Infectious Diseases* 2000;181:1760-1763.
24. Murray, K, Selleck, P, Hooper, P, Hyatt, A, Gould, A, Gleeson, L et al. A Morbillivirus That Caused Fatal Disease in Horses and Humans. *Science* 1995;268:94-97.
25. WHO. Nipah virus outbreak(s) in Bangladesh, January - April 2004. *Weekly Epidemiological Record* 2004;79:168-172.
26. Caplan, CE. New virus emerges in Malaysia. *Canadian Medical Association Journal* 1999;160:1607-1607.
27. Chua, KB, Goh, KJ, Wong, KT, Kamarulzaman, A, Tan, PSK, Ksiazek, TG et al. Fatal encephalitis due to Nipah virus among pig-farmers in Malaysia. *Lancet* 1999;354:1257-1259.
28. Chua, KB. Nipah virus outbreak in Malaysia. *Journal of Clinical Virology* 2003;26:265-275.
29. Lam, SK & Chua, KB. Nipah virus encephalitis outbreak in Malaysia. *Clinical Infectious Diseases* 2002;34:S48-S51.
30. Haldar, N, Dasgupta, K, Khandelwal, A, Halder, N, Banerjee, S, Das, S et al. First epidemic of viral encephalitis in 2001 of highly infectious nature with fading mortality at Siliguri. *Journal of Neurological Science* 2001;187:S121.
31. Tan, CT. Clinical manifestation of the Nipah virus infection. *Journal of Clinical Virology* 2003;28:S40-S40.
32. Daszak, P, Plowright R, Epstein JH, Pulliam J, Abdul Rahman S, Field HE, Smith CS, Olival KJ, Luby S, Halpin K, Hyatt AD, & (HERG). *The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum*. In: Collinge S, R. S., editor. *Disease Ecology: Community structure and pathogen dynamics*. Oxford: Oxford University Press; 2006. p.186-201.
33. Chua, KB, Chua, BH & Wang, CW. Anthropogenic deforestation, El Nino and the emergence of Nipah virus in Malaysia. *Malaysian Journal of Pathology* 2002;24:15-21.
34. Daszak, P, Tabor, GM, Kilpatrick, AM, Epstein, J & Plowright, R. Conservation medicine and a new agenda for emerging diseases. *Ann N Y Acad Sci* 2004;1026:1-11.
35. Morse, SS. Factors and determinants of disease emergence. *Revue Scientifique Et Technique De L Office International Des Epizooties* 2004;23:443-451.
36. Walker, D. *Peripheral Blood Smears*. In: Cowell, R. L., R.D. Tyler & Meinkoth, J. H., editors. *Diagnostic Cytology and Hematology of the Dog and Cat*. St. Louis, MO 63146: Moseby; 1999. p.272.
37. Aziz J., Olson J., Lee O.B., Daniels P., Adzhar A.B., Bunning M. et al. Nipah virus infections of animals in Malaysia. 1999. XIth Int. Cong. Virol. Sydney, Australia.
38. CDC. Update: Outbreak of Nipah Virus - Malaysia and Singapore, 1999. *MMWR* 1999;48:325-337.
39. Mackenzie, JS, Field, HE & Guyatt, KJ. Managing emerging diseases borne by fruit bats (flying foxes), with particular reference to henipaviruses and Australian bat lyssavirus. *J Appl Microbiol* 2003;94 Suppl:59S-69S.
40. Hall, L & Richards, G. *Flying Foxes: Fruit and Blossom Bats of Australia in Flying Foxes: Fruit and Blossom Bats of Australia*:Krieger Publishing Company; 2000.
41. Nowak, R. *Walker's Bats of the World* in. Baltimore: Johns Hopkins University Press; 1994.
42. Parashar, UD, Sunn, LM, Ong, F, Mounts, AW, Arif, MT, Ksiazek, TG et al. Case-control study of risk factors for human infection with a new zoonotic paramyxovirus, Nipah virus, during a 1998-1999 outbreak of severe encephalitis in Malaysia. *J Infect Dis* 2000;181:1755-9.

43. Gurley E.S., Hossain M.J., Islam M.R., Molla M.A.R., Shamsuzzaman S.M., Akram K. et al. Lack of nosocomial transmission of Nipah virus in a Bangladesh hospital. *Infection Control and Hospital Epidemiology* in Press.
44. Cramer, G, Wang, LF, Morrissy, C, White, J & Eaton, BT. A rapid immune plaque assay for the detection of Hendra and Nipah viruses and anti-virus antibodies. *J Virol Methods* 2002;99:41-51.
45. Daniels, PW, Ksiazek, T & Eaton, B. Diagnostic tests for Nipah and Hendra viruses. *Microbes and Infection* 2001;3:289-295.
46. Kashiwazaki, Y, Na, YN, Tanimura, N & Imada, T. A solid-phase blocking ELISA for detection of antibodies to Nipah virus. *J Virol Methods* 2004;121:259-61.
47. White J.R., Narasiman M., Ramlan M., Yeoh N., Noor, SM, Najamuddin M. et al. Establishment and operation of a serological screening capacity in Malaysia for the detection of Nipah virus specific antibodies in swine. *Microbiol. Aust.* 2000;21.
48. CDC & NIH. Biosafety in Microbiological and Biomedical Laboratories (BMBL) 4th Edition in Washington DC:US Government Printing Office; 1999.
49. Daniels, P, Ksiazek, T & Eaton, BT. Laboratory diagnosis of Nipah and Hendra virus infections. *Microbes and Infection* 2001;3:289-295.
50. Guillaume, V, Lefevre, A, Faure, C, Marianneau, P, Buckland, R, Lam, SK et al. Specific detection of Nipah virus using real-time RT-PCR (TaqMan). *J Virol Methods* 2004;120:229-37.
51. Riley, J. Mammals on the Sangihe and Talaud Islands, Indonesia, and the impact of hunting and habitat loss. *Oryx* 2002;36:288-296.
52. Flint, SJ, Enquist, LW, Racaniello, VR & Skalka, AM. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses in Washington D.C.:ASM Press; 2004.
53. AbuBakar, S, Chang, LY, Ali, AR, Sharifah, SH, Yusoff, K & Zamrod, Z. Isolation and molecular identification of Nipah virus from pigs. *Emerg Infect Dis* 2004;10:2228-30.
54. Chua, K, Koh, C, Hooi, P, Wee, K, Khong, J, Chua, B et al. Isolation of Nipah virus from Malaysian Island flying foxes. *Microbes Infect* 2002;4:145-51.
55. Chua, KB, Lam, SK, Goh, KJ, Hooi, PS, Ksiazek, TG, Kamarulzaman, A et al. The presence of Nipah virus in respiratory secretions and urine of patients during an outbreak of Nipah virus encephalitis in Malaysia. *Journal of Infection* 2001;42:40-43.
56. Fogarty, RH, K. Mungall, BA, Hyatt, AD. . *International Conference on Emerging Infectious Diseases* (Centers for Disease Control, Atlanta, 2006).
57. Anderson, RM & May, RM. Population Biology of Infectious-Diseases I. *Nature* 1979;280:361-367.
58. Bartlett, M. Stochastic population models in ecology and epidemiology. in London, UK:Methuen; 1960.
59. MacDonald, G. The epidemiology and control of malaria. in London:Oxford University Press; 1957.
60. May, RM & Anderson, RM. Population Biology of Infectious-Diseases II. *Nature* 1979;280:455-461.
61. Anderson, RM & May, RM. Infectious diseases of humans. Dynamics and control. in London:Oxford University Press; 1991.
62. Hess, G. Disease in metapopulations: implications for conservation. *Ecology* 1996;77:1617-1632.
63. McCallum, H & A.P., D. Disease, habitat fragmentation and conservation. *Proc R Soc Lond B Biol Sci.* 2002;269:2041-9.
64. Anderson, RM & May, RM. The invasion, persistence and spread of infectious diseases within animal and plant communities. *Phil. Trans. R. Soc. Lond. B* 1986;314:533-573.
65. Diekmann, O, Heesterbeek, JA & Metz, JA. On the definition and the computation of the basic reproduction ratio  $R_0$  in models for infectious diseases in heterogeneous populations. *J Math Biol* 1990;28:365-82.
66. Dobson AP, FJ. *Emerging infectious pathogens of wildlife*. In: Woolhouse MEJ, D. C., editor. Population biology of emerging and re-emerging pathogens. London: Phil. Trans. R. Soc. Lond.; 2001. p.1001-1012.
67. Chadha, MS, Comer, JA, Lowe, L, Rota, PA, Rollin, PE, Bellini, WJ et al. Nipah virus-associated encephalitis outbreak, Siliguri, India. *Emerg Infect Dis* 2006;12:235-40.
68. Field, H. The ecology of Hendra virus and Australian bat Lyssavirus. . Thesis, The University of Queensland (2005)
69. Kim Halpin, R, Fogarty, D, Middleton & Hyatt, AD. Henipavirus spillover: How bats might be involved.

2006. International Conference on Emerging Infectious Diseases. Atlanta, GA.
70. Selvey, L, Wells, RM, McCormack, JG, Ansford, AJ, Murray, PK, Rogers, RJ et al. Infection of humans and horses by a newly described morbillivirus. *Med J Aust* 1995;162:642-645.
  71. Pulliam J.R.C., Epstein J.H., Dushoff, JG, Rahman, SA, Field, HE, Bunning, M et al. Agricultural intensification and 'epidemic enhancement' drive Nipah virus emergence in Malaysia. submitted.
  72. Dohoo, I, W. Martin and H. Stryhn (eds). *Veterinary Epidemiologic Research in Charlottetown*, Prince Edward Island, Canada:AVC Inc; 2003.
  73. Jonsson, NN, Johnston, S.D., Field, H., De Jong, C, Smith, C. Field anaesthesia of three Australian species of flying fox. *The Veterinary Record* 2004;154:664.
  74. Chua, K, Wang, L, Lam, S, Cramer, G, Yu, M, Wise, T et al. Tioman virus, a novel paramyxovirus isolated from fruit bats in Malaysia. *Virology* 2001;283:215-19.
  75. Chua, KB. A novel approach for collecting samples from fruit bats for isolation of infectious agents. *Microbes and Infection* 2003;5:487-490.
  76. Reynes, JM, Counor, D, Ong, S, Faure, C, Seng, V, Molia, S et al. Nipah virus in Lyle's flying foxes, Cambodia. *Emerg Infect Dis* 2005;11:1042-7.
  77. Williamson, MM, Hooper, PT, Selleck, PW, Westbury, HA & Slocombe, RF. Experimental hendra virus infection in pregnant guinea-pigs and fruit Bats (*Pteropus poliocephalus*). *J Comp Pathol* 2000;122:201-7.
  78. Tidona, CA, Kurz, HW, Gelderblom, HR & Darai, G. Isolation and molecular characterization of a novel cytopathogenic paramyxovirus from tree shrews. *Virology* 1999;258:425-34.
  79. Daszak, P, Plowright, R, Epstein, JH, Pulliam, J, Abdul Rahman, S, Field, HE et al. *The emergence of Nipah and Hendra virus: pathogen dynamics across a wildlife-livestock-human continuum*. In: Collinge, S. K. & Ray, C., editors. *Disease Ecology: Community Structure and Pathogen Dynamics*. Oxford University Press; 2006. p.186-201.
  80. Kramer, LD & Bernard, KA. West Nile virus in the western hemisphere. *Current Opinion in Infectious Diseases* 2001;14:519-525.
  81. Olival, KJ & H., H. *Monitoring the long-distance movement of wildlife in Asia using satellite telemetry*. In: McNeely, J., editor. *Conservation Biology in Asia: Current status and future perspectives*.; In press.
  82. Reeder, DM, Kunz, TH & Widmaier, EP. Baseline and stress-induced glucocorticoids during reproduction in the variable flying fox, *Pteropus hypomelanus* (Chiroptera : Pteropodidae). *Journal of Experimental Zoology Part a-Comparative Experimental Biology* 2004;301A:682-690.
  83. Stenseth, NC, Chan, KS, Tavecchia, G, Coulson, T, Mysterud, A, Clutton-Brock, T et al. Modelling non-additive and nonlinear signals from climatic noise in ecological time series: Soay sheep as an example. *Proceedings of the Royal Society of London Series B-Biological Sciences* 2004;271:1985-1993.
  84. Coulson, T, Mace, GM, Hudson, E & Possingham, H. The use and abuse of population viability analysis. *Trends in Ecology & Evolution* 2001;16:219-221.
  85. Bolker, B & Grenfell, BT. Space, persistence and dynamics of measles epidemics. *Philosophical Transactions of the Royal Society of London Series B - Biological Sciences* 1995:309-320.
  86. Vardon, MT, CR. The black flying-fox (*Pteropus alecto*) in north Australia: juvenile mortality and longevity. *Australian Journal of Zoology* 1999;48:91-97.
  87. Tidemann, CN, JE. Long-distance movements of the grey-headed flying fox (*Pteropus poliocephalus*). *Journal of Zoology* 2004;263:141-146.
  88. Heard, DB, C. Owens, J. J. Ketamine and ketamine:xylazine ED(50) for short-term immobilization of the island flying fox (*Pteropus hypomelanus*). . 1996 1996;27:44-48.

**H. Consortium / Contractual Agreements: N/A**

**I. Consultants: N/A**

**J. Resource Sharing: N/A**

National Institutes of Health  
Department of Health and Human Services  
Public Health Services

1<sup>st</sup> November 2006

To Whom It May Concern:

**Dr Jonathan H. Epstein**

I am writing in support of Dr Epstein's application for a K08 grant to support his research on henipavirus emergence as a zoonotic threat in Bangladesh. My evaluation of this candidate with reference to the headings requested is as follows:

**Potential for conducting research**

I have worked with Dr Epstein for four years and I have known of him for longer. Dr Epstein first came to my attention when he was conducting an independent research project on zoonotic risks from sacred ibis in Australia. He conducted this public health research as an extracurricular project during his veterinary training. Rarely for such projects, this work led to a first-authored paper in an international scientific journal. Since Dr Epstein graduated, he has been conducting research on the emergence of zoonotic paramyxoviruses (henipaviruses) – a project on which I am a collaborator. As such, I have worked with Dr Epstein in the field in India and I have been impressed with his organisational abilities and enthusiasm for research. India is a very difficult country to work in – both logistically and politically – and Dr Epstein showed that he has both the personality and the approach required for working under such conditions. These qualities have continued as he has completed his first year of research in Bangladesh. In addition, for the past three years, Dr Epstein has been managing the henipavirus research project in Malaysia, including project management, personnel management and conducting some of the research work himself. Recently, he successfully supervised two students conducting undergraduate projects. I can confirm that Dr Epstein has the ability both to organise and conduct research in developing countries and to write research papers, and he has a high likelihood of succeeding with his proposed Mentored Clinical Research project.

**Evidence of originality**

In addition to developing hypotheses and methodology for his undergraduate ibis project, Dr Epstein has been closely involved in developing and directing areas of research in the henipavirus project. I have no doubt of Dr Epstein's abilities for formulating novel hypotheses and devising ways of testing them.

**Adequacy of scientific background**

Dr Epstein is a veterinarian with a Masters degree in Public Health and a Certificate of International Veterinary Medicine. There is an urgent need for such well-qualified veterinarians to be directly involved in research into the emergence, transmission and control of zoonotic diseases, especially zoonotic threats from wildlife in developing countries. Dr. Epstein is likely to become a future leader in the field of public health, and has rare qualifications for a young investigator.

**Commitment to health-oriented research**

Dr Epstein showed an interest in health-oriented research as a veterinary student, as shown by the research project he devised and conducted on the zoonotic threat from Australian White Ibis. While at Tufts, he studied for, and obtained, a Masters degree in Public Health and he won a prize for outstanding achievement in this field. Since graduating, Dr Epstein has been working on the ecology and epidemiology of zoonotic pathogens at the Consortium for Conservation Medicine. This shows his continued and clear commitment to health-oriented research.

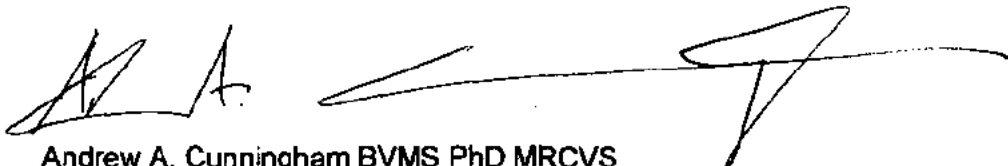
**Need for further research experience and training**

While Dr Epstein has been immersed in public health research for many years, he would greatly benefit from conducting PhD research in this field. Also, he is lacking in a number of key skills, such as molecular diagnostic and epidemiology techniques, GIS and disease modelling. The granting of this award and the acquirement of these skills would greatly benefit Dr Epstein's career path and the field of public health research in general.

In summary, I regard Dr Epstein to be an outstanding candidate for the award of a K08 grant and I have every confidence that he will achieve the goals he has set in this proposal. As this is his final opportunity to receive a K08 award, I strongly recommend that the reviewers consider funding this exceptional scientist.

Please let me know if I can be of any further assistance with this matter.

Yours faithfully



Andrew A. Cunningham BVMS PhD MRCVS  
Reader & Head of Wildlife Epidemiology  
Institute of Zoology



## TUFTS UNIVERSITY

Vice Provost

*Physical Address:*  
75 Kneeland Street, Suite 950  
Boston, Massachusetts 02111

November 1, 2006

Dear Review Panel,

I am pleased to serve as a reference for Dr. Jonathan Epstein's re-submission of a Mentored Clinical Scientist Award (K08).

I have known Jonathan since 1997. As a veterinary student at the Cummings School of Veterinary Medicine at Tufts University, Jonathan excelled. He was the first student to complete a Certificate in International Veterinary Medicine—a signature program at Tufts. Moreover, he completed a Master of Public Health degree through Tufts Medical School during his four years at Tufts, graduating with both degrees in 2002. I served as Dean from 1996–2005.

Jonathan was one of those students you don't want to loose, yet you look forward to what great things they end up doing. While on our campus he demonstrated all of the qualities one looks for in a student with great potential in conducting original research. He is bright, industrious, and searches out the expertise and advice needed to develop his ideas.

Jonathan was clearly interested in using his DVM and MPH education to pursue research after graduation. He took my advice and completed a one-year clinical internship at a very good specialty hospital to solidify his clinical expertise. He then followed his interest in Conservation Medicine in New York. I knew that this would be an excellent opportunity for Jonathan to use his background in veterinary medicine, public health, and international expertise.

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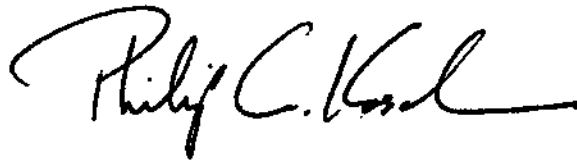


I have interacted with Jonathan since he graduated several times, and in my opinion, he has done a fabulous job. The high quality of his work, presentations made, and publications are an indication of his high potential to make major contributions in health-oriented research. A K08 Award at this time in his young career would be ideal for him and a worthy investment by NIH. I should note that this is the last opportunity for the review panel to select Jonathan for K08 support of his development as an independent investigator and future leader.

The research Dr. Epstein proposes as a K08 candidate is highly meritorious and of great significance to global health. Jonathan has revised his research plan in accordance with constructive criticism of his earlier resubmission. He has always demonstrated an ability to achieve his goals and I have great confidence that he will succeed in carrying out his research plan.

I have very high expectations of him in the future as an outstanding investigator. His maturity and personal qualities, broad scientific and clinical background, and commitment to contribute to areas of public health importance point to why I consider him one of the top five graduates of the Cummings School.

I can't say enough good things about Jonathan other than I hope Tufts will attract him back as a faculty member upon the completion of his research training. I strongly urge the review panel to select Jonathan for support. He is worthy of this investment and with this award he will make valuable research contributions. More importantly, you will have assisted his career development as a future leader.



Philip C. Kosch, D.V.M., Ph.D.  
Professor of Biomedical Sciences,  
Tufts Cummings School of  
Veterinary Medicine  
Professor of Pediatrics, Tufts University  
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# WILDLIFE TRUST

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National Institutes of Health  
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Public Health Services

November 1<sup>st</sup>, 2006

## To Whom It May Concern:

I am writing in support of Dr. Jonathan Epstein's application for a Mentored Clinical Research Award (K08) for his proposal on Nipah virus emergence in Bangladesh. I have worked with Jonathan for over three years, since he first started working at The Consortium for Conservation Medicine, which is based at Wildlife Trust and Columbia University.

## Potential for conducting research

Before I had ever met Dr. Epstein, I was given his CV to review when he was being considered for his current position at The Consortium for Conservation Medicine. I was immediately impressed by the level of his accomplishments, which were far above those of a typical vet student. He had completed a combined DVM / MPH degree in four years, as well as three international research projects which were each funded by competitive grants. In addition, he already had a publication in a prestigious journal, *Emerging Infectious Diseases*. Jonathan was also the first student to graduate the Cummings School of Veterinary Medicine with a certificate in International Veterinary Medicine, a testament to his ability to conduct research and a capstone to his accomplishments there.

Since beginning work at CCM, Jonathan has shown tremendous aptitude and independence in his work, which has focused on coordinating research within a large collaborative NIH-funded project on the emergence of Henipaviruses in Malaysia and Australia. He has repeatedly demonstrated that he is able to effectively design and conduct research and collaborate with colleagues from around the world, including developing countries like India, China, and Bangladesh – which having spent many years living and working in Pakistan, I know is highly challenging. One of the most significant research collaborations that he has been involved in was a collaboration between CCM, the Australian government, and the Chinese

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Academy of Sciences, in which Jon led a field team to study wild and marketplace bats for Nipah virus and SARS, which resulted in the discovery of Chinese Horseshoe bats as a natural reservoir for SARS-like Coronavirus - a finding which was published in *Science* in 2005. Subsequently, the relationships Jonathan forged with Chinese collaborators has led to a formal and long-term relationship between the CCM and the Chinese Academy of Sciences.

#### **Evidence of Originality**

Dr. Epstein has clearly demonstrated an ability to design and implement original research, particularly with the work he did in Kenya and Australia as a vet student, and more recently with his contributions to the Henipavirus ecology research team that have extended, through his PhD program, to Bangladesh.

#### **Adequacy of scientific background**

One of the advantages of Jonathan's combined training in veterinary medicine and public health is that it has given him a broader framework through which to approach issues of health than traditional health care professionals. Veterinarians are highly qualified to work in public health, and are particularly valuable to Dr. Epstein's field of interest: emerging zoonoses. Dr. Epstein has a solid foundation in epidemiology and veterinary medicine, although lacks formal training in research design, advanced statistical analyses, and laboratory techniques.

#### **Commitment to health-oriented research**

Dr. Epstein demonstrated a strong commitment to public health by completing his Masters in public health while in vet school. It's clear that he was able to identify the connections between human and animal health, and he took every opportunity to conduct research that explored those connections. Dr. Epstein was recently honored by Tufts University Medical School when he became the first alumnus to be inducted into the Delta Omega Honor Society for Public Health at Tufts, and their first inaugural keynote speaker. This speaks volumes about his dedication to the field of public health and his rare level of achievement such an early stage in his research career.

#### **Need for further research experience and training**

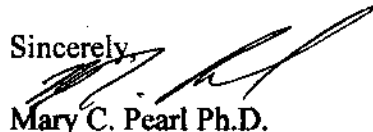
While Dr. Epstein has substantial experience for his stage of career, there are certain skills which he still needs to develop: advanced statistics, mathematical modeling, and laboratory diagnostics, which will make him able to ask better research questions, and interpret data more rigorously. He has not been through a formal, mentored PhD program, and the

program he has outlines at Columbia and Imperial College will significantly enhance his skills as an epidemiologist. I have every confidence that Dr. Epstein will successfully complete this PhD program and go on to become a successful independent researcher.

Overall, you would be hard-pressed to find a more suitable candidate for a career development award, and I have no doubt that Dr. Epstein will have a distinguished career in public health research. He has already proven to be exceptional in the short time that he has been working and will certainly become a leader in the field of public health.

This is the last opportunity for his K08 proposal to be funded, and I strongly urge the review panel to consider this worthy proposal and highly talented young scientist.

Sincerely,



Mary C. Pearl Ph.D.  
President, Wildlife Trust

<b>Grant Number</b> 5K08AI67549-2		<b>Total Project Period</b> From: 09/15/2007 To: 08/31/2011	
<b>EIN:</b> 1311726494A1	<b>Review Group:</b> MID	<b>Requested Budget Period:</b> From: 09/01/2008 To: 08/31/2009	
<b>Title of Project:</b> Risk for Future Outbreaks of Henipaviruses in South Asia			<b>Due Date:</b> 07/16/2008 <b>Submitted Date:</b> 07/17/2008
<b>Principal Investigator:</b> JONATHAN H EPSTEIN WILDLIFE TRUST CONSORTIUM FOR CONSERVATION MED 460 West 34th 17th Floor New York , NY 10001  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> 212 380-4475 <b>Email Address:</b> (b) (6)		<b>Applicant Organization:</b> WILDLIFE TRUST WILDLIFE TRUST 460 West 34th Street New York , NY 10001  <b>Department:</b>  <b>Major Subdivision:</b>	
<b>Administrative Official:</b> Aleksei Avery Chmura WILDLIFE TRUST 61 ROUTE 9W PALISADES , NY 109648000  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> <b>Email Address:</b> (b) (6)		<b>Signing Official:</b> Aleksei Avery Chmura WILDLIFE TRUST 61 ROUTE 9W PALISADES , NY 109648000  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> <b>Email Address:</b> (b) (6)	
<b>Human Subjects:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Research Exempt:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Exemption No:</b> <b>FWA Number:</b> <b>Full IRB:</b> <input type="checkbox"/> No <input type="checkbox"/> Yes <b>Phase III Clinical Trial:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		<b>Vertebrate Animals:</b> <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes <b>Animal Assurance Number:</b> A3415-01 <b>Inventions and Patents:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Previously Reported <input type="checkbox"/> Not Previously Reported	
<b>Program Income:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
<b>Budget Period</b>		<b>Anticipated Amount</b>	
<b>Source</b>			
<b>F&amp;A Changes:</b>			
<b>Performance Sites:</b> WILDLIFE TRUST WILDLIFE TRUST 460 West 34th Street New York NY 10001			

<b>Principal Investigator:</b> JONATHAN H EPSTEIN	<b>Grant Number</b> 5K08AI67549-2
<b>Applicant Organization:</b> WILDLIFE TRUST	<b>Period Covered by this Report:</b> 09/15/2007 - 08/31/2008
<b>Title of Project:</b> Risk for Future Outbreaks of Henipaviruses in South Asia	
<b>SNAP Questions:</b>	
<b>Has there been a change in the other support of key personnel since the last reporting period?</b> <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes <b>Justification:</b> Dr. Daszak has been awarded several new grants. See attached additional support page.	
<b>Will there be, in the next budget period, a significant change in the level of effort for the PI or other personnel designated on the Notice of Grant Award from what was approved for this project?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Justification:</b>	
<b>Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total budget?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Justification:</b>	
<b>Changes in Select Agent Research?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
<b>Changes in Multiple PI Leadership plan?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
<b>Human Subject Education Requirement:</b>	
<b>Has the Involvement of Human Subjects changed since previous submission?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
<b>Has the Involvement of Animal Subjects changed since previous submission?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
<b>Publications:</b>	
<b>Citation ID:</b>	<b>Citation Text:</b>

**Research Accomplishments:**

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Personnel Report						
Principal Investigator:				Grant Number		
JONATHAN H EPSTEIN				5K08AI67549-2		
Name:	Degree(s) Name:	SSN:	Role on Project:	Months Devoted to Project		
				Cal	Acad	Sum
JONATHAN H EPSTEIN	MPH, DVM, BA, PHD	(b) (6)	PI	(b) (6), (b) (4)		
Timothy Coulson	PhD		Mentor			
Peter Daszak	PhD		Primary Mentor			
W Ian Lipkin	MD		Mentor			
Stephen Patrick Luby	MD, MPH		Research Collaborator			



Department of Health and Human Services  
Public Health ServicesReview Group  
MIDType  
5Activity  
K08Grant Number  
5 K08 A1067549-02**Grant Progress Report**

Total Project Period

From: 9/15/2007

Through: 8/31/2011

Requested Budget Period

From: 8/1/2008

Through: 7/31/2009

## 1. TITLE OF PROJECT

Risk for Future Outbreaks of Henipaviruses in South Asia

## 2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR

(Name and address, street, city, state, zip code)

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## 2d. MAJOR SUBDIVISION

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4. ENTITY IDENTIFICATION NUMBER  
1311726494A16. HUMAN SUBJECTS  No  Yes6a. Research  
Exempt No  YesIf Exempt ("Yes" in  
6a):  
Exemption No.If Not Exempt ("No" in  
6a):  
IRB approval date

## 5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL

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Tel: (b) (6)

Fax: 212 380-4465

## 6c. NIH-Defined Phase III

Clinical Trial  No  Yes

E-MAIL: (b) (6)

7. VERTEBRATE ANIMALS  No  Yes

7a. If "Yes," IACUC approval Date 01/03/2008

7b. Animal Welfare Assurance No. A3415-01

## 10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Wildlife Trust

DUNS: 07-709-0066

## 8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT \$121,250.00

8b. TOTAL \$130,950.00

Street 1: 460 W. 34<sup>th</sup> stStreet 2: 17<sup>th</sup> Floor9. INVENTIONS AND PATENTS  No  YesIf "Yes,"  Previously Reported  
 Not Previously Reported

City: New York

County:

State: New York

Province:

Country: USA

Zip/Postal Code: 10001

Congressional Districts:

## 11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION (Item 13)

Aleksei Chmura, Program Assistant, Wildlife Trust

TEL: (b) (6)

FAX: 212 380-4475

E-MAIL: (b) (6)

## 12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN

11. (In ink)

DATE

DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY		FROM 9/15/2008			THROUGH 8/31/2009		GRANT NUMBER K08AI067549-02	
PERSONNEL (Applicant organization only)		Months Devoted to Project			DOLLAR AMOUNT REQUESTED (omit cents)			
NAME	ROLE ON PROJECT	Cal. Mnth	Acad. Mnth	Summer Mnth	SALARY REQUESTED	FRINGE BENEFITS	TOTALS (b) (6), (b) (4)	
Jonathan Epstein	PD/PI							
<b>SUBTOTALS</b> →					(b) (6), (b) (4)			
CONSULTANT COSTS								
N/A								
EQUIPMENT (Itemize)								
N/A								
SUPPLIES (Itemize by category)								
N/A								
PATIENT CARE COSTS								
	INPATIENT							
	OUTPATIENT							
ALTERATIONS AND RENOVATIONS (Itemize by category)								
OTHER EXPENSES (Itemize by category)								
<b>SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD</b>							<b>\$ 121,250.00</b>	
CONSORTIUM/CONTRACTUAL COSTS		DIRECT COSTS						
		FACILITIES AND ADMINISTRATIVE COSTS						
<b>TOTAL DIRECT COSTS FOR NEXT PROJECT PERIOD (Item 8a, Face Page)</b>							<b>\$ 121,250.00</b>	

Program Director/Principal Investigator (Last, First, Middle): Epstein, Jonathan Harris

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**BUDGET JUSTIFICATION**

GRANT NUMBER  
5 K08 AI067549-02

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Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

N / A

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**CURRENT BUDGET PERIOD**

FROM  
09/15/2007

THROUGH  
08/31/2008

---

Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Epstein, Jonathan Harris

<b>PROGRESS REPORT SUMMARY</b>	GRANT NUMBER	
	5 K08 AI067549-02	
PERIOD COVERED BY THIS REPORT		

PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR	FROM	THROUGH
Epstein, Jonathan Harris	09/15/2007	08/31/2008

APPLICANT ORGANIZATION  
Wildlife Trust, Consortium for Conservation Medicine

TITLE OF PROJECT (Repeat title shown in Item 1 on first page)  
Risk for Future Outbreaks of Henipaviruses in South Asia

A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	<input type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	<input checked="" type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
C. Select Agent Research	<input checked="" type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
D. Multiple PD/PI Leadership Plan	<input type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change

SEE PHS 2590 INSTRUCTIONS.

**WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.**

## A. Specific Aims

The proposed specific aims of this study have not changed. There are no changes to senior or key personnel and no anticipated program income, therefore a key personnel report and the checklist have not been included.

## B. Studies and Results.

To date, I have collected 1000 blood, saliva, and urine samples as well as 3000 environmental urine samples from bats in six districts in Bangladesh (**Specific Aims 1 and 2** – Spatial and longitudinal survey of NiV in *P. giganteus*), four of which have had Nipah virus outbreaks in people. Four of the six colonies sampled have been tested for anti-NiV antibodies by ELISA, and two of those (Thakurgaon and Kushtia) have been confirmed by a serum neutralization test at AAHL, Australia. Seroprevalence by ELISA ranged from 20-46%. Serology results are summarized in **Figure 1**. This year I have gained skills in RNA extraction from field samples, developed degenerate and specific PCR primers to detect henipaviruses, and run reverse transcription and consensus PCR assays. I have tested 120 saliva and urine samples by PCR. I used a *Pteropus* bat-specific NAD gene as a housekeeping gene to confirm that the extractions worked. Greater than 90% of samples tested (n=240) showed positive bands for the NAD gene. I developed protocols for both single and hemi-nested henipavirus PCR assays using both individual samples and pooled samples containing material from 5 bats. Samples were pooled for screening purposes, with a sensitivity of approximately  $10^2$  RNA molecules on single PCR (considered adequate to detect Nipah virus in an actively infected bat). Bat samples from pools showing NiV positive bands were re-tested individually. Preliminary results from a hemi-nested PCR indicate that 2/100 urine samples from the Thakurgaon colony are NiV positive for the NiV glycoprotein (G) gene region. I excised and purified bands from the agarose gel and sequenced the gene which showed 97-99% similarity to Nipah virus sequences on Genbank (**Figure 2**). I am currently currently confirming these samples by PCR for the NiV matrix and polymerase genes.

Under **S.A. 2**, the longitudinal survey to measure seasonal variation in NiV infection in bats, I identified a colony for repeated testing in Faridpur District, and 100 bats have been sampled at four different time points, including in January 2006 (**Figure 1**). Each bat in the longitudinal study has been microchipped, and there has been approximately a 5% recapture rate. Serum from the longitudinal study will be tested in two batches of 600 in order to minimize error due to ELISA test-to-test variation.

As part of a small trial study, I used serum, saliva, and urine from a subset of the Thakurgaon bats to test the hypothesis that pregnant bats are more likely to be infected with viruses (Nipah or others) than non-pregnant females and males. We used high throughput sequencing to test pooled samples of serum from 4 pregnant bats, 4 non-pregnant bats, and 4 male bats. This process was repeated using saliva and urine samples. The results generated an extensive list of both microbial and genomic short sequences. **I also discovered a novel Hepatitis C-like flavivirus in the serum of one of the pregnant bats.** Conventional PCR primers were initially designed based on the sequences generated by 4-5-4. From the resultant PCR products, other sets of primers were designed and several sections of genome have now been sequenced. This virus does not match anything on genbank at the nucleotide level, but amino acid-level comparisons suggest that it is ~45% homologous to GB virus A or C. **Figure 3** shows a schematic diagram of sequenced regions of this novel virus superimposed upon the GBV A genome.

**Specific Aim 3:** Modeling of Nipah virus in bat populations. This year I have had three meetings with Tim Coulson: two at Imperial College (Dec 2007, April, 2008), and one in May, 2008 in New York. I have continued learning the statistical and modeling program “R,” and completed practice

exercises with Dr. Coulson in statistical analyses using a similar data set to the one I will generate in this study. We developed a matrix model structure which I will ultimately use to describe the dynamics of NiV infection in bats over the 3-yr longitudinal study, based on sex and age class. I will parameterize the model over the next two years based on field data.

### **C. Significance**

The finding that bat colonies in both NiV outbreak locations and non-outbreak locations across Bangladesh had equally high seroprevalence suggests that NiV circulates widely among *Pteropus giganteus* in Bangladesh, as it does with *P. vampyrus* and *hypomelanus* in Malaysia. The finding of PCR positive bats from Thakurgaon, if confirmed, will allow me to obtain NiV sequence, characterize this strain of virus, and compare it to those carried by pteropid bats elsewhere. This would represent the first NiV sequence from bats in Bangladesh. Urine and Saliva samples from confirmed PCR-positive bats, will be cultured at the Australian Animal Health Laboratory (AAHL) in Geelong.

**The most interesting finding to date is my discovery of a hepatitis C-like flavivirus in a pregnant bat.** GB viruses A-C are classified as non-Hepatitis A-E viruses and have been described in new world primates. These viruses have also been found in hepatitis patients that initially tested negative for Hep A-E. The potential bat and human health impact of this virus is currently unknown, but this represents the first finding of a potentially zoonotic hepatitis virus in a bat.

### **D. Plans**

Once the new hepatitis C-like virus has been fully characterized I will screen the serum from the remainder of the 100 Thakurgaon bats to determine its prevalence in this colony. This data may be incorporated into a similar matrix model to compare the theoretical likelihood of spillover of this virus to that of Nipah. Future studies (beyond this K award) may include the development of serologic assays for this virus and the screening of non-Hep A-E hepatitis patients in Bangladesh. I will also continue to test serum using ELISA and saliva and urine using PCR for Nipah virus. The spatial survey is planned to be completed by February, 2009, leaving the longitudinal sampling as the remaining field component. At that point, I will spend the majority of my time in the laboratory at Columbia and at CCM conducting data analysis.

### **E. Publications.**

*Published:* Epstein JH, Prakash V, Smith CS, Daszak P, McLaughlin AB, Meehan G, et al. Henipavirus infection in fruit bats (*Pteropus giganteus*), India. *Emerg Infect Dis* 2008; 14, 1309-11.

*Submitted:* Epstein, J.H., Olival, K.J., Smith, C., Westrum, J., Hughes, T., Dobson, A.P., Zubaid, A., Rahman, S.A., Basir, M.M., Field, H.E. & Daszak, P. Management of a hunted migratory species with a multinational home-range. *Journal of Applied Ecology*

### **F. Project-Generated Resources**

This project has not generated any resources during this budget period.

### **G. Research Development**

Over the past year I entered the 2<sup>nd</sup> year of my part-time PhD, upgrading from MPhil status. I transferred enrollment from Imperial College to Kingston University to reduce tuition fees, but retaining Dr. Coulson as my K08 co-mentor, so there are no changes to Senior Personnel. My primary mentor (Dr. Daszak) is on faculty at Kingston University and will remain my PhD co-supervisor with Dr. Coulson and Dr. Mark Fielder, professor of Microbiology at Kingston. The aims of my PhD thesis remain the same.

I continued training in molecular laboratory techniques under Dr. Lipkin, including PCR and high throughput sequencing. My finding of a novel virus in one of my bat samples has allowed me to learn techniques of virus characterization, enhancing my molecular epidemiology skill set. I have also continued to receive experimental design and grant writing experience under Dr. Daszak. I have conceived of a study and written an R03 proposal which aims to test the hypothesis that female bats experience increased physiological stress during pregnancy which suppresses the immune system and results in a delayed immune response to antigenic insult. This experiment aims to address the hypothesis in Specific Aim 2 of this K award, as a separate study from this K award, by attempting to demonstrate that pregnant bats within a population may be responsible for increased viral shedding due to immune suppression. In preparing for this experimental study, I have assembled a collaborative team of senior investigators for this project which has already generated preliminary experimental data, showing proof of concept. This grant has been reviewed by NIH, but has not been funded, although it received positive reviews. I will resubmit this grant in October. This has been a valuable training experience because I have been directly responsible for the design and execution of an experimental, hypothesis driven study. I am also a co-investigator on two NIH R01 awards (Daszak, PI) that will be awarded this year (each take (b) (4)).

#### **H. Other Activities**

**Review Editor**, EcoHealth Journal ([www.ecohealth.com](http://www.ecohealth.com))

**Member**, Scientific Program & Scholarship Committee, EcoHealth International Forum 2008; IUCN Veterinary Specialist Group & Chiroptera Species Specialist Group

**Invited Lectures/teaching (<5% time)**: Emerging Zoonoses, University Malaya, Sarawak (2008); Emergence of Nipah virus and SARS, Mt. Sinai School of Medicine, NY, MPH course (May 2008); Predicting Emerging Zoonoses, University of Minnesota Veterinary College / School of Public Health (June 2008);

**Mentored** Tufts Veterinary student for summer research study on potential food-borne exposure to Nipah virus, Bangladesh in parallel with bat surveillance (July-Aug, 2007).

**Testified**, IOM/ NRC Workshop on zoonotic disease surveillance, Washington DC (June 2008)

**Presented**, Understanding the emergence of Nipah Virus in Malaysia, ICID, Kuala Lumpur (June 2008)

#### **I. Research Development and Other Activities Planned for the Next Year.**

I will continue to work under Dr. Ian Lipkin's supervision at the Center for Infection and Immunity at Columbia University. The discovery of a GBV-like flavivirus has opened up a new avenue for my career development in viral discovery and diagnostics. I will continue to develop my skills in primer design, PCR, and cloning to finish sequencing the complete genome of this virus. I will also learn how to create and analyze phylogenies based on sequence data, which will culminate in a publication characterizing this new virus. I will also use PCRs that I have designed, with Dr. Lipkin's guidance, to screen all remaining samples from the Thakurgaon colony to determine the prevalence of this flavivirus in these bats. This process will develop critical skills in pathogen discovery and diagnosis which will be invaluable to future epidemiological studies in my career. In the upcoming year I will also continue to meet with Dr. Coulson both at Imperial College and at CCM in New York to receive further training in model design and statistical analyses using R. I also will continue to learn grant-writing skills by re-writing my R03 application and others. This year I will give invited presentations at the 10<sup>th</sup> Anniversary Nipah symposium in Kuala Lumpur in Oct 2008; the EcoHealth International Forum Zoonotic Disease Transmission Symposium in Dec 2008; and in the Nipah virus symposium at the American Society for Tropical Medicine and Hygiene meeting in Dec 2008.

### **J. Mentor's report**

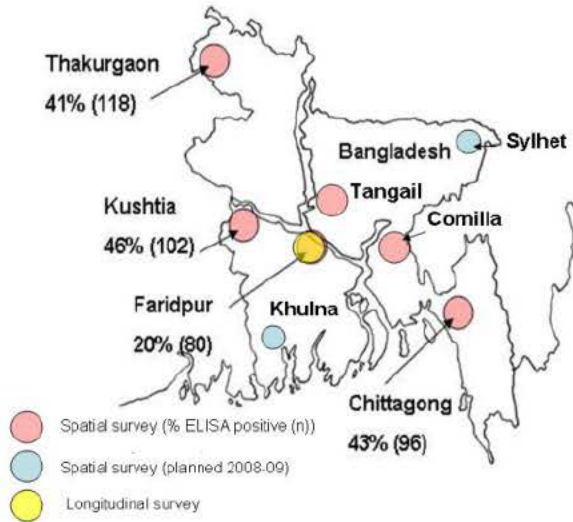
Jon Epstein has made significant progress this year towards his K08 aims, achieving and excelling at all the goals we set together at the beginning of his training. I have been impressed with the ease with which he has learned PCR, high-throughput sequencing and viral characterization techniques with Dr Lipkin. He has visited Bangladesh repeatedly, conducting fieldwork efficiently, an outbreak investigation with CDC and the ICDDR,B and collecting around 1,000 samples. He has undertaken 3 periods of training with Dr Coulson and now has a good basic grasp of mathematical modeling. He has pushed 2 papers through (one accepted, one published) and has pursued an R03 grant for a new research angle which was planned, drafted and the preliminary experiments designed by himself. Finally, he has dealt with IACUC, CITES and USDA import permits to successfully import samples from bats, and discover a new virus from a zoonotic group (hepatitis C). He has worked extremely hard to fit all of these diverse tasks into his schedule, and has done this extremely successfully, and with minimal need for supervision, proving himself well capable of developing into an independent researcher.

The availability of support for Jon remains excellent. Dr Lipkin will continue to offer full use of his lab facilities at no cost, other than consumables. This includes desk space, phone etc. Kingston University, where Jon is registered for a Ph.D remains very supportive of his application, and Dr Coulson is fully committed to the schedule of mentoring that we set. Finally, CCM has received two new R01 grants that will provide extra support for Jon – a grant from NIAID to conduct viral discovery, characterization and pathogenesis studies in bats, and a grant from the Fogarty Intl. Center to analyze the dynamics of Nipah virus emergence in Bangladesh. While there is no direct overlap with Jon's K08 aims, these grants will add to the intellectual, field and lab support for Jon's work.



**Figure 1.** Map showing completed and future bat surveillance locations and serology results.

Nipah virus surveillance in *Pteropus giganteus*, Bangladesh



**Figure 2.** Nipah virus hemi-nested PCR testing for the nucleocapsid (N) region of the genome. Three bands from pooled samples from bat throat swabs showed sequence with 97-99% homology to Nipah virus isolates in Malaysia and Bangladesh. Confirmatory PCR tests of these samples for other genomic regions are pending.

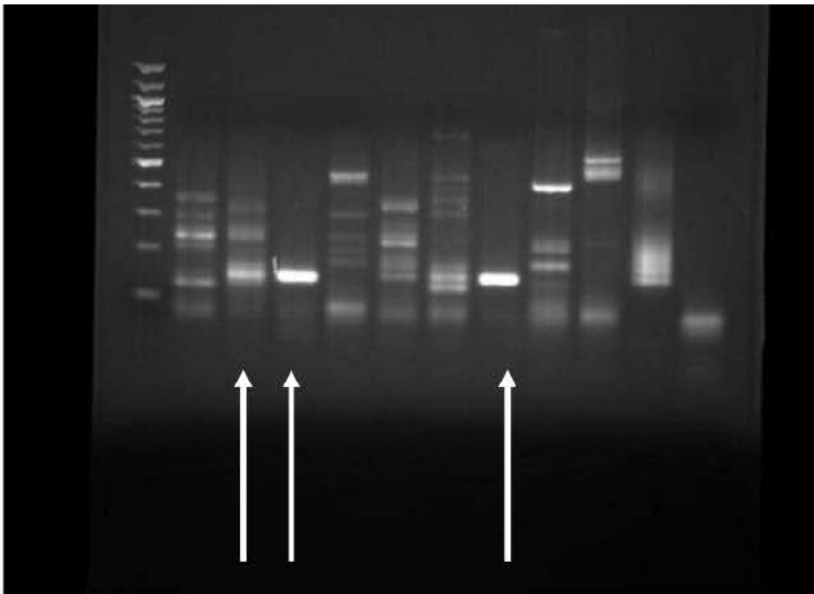
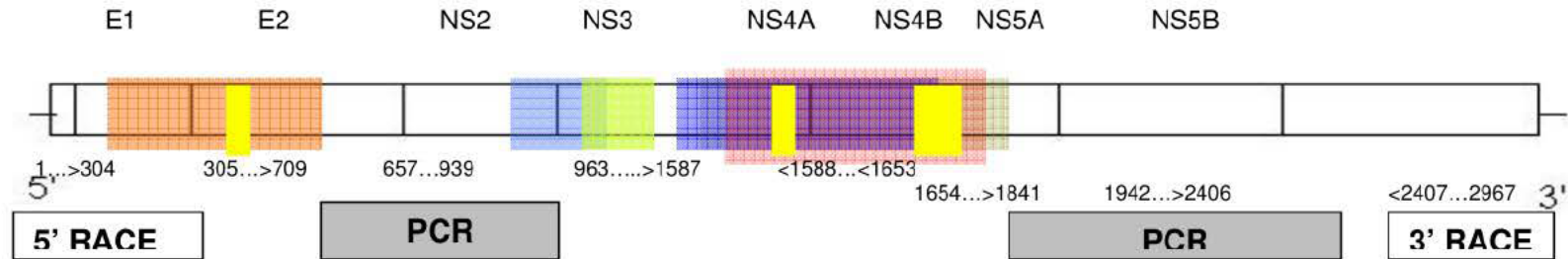


Figure 3. Schematic drawing of GBV A genome with superimposed estimated amino acid positions of sequences obtained from newly discovered Hepatitis G-like flavivirus from *Pteropus giganteus*. PCR and Rapid Amplification of cDNA Ends (RACE) will be used to sequence the remaining sections of the genome.

**GBV A (2,967 AA; 9,360 nt)**



**Sequences and estimated amino acid positions**

Sample	AA position	Length (AA / nt)	Gene Region
93S_750A	GBV A [187 - 441]	254 / 762	E1,E2
93S_5C	GBV A [226 - 408]	182 / 559	E1, E2
GB 454 Long	GBVA [403-456]	53 / 147	E2
93S_2A	GBVA [226 - 453]	227 / 681	E1, E2
93S_5D	GBV A [886 - 1086]	204 / 612	NS2,NS3
93S_400	Marm GBVA [1494-1600]	91 / 273	NS3
GB454 Mid	GBVA [1600...1646]	46 / 138	NS4A
GB454 short	GBV [1618 - 1635]	17 / 51	NS4A
93S_4A	Marm GBV A[1494 - 1682]	188 / 564	NS3, NS4A,NS4B
93S_4B	Marmoset GBVA [1539-1746]	177 / 531	NS3, NS4A,NS4B
93SA_750*	GBVC [1555 - 1635]	80 / 240	NS4A,NS4B
93S_2500E	Marm GBV A [1064-1279]	179 / 537	NS3
GBVXd-M13F(-47)	GBV A [1366-1544]	182 / 546	NS3
GBVXg-M13F(-47)	GBV A [1055 - 1272]	217 / 627	NS3

Program Director/Principal Investigator (Last, first, middle): Epstein, Jonathan Harris

GRANT NUMBER  
K08AI067549-02

## CHECKLIST

### 1. PROGRAM INCOME (See instructions.)

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
8/1/2008 – 7/31/2009	NONE	

### 2. ASSURANCES/CERTIFICATIONS (See instructions.)

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the [PHS 398](#), and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

### 3. FACILITIES AND ADMINISTRATIVE (F&A) COSTS

Indicate the applicant organization's most recent F&A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will **not** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

DHHS Agreement dated: 03/10/2008  No Facilities and Administrative Costs Requested.  
 No DHHS Agreement, but rate established with \_\_\_\_\_ Date \_\_\_\_\_

### CALCULATION\*

Entire proposed budget period: Amount of base \$ 121,250 x Rate applied 8 % = F&A costs \$ 9,700  
Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

\*Check appropriate box(es):

Salary and wages base  Modified total direct cost base  Other base (Explain)

Off-site, other special rate, or more than one rate involved (Explain)

Explanation (Attach separate sheet, if necessary.):

**SENIOR/KEY PERSONNEL REPORT**

**GRANT NUMBER**  
5 K08 AI067549-02

Place this form at the end of the signed original copy of the application. Do not duplicate.

**All Key Personnel for the Current Budget Period (do not include Other Significant Contributors)**

Name	Degree(s)	SSN (last 4 digits)	Role on Project (e.g. PD/PI, Res. Assoc.)	Months Devoted to Project		
				Cal	Acad	Summer
Daszak, Peter	PhD	N/A	Primary Mentor	(b) (6), (b) (4)		
Lipkin, Ian	MD	N/A	Mentor			
Coulson, Timothy	PhD	N/A	Mentor			
Stephen P. Luby	MD, MPH	N/A	Res. Collaborator			

**ADDITIONAL ACTIVE RESEARCH SUPPORT, Daszak, P. (Primary Mentor)**

- N01 AI-25490 Kramer (PI) 10/01/02 -  
10/01/09  
NIH/NIAID  
West Nile & pox viruses: ecology, pathogenesis & immunity  
This subcontract provides partial salary for a postdoc to conduct field studies, mathematical modeling and analysis of the ecology of West Nile virus in the USA.  
Role: PI on a subcontract, oversee research on WNV ecology. 1 month commitment
- NSF EF-062239 Kilpatrick (PI) 09/01/06 -  
08/30/11  
National Science Foundation/National Institutes of Health: Ecology of Infectious Diseases program  
Predicting spatial variation in West Nile virus transmission  
This project is to assess the interaction between vector populations, reservoir host populations and West Nile virus across an urban-to-rural human density gradient in the northeastern USA.  
Role: Co-PI, planning and executing research on WNV ecology. 1 month commitment
- NSF RCN Charles Perrings (PI) 02/01/07 -  
01/31/10  
NSF Research Coordination Network  
Biodiversity and Ecosystem Services Training Network (BESTNet)  
This project is to provide interdisciplinary research and training among diverse disciplines including ecologists and health scientists.  
Role: Co-PI, responsible for program on biodiversity and infectious diseases. 0.2 months commitment.
- 1 R01-TW008245 Daszak (PI) 07/01/08 -  
06/30/13  
NIH Fogarty Intl. Center: NSF/NIH Ecology of Infectious Diseases program  
Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh  
This project is to examine the dynamics, drivers and emergence of Nipah virus in Bangladesh.  
Role: PI, responsible for planning and executing overall program of work. 2 months commitment
- 1 R01 AI079231-01 Daszak (PI) 07/01/08 -  
06/30/13  
NIH/ NIAID  
Risk of Viral Emergence from Bats.  
This study is to model the regions most likely to generate new zoonoses from bats, to test samples from bat species for new viruses, and to examine their pathogenesis.  
Role: PI, responsible for planning and executing overall program of work. 1.5 months commitment
- NSF/HSD Daszak (PI) 10/01/08-  
09/30/11  
NSF Human and Social Dynamics Program  
Anthropogenic drivers of emerging infectious diseases  
The major goal of this research is to map the global drivers of emerging diseases in collaboration with a socio-economic database group.  
Role: PI, responsible for planning and executing overall program of work. 1.5 months commitment

**ADDITIONAL ACTIVE RESEARCH SUPPORT, Daszak, P. (Primary Mentor)**

- N01 AI-25490 Kramer (PI) 10/01/02 -  
10/01/09  
NIH/NIAID  
West Nile & pox viruses: ecology, pathogenesis & immunity  
This subcontract provides partial salary for a postdoc to conduct field studies, mathematical modeling and analysis of the ecology of West Nile virus in the USA.  
Role: PI on a subcontract, oversee research on WNV ecology. 1 month commitment
- NSF EF-062239 Kilpatrick (PI) 09/01/06 -  
08/30/11  
National Science Foundation/National Institutes of Health: Ecology of Infectious Diseases program  
Predicting spatial variation in West Nile virus transmission  
This project is to assess the interaction between vector populations, reservoir host populations and West Nile virus across an urban-to-rural human density gradient in the northeastern USA.  
Role: Co-PI, planning and executing research on WNV ecology. 1 month commitment
- NSF RCN Charles Perrings (PI) 02/01/07 -  
01/31/10  
NSF Research Coordination Network  
Biodiversity and Ecosystem Services Training Network (BESTNet)  
This project is to provide interdisciplinary research and training among diverse disciplines including ecologists and health scientists.  
Role: Co-PI, responsible for program on biodiversity and infectious diseases. 0.2 months commitment.
- 1 R01-TW008245 Daszak (PI) 07/01/08 -  
06/30/13  
NIH Fogarty Intl. Center: NSF/NIH Ecology of Infectious Diseases program  
Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh  
This project is to examine the dynamics, drivers and emergence of Nipah virus in Bangladesh.  
Role: PI, responsible for planning and executing overall program of work. 2 months commitment
- 1 R01 AI079231-01 Daszak (PI) 07/01/08 -  
06/30/13  
NIH/ NIAID  
Risk of Viral Emergence from Bats.  
This study is to model the regions most likely to generate new zoonoses from bats, to test samples from bat species for new viruses, and to examine their pathogenesis.  
Role: PI, responsible for planning and executing overall program of work. 1.5 months commitment
- NSF/HSD Daszak (PI) 10/01/08-  
09/30/11  
NSF Human and Social Dynamics Program  
Anthropogenic drivers of emerging infectious diseases  
The major goal of this research is to map the global drivers of emerging diseases in collaboration with a socio-economic database group.  
Role: PI, responsible for planning and executing overall program of work. 1.5 months commitment



**Grant Number:** 5K08AI067549-02 REVISED

**Principal Investigator(s):**  
JONATHAN H EPSTEIN, DVM

**Project Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

aLEKSEI CHMURA  
SENIOR RESEARCH SPECIALIST  
WILDLIFE TRUST  
61 ROUTE 9W  
460 WEST 34TH ST, 17TH FL  
PALISADES, NY 109648000

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 09/01/2008 – 08/31/2009

**Project Period:** 09/15/2007 – 08/31/2011

Dear Business Official:

The National Institutes of Health hereby revises this award (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to WILDLIFE TRUST in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release or other document that cites results from NIH grant-supported research must include an acknowledgment of NIH grant support and disclaimer such as "The project described was supported by Award Number K08AI067549 from the National Institute Of Allergy And Infectious Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Allergy And Infectious Diseases or the National Institutes of Health."

Award recipients are required to comply with the NIH Public Access Policy. This includes submission to PubMed Central (PMC), upon acceptance for publication, an electronic version of a final peer-reviewed, manuscript resulting from research supported in whole or in part, with direct costs from National Institutes of Health. The author's final peer-reviewed manuscript is defined as the final version accepted for journal publication, and includes all modifications from the publishing peer review process. For additional information, please visit <http://publicaccess.nih.gov/>.

Award recipients must promote objectivity in research by establishing standards to ensure that the design, conduct and reporting of research funded under NIH-funded awards are not biased by a conflicting financial interest of an Investigator. Investigator is defined as the Principal Investigator and any other person who is responsible for the design, conduct, or reporting of NIH-funded research or proposed research, including the Investigator's spouse and dependent children. Awardees must have a written administrative process to identify and manage financial conflict of interest and must inform Investigators of the conflict of interest policy and of the Investigators' responsibilities. Prior to expenditure of these awarded funds, the Awardee must report to the NIH Awarding Component the existence of a conflicting interest and within 60 days of any new conflicting interests identified after the initial report. Awardees must comply with these and all other aspects of 42 CFR Part 50, Subpart F. These requirements also apply to subgrantees, contractors, or collaborators engaged by the Awardee under this award. The NIH website <http://grants.nih.gov/grants/policy/coi/index.htm> provides additional information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Jackie F. Johnson  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows



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**SECTION I – AWARD DATA – 5K08AI067549-02 REVISED****Award Calculation (U.S. Dollars)**

Federal Direct Costs	\$121,250
Federal F&A Costs	\$9,700
Approved Budget	\$130,950
Federal Share	\$130,950
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$130,950</b>

**AMOUNT OF THIS ACTION (FEDERAL SHARE)** \$0

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
2	\$130,950	\$130,950
3	\$130,950	\$130,950
4	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

**CFDA Number:** 93.855  
**EIN:** 1311726494A1  
**Document Number:** KAI067549A  
**Fiscal Year:** 2008

IC	CAN	2008	2009	2010
AI	8472401	\$130,950	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

**PCC:** M32A B / **OC:** 415P / **Processed:** (b) (6) 09/30/2008

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**SECTION II – PAYMENT/HOTLINE INFORMATION – 5K08AI067549-02 REVISED**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

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**SECTION III – TERMS AND CONDITIONS – 5K08AI067549-02 REVISED**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at 'http://grants.nih.gov/grants/policy/awardconditions.htm' for certain references cited above.)

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

**Treatment of Program Income:**  
Additional Costs

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**SECTION IV – AI Special Terms and Conditions – 5K08AI067549-02 REVISED**

Revised award to update Select Agent term below:

Awardees who conduct research involving Select Agents (see 42 CFR 73 for the Select Agent list; and 7 CFR 331 and 9 CFR 121 for the relevant animal and plant pathogens) must complete registration with CDC (or USDA, depending on the agent) before using NIH funds for any work directly involving the Select Agent at the US institution. No funds can be used for research involving Select Agents if the final registration certificate is denied. Before using NIH funds for any work directly involving the Select Agents at the foreign institution, the US awardee must provide information from the foreign institution satisfactory to the NIH that a process equivalent to that described in 42 CFR 73 for US institutions is in place and will be administered on behalf of all Select Agent work sponsored by these funds. Awardees must be willing to address the following key elements appropriate for the foreign institution: safety, security, training, procedures for ensuring that only approved/appropriate individuals have access to the Select Agents, and any applicable laws, regulations and policies equivalent to 42 CFR 73. If this work will not, in fact, involve Select Agents (e.g. excluded strains), and you provide documentation satisfactory to the NIH that your work does not now nor will it in the future (i.e. throughout the life of the award) involve Select Agents, no further action will be necessary.

Supersedes NOA issued 08/14/2008.

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\*\*\*\*\*

Grants Management must be notified at least 3 months in advance of any anticipated administrative changes on this award (for example change of institution, sponsor, and/or any type of sabbatical or leave of absence).

This Career Award requires a minimum of [redacted] (b) (6), (b) (4) be devoted to the research project.

The guidelines for this K award (see applicable Program Announcement at <http://www.niaid.nih.gov/ncn/training/k.htm>) state that your institution may supplement the NIH salary contribution up to a level that is consistent with your institution's salary scale; however, supplementation may not be from Federal funds unless specifically authorized by the Federal program from which such funds are derived. Because the salary amount provided by this award is based on the full-time institutional salary, no other PHS funds may be used for salary supplementation.

The research proposed in this grant may involve Select Agents and/or Highly Pathogenic Agents.

NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that, under some circumstances, may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL)(<http://www.cdc.gov/OD/ohs/biosfty/bmb15/bmb15toc.htm>), your Institutional Biosafety Committee (IBC) or equivalent body, or appropriate designated institutional biosafety official. If there is ambiguity in the BMBL guidelines and/or there is disagreement among the BMBL, an institutional committee or institutional official, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If your IBC or equivalent body or official has determined, for example, by conducting a risk assessment, that the work being planned or performed under this grant may be conducted at a biocontainment safety level that is lower than BSL3.

If the work involves Select Agents and/or Highly Pathogenic Agents. Also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s);
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

For domestic work with Select Agents provide documentation of Registration status of all domestic organizations/entities where Select Agent(s) will be used

Please be advised that changes in the use of a Select Agent will likely be considered a change in scope and, therefore, require NIH awarding office prior approval.

**STAFF CONTACTS**

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Jackie F. Johnson  
**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Cristina Cassetti  
**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-496-8030

**SPREADSHEET SUMMARY**

**GRANT NUMBER:** 5K08AI067549-02 REVISED

**INSTITUTION:** WILDLIFE TRUST

<b>Budget</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
TOTAL FEDERAL DC	\$121,250	\$121,250	\$121,250
TOTAL FEDERAL F&A	\$9,700	\$9,700	\$9,700
TOTAL COST	\$130,950	\$130,950	\$130,950

<b>Facilities and Administrative Costs</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
F&A Cost Rate 1	8%	8%	8%
F&A Cost Base 1	\$121,250	\$121,250	\$121,250
F&A Costs 1	\$9,700	\$9,700	\$9,700

<b>Grant Number</b> 5K08AI67549-3		<b>Total Project Period</b> From: 09/15/2007 To: 08/31/2011	
<b>EIN:</b> 1311726494A1	<b>Review Group:</b> MID	<b>Requested Budget Period:</b> From: 09/01/2009 To: 08/31/2010	
<b>Title of Project:</b> Risk for Future Outbreaks of Henipaviruses in South Asia			<b>Due Date:</b> 07/16/2009 <b>Submitted Date:</b> 08/25/2009
<b>Program Director/Principal Investigator:</b> JONATHAN H EPSTEIN WILDLIFE TRUST CONSERVATION MEDICINE PROGRAM 460 West 34th 17th Floor New York , NY 10001  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> 212 380-4475 <b>Email Address:</b> (b) (6)		<b>Applicant Organization:</b> WILDLIFE TRUST WILDLIFE TRUST 460 West 34th Street New York , NY 10001  <b>Department:</b>  <b>Major Subdivision:</b>	
<b>Administrative Official:</b> Aleksi Avery Chmura WILDLIFE TRUST 61 ROUTE 9W PALISADES , NY 109648000  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> <b>Email Address:</b> (b) (6)		<b>Signing Official:</b> Aleksi Avery Chmura WILDLIFE TRUST 61 ROUTE 9W PALISADES , NY 109648000  <b>Phone Number:</b> (b) (6) <b>Fax Number:</b> <b>Email Address:</b> (b) (6)	
<b>Human Subjects:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Research Exempt:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <b>Exemption No:</b> <b>FWA Number:</b> <b>Phase III Clinical Trial:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		<b>Vertebrate Animals:</b> <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes <b>Animal Assurance Number:</b> A3415-01  <b>Inventions and Patents:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> Previously Reported <input type="checkbox"/> Not Previously Reported	
<b>Program Income:</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes			
<b>Budget Period</b>		<b>Anticipated Amount</b>	
<b>Source</b>			
<b>F&amp;A Changes:</b>			
<b>Primary Project/Performance Site Location</b>			
Organizational Name: WILDLIFE TRUST			
DUNS: 077090066			
Street 1: WILDLIFE TRUST		Street 2: 460 West 34th Street	
City: New York		County:	State: NY
Province:	Country: UNITED STATES		Zip/Postal Code: 10001
Congressional Districts: 8			

<b>Program Director/Principal Investigator:</b> JONATHAN H EPSTEIN	<b>Grant Number</b> 5K08AI67549-3
<b>Applicant Organization:</b> WILDLIFE TRUST	<b>Period Covered by this Report:</b> 09/01/2008 - 08/31/2009
<b>Title of Project:</b> Risk for Future Outbreaks of Henipaviruses in South Asia	
<b>SNAP Questions:</b>	
<p><b>Has there been a change in the other support of Senior/Key Personnel since the last reporting period?</b></p> <p><input type="checkbox"/> No <input checked="" type="checkbox"/> Yes</p> <p><b>Justification:</b> Peter Daszak has been awarded two new grants with no scientific overlap or significant change in effort on this award. These awards will support Dr. Epstein's salary for 3 month's time, but Dr. Epstein be at a 75% effort level (09 calendar months) for this K award. Details provided in the attached additional support pages.</p>	
<p><b>Will there be, in the next budget period, a significant change in the level of effort for the PD/PI or other Senior/Key Personnel designated on the Notice of Award from what was approved for this project?</b></p> <p><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p> <p><b>Justification:</b></p>	
<p><b>Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget?</b></p> <p><input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p> <p><b>Justification:</b></p>	
<p><b>Changes in Select Agent Research?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p> <p><b>Changes in Multiple PD/PI Leadership plan?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p>	
<b>Human Subject Education Requirement:</b>	
<p><b>Has the Involvement of Human Subjects changed since previous submission?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p> <p><b>Has the Involvement of Animal Subjects changed since previous submission?</b> <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes</p>	
<b>Publications:</b>	
<p><u>Valid NIHMSID:</u>    <u>Citation ID:</u>    <u>Citation Source:</u>    <u>Citation Text:</u></p>	

**Research Accomplishments:**

File is not uploaded

**Other Document File:**

File is not uploaded

Senior/Key Personnel Report						
Program Director/Principal Investigator:				Grant Number		
JONATHAN H EPSTEIN				5K08AI67549-3		
Name:	Degree(s) Name:	SSN:	Role on Project:	Months Devoted to Project		
				Cal	Acad	Sum
JONATHAN H EPSTEIN	MPH, DVM, BA, PHD	(b) (6)	PD/PI	(b) (6), (b) (4)		
Timothy Coulson	PhD		Mentor			
Peter Daszak	PhD		Primary Mentor			
W Ian Lipkin	MD		Mentor			
Stephen Patrick Luby	MD, MPH		Research Collaborator			

Department of Health and Human Services  
Public Health Services

Review Group MID	Type 5	Activity K08	Grant Number 5 K08 AI067549-03
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## Grant Progress Report

Total Project Period	
From: 9/15/2007	Through: 8/31/2011
Requested Budget Period	
From: 8/1/2009	Through: 7/31/2010

## 1. TITLE OF PROJECT

Risk for Future Outbreaks of Henipaviruses in South Asia

## 2a. PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR

(Name and address, street, city, state, zip code)  
EPSTEIN, JONATHAN H  
WILDLIFE TRUST  
CONSERVATION MEDICINE PROGRAM  
460 W. 34<sup>TH</sup> ST, 17<sup>TH</sup> FLOOR  
NEW YORK, NY 10001

## 2b. E-MAIL ADDRESS

(b) (6)

## 2c. DEPARTMENT, SERVICE, LABORATORY, OR EQUIVALENT

Conservation Medicine Program

## 2d. MAJOR SUBDIVISION

2e. Tol: (b) (6) Fax: 212 380-4475

## 3a. APPLICANT ORGANIZATION

(Name and address, street, city, state, zip code)  
WILDLIFE TRUST  
460 W. 34<sup>TH</sup> ST  
17<sup>TH</sup> FLOOR  
NEW YORK, NY 10001

3b. Tel: (b) (6) Fax: 212 380-4465

3c. DUNS: 077090066

4. ENTITY IDENTIFICATION NUMBER  
1311726494A16. HUMAN SUBJECTS  No  Yes

## 6a. Research Exempt

No  Yes

If Exempt ("Yes" in  
6a):  
Exemption No.

If Not Exempt ("No" in  
6a):  
IRB approval date

## 5. NAME, TITLE AND ADDRESS OF ADMINISTRATIVE OFFICIAL

Harvey Kasdan  
Chief Financial Officer  
Wildlife Trust  
460 W 34<sup>th</sup> st, 17<sup>th</sup> Floor, New York, NY 10001

## 6b. Federal Wide Assurance No.

Tel: (b) (6) Fax: 212 380-4465

## 6c. NIH-Defined Phase III

Clinical Trial  No  Yes

E-MAIL: (b) (6)

7. VERTEBRATE ANIMALS  No  Yes

7a. If "Yes," IACUC approval Date 01/03/2008

7b. Animal Welfare Assurance No. A3415-01

## 10. PROJECT/PERFORMANCE SITE(S)

Organizational Name: Wildlife Trust

DUNS: 07-709-0066

## 8. COSTS REQUESTED FOR NEXT BUDGET PERIOD

8a. DIRECT \$121,250.00

8b. TOTAL \$130,950.00

Street 1: 460 W. 34<sup>th</sup> stStreet 2: 17<sup>th</sup> Floor9. INVENTIONS AND PATENTS  No  Yes

If "Yes,"  Previously Reported  
 Not Previously Reported

City: New York

County:

State: New York

Province:

Country: USA

Zip/Postal Code: 10001

Congressional Districts:

## 11. NAME AND TITLE OF OFFICIAL SIGNING FOR APPLICANT ORGANIZATION (Item 13)

Aleksei Chmura, Program Assistant, Wildlife Trust

TEL: (b) (6)

FAX: 212 380-4475

E-MAIL: (b) (6)

## 12. Corrections to Page 1 Face Page

13. APPLICANT ORGANIZATION CERTIFICATION AND ACCEPTANCE: I certify that the statements herein are true, complete and accurate to the best of my knowledge, and accept the obligation to comply with Public Health Services terms and conditions if a grant is awarded as a result of this application. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties.

SIGNATURE OF OFFICIAL NAMED IN

11. (In ink)

DATE



DETAILED BUDGET FOR NEXT BUDGET PERIOD – DIRECT COSTS ONLY		FROM	THROUGH	GRANT NUMBER			
		08/01/2009	07/31/2010	K08AI067549-03			
PERSONNEL (Applicant organization only)		Months Devoted to Project			DOLLAR AMOUNT REQUESTED (omit cents)		
NAME	ROLE ON PROJECT	Cal. Mnth	Acad. Mnth	Summer Mnth	SALARY REQUESTED	FRINGE BENEFITS	TOTALS
Jonathan Epstein	PD/PI						(b) (6), (b) (4)
<b>SUBTOTALS</b> →					(b) (6), (b) (4)		
CONSULTANT COSTS							
N/A							
EQUIPMENT <i>(Itemize)</i>							
N/A							
SUPPLIES <i>(Itemize by category)</i>							
N/A							
PATIENT CARE COSTS							
		INPATIENT					
		OUTPATIENT					
ALTERATIONS AND RENOVATIONS <i>(Itemize by category)</i>							
OTHER EXPENSES <i>(Itemize by category)</i>							
<b>SUBTOTAL DIRECT COSTS FOR NEXT BUDGET PERIOD</b>							<b>\$ 121,250.00</b>
CONSORTIUM/CONTRACTUAL COSTS		DIRECT COSTS					
		FACILITIES AND ADMINISTRATIVE COSTS					
<b>TOTAL DIRECT COSTS FOR NEXT PROJECT PERIOD</b> <i>(Item 8a, Face Page)</i>							<b>\$ 121,250.00</b>

Program Director/Principal Investigator (Last, First, Middle): Epstein, Jonathan Harris

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**BUDGET JUSTIFICATION**

GRANT NUMBER  
5 K08 AI067549-03

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Provide a detailed budget justification for those line items and amounts that represent a significant change from that previously recommended. Use continuation pages if necessary.

N / A

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**CURRENT BUDGET PERIOD**

FROM  
08/01/2009

THROUGH  
07/31/2010

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Explain any estimated unobligated balance (including prior year carryover) that is greater than 25% of the current year's total budget.

None

Program Director/Principal Investigator (Last, First, Middle): Epstein, Jonathan Harris

<b>PROGRESS REPORT SUMMARY</b>	GRANT NUMBER 5 K08 AI067549-03	
	PERIOD COVERED BY THIS REPORT	
PROGRAM DIRECTOR / PRINCIPAL INVESTIGATOR Epstein, Jonathan Harris	FROM 08/01/2008	THROUGH 07/31/2009
APPLICANT ORGANIZATION Wildlife Trust, Consortium for Conservation Medicine		
TITLE OF PROJECT (Repeat title shown in Item 1 on first page) Risk for Future Outbreaks of Henipaviruses in South Asia		
A. Human Subjects (Complete Item 6 on the Face Page)		
Involvement of Human Subjects	<input type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
B. Vertebrate Animals (Complete Item 7 on the Face Page)		
Use of Vertebrate Animals	<input checked="" type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
C. Select Agent Research	<input checked="" type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change
D. Multiple PD/PI Leadership Plan	<input type="checkbox"/> No Change Since Previous Submission	<input type="checkbox"/> Change

SEE PHS 2590 INSTRUCTIONS.

**WOMEN AND MINORITY INCLUSION: See PHS 398 Instructions. Use Inclusion Enrollment Report Format Page and, if necessary, Targeted/Planned Enrollment Format Page.**

## A. Specific Aims

The proposed specific aims of this study have not changed. There are no changes to senior or key personnel and no anticipated program income; therefore a key personnel report and the checklist have not been included.

## B. Studies and Results.

To date, I have collected 1500 blood, saliva, and urine samples as well as 4500 environmental urine samples from bats in eight districts in Bangladesh (**Specific Aims 1 and 2** – Spatial and longitudinal survey of NiV in *P. giganteus*), four of which have had Nipah virus outbreaks in people. This completes the field component for **Specific Aim 1**. Six of the eight colonies sampled as part of the spatial survey have been tested for anti-NiV antibodies by ELISA, and two of those (Thakurgaon and Kushtia) have been confirmed by a serum neutralization test at AAHL, Australia. Seroprevalence by ELISA ranged from 20- 56%. Serology results are summarized in **Figure 1**. I have continued to find that there are consistently bats with antibodies to Nipah virus, independent of region. However, preliminary analyses of age-stratified data suggest that juvenile seroprevalence (bats 1-3 years of age) is typically lower than adults. These bats are presumed to be old enough to have lost their maternal antibodies, and so the seroprevalence in this population may be an indicator of how recently an outbreak occurred in a particular colony. This information is important for identifying bat colonies where herd immunity may have waned, and which may be susceptible to a large outbreak, thereby increasing the risk of spillover into people.

Under **S.A. 2**, the longitudinal survey to measure seasonal variation in NiV infection in bats, 900 bats have now been sampled at nine different time points in a single location (**Figure 1**). Each bat in the longitudinal study has been micro-chipped, and the recapture rate appears to have increased from 5% to 7% as of May, 2009. This is significant because I will be using mark-recapture techniques to estimate population size at our longitudinal site, and we hope that the recapture rate will continue to increase as we microchip more bats. I will complete the longitudinal component of my study in March, 2010 at which time I will run ELISAs on all of the serum samples together to reduce the chance of test-to-test error. I will also complete the PCR testing of the urine and saliva samples over the next year.

Another significant achievement this year was the deployment of six satellite collars on *P. giganteus* (**Figure 2**) from a colony in Faridpur district, the region of our longitudinal study and location of several human cases of Nipah virus encephalitis. We decided to place all six collars in this location, rather than three collars in two different locations to increase the likelihood that the bats we collared would be representative of behavior in this colony. We selected three adult males and three adult females, each of whom were pregnant, which will provide valuable comparative information to see whether there are sex-based differences in migratory patterns. The collars were deployed in February, which is during Nipah virus season (although no cases were reported in 2009).

We intend to expand our satellite telemetry study through an R01 that my mentor, Dr. Daszak, received from NIAID (2R01TW005869-05). Under this larger-scale study we will deploy collars in several regions of Bangladesh to determine whether there are regional differences in the movement patterns of *P. giganteus*. **Figure 3** shows the preliminary results of our satellite tracking data for six bats in Bangladesh. Bat movement has been mainly concentrated around the roost, with most satellite reads locating the bats within 6 kilometers of the roost in Shubarampur. A preliminary analysis comparing telemetry data from *P. vampyrus* in Malaysia suggests that there was more long-range movement than we are seeing in Bangladesh. This may be attributable to the drastically different landscapes; Bangladesh being more uniform in its composition of rice paddies, villages, and small tree stands, while Malaysia had highly fragmented rainforest with large national parks separated by agricultural and urban areas, which may result in greater migratory distances as bats move between roosting locations. I plan to conduct a more in-depth comparison of bat movement patterns in Bangladesh and Malaysia, focusing on land cover.

This past year I have spent a large proportion of my time in the lab completing the sequencing and phylogenetic analysis of the bat GB-like virus I discovered last year. **Figure 4** shows the phylogeny of the Bat GB-like virus based on a highly conserved gene, the NS3/helicase gene. The bat virus is most closely related to GBV A, found in New World monkeys and GBV C, found in Chimpanzees. The NS5B gene, which contains

the RNA-dependent RNA polymerase (RdRp) motif, shows a similar relationship. I have also tested serum from 96 other bats from the same colony and sampling point (100 total) using a real-time PCR, and discovered that 5 bats in total were infected with this GB-like virus. I was able to get partial sequence from all five bats; full-length genomic sequence from one bat and near-full length sequence from a second one. This now gives us an idea of the viral prevalence (5%) of this new virus.

**Specific Aim 3:** Most of the statistical analyses and mathematical modeling will require PCR test results, and I plan to spend a significant amount of time in the first half of 2010 with Dr. Coulson after I have completed testing the bat samples.

### C. Significance

The finding that bat colonies in both NiV outbreak locations and non-outbreak locations across Bangladesh have comparably high seroprevalence suggests that NiV circulates widely among *Pteropus giganteus* in Bangladesh, as it does with *P. vampyrus* and *hypomelanus* in Malaysia.

The launching of six satellite transmitters from the same time and location is a first as well, representing the first study of this kind in *P. giganteus*, and the largest study of its kind on a Nipah virus host. This is also the first time anywhere that female *Pteropus* have been tracked using satellite telemetry, which will provide valuable comparative data between males and females during pregnancy and birthing. We have now published the results from our previous telemetry study in the *Journal of Applied Ecology* (see **Section E**).

**Lastly, I have now fully sequenced the entire open reading frame of the new bat GB-like virus, and will be submitting a manuscript shortly for publication.** We also now know that this virus occurs in 5% of *P. giganteus*, and the next step is to develop a serological assay and determine the exposure rate in bats. This represents the first GB-like virus found in bats, and its relationship suggests that there may be other related bat viruses. GBC and GBVB viruses have also been found in hepatitis patients that initially tested negative for Hep A-E. The potential bat and human health impact of this virus is currently unknown, but this represents the first finding of a potentially zoonotic hepatitis virus in a bat. This work has greatly expanded my proficiency in molecular virology – particularly as I have studied both the *Paramyxoviridae* and *Flaviviridae* family of viruses looking at common characteristics among the different genera within each family and specifically focusing on the genera *Henipavirus* and *Hepacivirus*. I have also learned a tremendous amount about the nuances of PCR reactions, running hundreds of them in order to obtain the complete sequence for this virus. I have experienced the whole process of viral discovery from the initial use of high throughput sequencing to the development of primers, and the use of less orthodox PCR techniques such as 2-step walking to obtain sequence in regions of an uncharacterized genome. I also used Rapid Amplification of cDNA Ends (RACE) to obtain terminal regions of the genome. I have also become proficient at using analytical software such as MEGA and Geneious to align sequences, compare gene regions, build consensus sequences, and perform phylogenetic analyses including building phylogenetic trees.

### D. Plans

I am planning to apply for R21 funding to develop a serological assay in order to test the hypothesis that this GB-like virus is zoonotic. We would then screen human Non A-E hepatitis cases from Bangladesh. Through our collaboration with Dr. Luby at ICDDR,B, we will have access to sera from these patients and should be able to screen them for exposure to this virus. Over the next year I will also focus on finishing testing the bat sera and saliva and urine for Nipah virus. The longitudinal sampling is scheduled to be complete by March 2010, and at that point, I will spend the majority of my time in the laboratory at Columbia and at CCM conducting data analysis. Analyses from this study will be used in my PhD thesis, which I aim to complete by the end of 2010.

### E. Publications.

*Published:*

**Epstein, J.H.**, Olival, K.J., Smith, C., Westrum, J., Hughes, T., Dobson, A.P., Zubaid, A., Rahman, S.A., Basir, M.M., Field, H.E. & Daszak, P. Management of a hunted migratory species with a multinational home-range. (*In Press J. A pp. Ecol.*)

**Epstein, J.H.E.** and J. Price. Zoonothonotic infections: A poorly understood component of global human and animal health. 2009. (*In press, MSJM*).

Kaufman, G.E., **J.H. Epstein**, J Paul-Murphy, and J.D. Modrall. Designing graduate training programs in conservation medicine - producing the right professionals with the right tools. 2008. *EcoHealth* vol 5. Pp. 519-27

Sohayati, A.R., Latifah, H., Zaini, C.M., **Epstein, J.H.**, Daszak, P., and Sharifah, S.H. Ketamine and Xylazine combination for short-term immobilization of wild variable flying fox (*Pteropus hypomelanus*). *J. Zoo and Wildl. Med.* 2008. 39(4). 674-6.

M M Hassan, S A Khan, **Jonathan H. Epstein**, M M M Chowdhury and S K M A Islam. (2009). Clinico-pathological findings of a Royal Bengal tiger (*Panthera tigris*)- A Case report. INTAS POLIVET. Vol. 10, No. 1: 111-112.

*Submitted:*

Pulliam JR, **Epstein JH**, Dushoff J, Rahman SA, Meehan G, Bunning M, HERG, Jamaluddin AA, Hyatt AD, Field HE, Dobson AP & Daszak P. Agricultural intensification, epidemic enhancement and the emergence of new lethal zoonoses from wildlife. (*Nature, in review*).

N. Homaira, M. Rahman, M. J. Hossain, **J. H. Epstein**, R. Sultana, M.S.U Khan, G. Podder, K. Nahar, E. S. Gurley, P. Daszak, W. I. Lipkin, P. E. Rollin, J. A. Comer, T. G. Ksiazek, S. P. Luby. Nipah outbreak with person-to-person transmission in Thakurgaon, Bangladesh 2007. *Epidemiology and Infection (Journal of Epidemiology and Infection, in review)*.

*Abstracts:*

**Epstein JH**, Rahman SA, Pulliam JRC, et al. [The Emergence of Nipah Virus in Malaysia: The Role of Pteropus Bats as Hosts and Agricultural Expansion as a Key Factor for Zoonotic Spillover](#). INTERNATIONAL JOURNAL OF INFECTIOUS DISEASES Volume: 12 Pages: E46-E46 Supplement: Suppl. 1 DEC 2008

Sohayati AR, Hassan SS, Hassan L, et al. Endemicity of [Nipah Virus](#) in Pteropus Bats Over Wide Geographical Areas in Peninsular Malaysia INTERNATIONAL JOURNAL OF INFECTIOUS DISEASES Volume: 12 Pages: E138-E138 Supplement: Suppl. 1 DEC 2008

**Jonathan Epstein**, Stephen P. Luby, W. Ian Lipkin, and Peter Daszak. Nipah virus in Bangladesh: Is there the potential for a global pandemic? *EcoHealth International Forum*. Merida, Mexico Dec 2008.

Tom Hughes and **Jonathan H. Epstein**. Educational outreach as a component of conservation and public health research. *EcoHealth International Forum*. Merida, Mexico Dec 2008

Kevin J. Olival, **Jonathan H. Epstein**, Craig Smith, Justin Westrum, Thomas Hughes, Akbar Zubaid, Sohayati Abdul Rahman, Misliah Mohamad Basir, Hume E. Field, and Peter Daszak. Long-distance movement of the Old-World fruit bat, *Pteropus vampyrus*, determined by satellite telemetry and population genetics. *Bat Migration Symposium*. Berlin, Germany. Feb 2009

## F. Project-Generated Resources

This project has not generated any resources during this budget period.

## G. Research Development

Over the past year I entered the 3<sup>rd</sup> year of my part-time PhD at Kingston University. I have become much more proficient in molecular laboratory techniques under Dr. Lipkin's mentorship, including the use of MassTag PCR and high throughput pyrosequencing techniques in the context of viral discovery. I have also become proficient in the use of computer programs such as MEGA and Geneious to do nucleotide and protein alignments and phylogenies. I have now fully characterized the new bat GB-like virus I discovered, which has taken me through the entire process of discovery. We have a manuscript in prep and I am now engaged in discussion with Drs. Daszak and Lipkin as to what the next step will be in advancing this finding and in advancing my career development, which will be to pursue an R21 grant to develop a serological assay and begin exploring the hypothesis that this virus has been transmitted to humans in Bangladesh. I have also continued to receive scientific study design and grant writing experience under Dr. Daszak's guidance by

participating in the writing of federal and private grant proposals. I have continued to direct an experimental physiology study in pteropid bats at the Lube Bat conservancy in Florida that is testing the hypothesis that pregnant bats will have a delayed immune response to antigenic insult from a Nipah-like Paramyxovirus, when compared to non-pregnant females given the same exposure. This experiment aims to address the hypothesis in Specific Aim 2 of this K award, as a separate study from this K award, by attempting to demonstrate that pregnant bats within a population may be responsible for increased viral shedding due to immune suppression. In conducting this experimental study, I have assembled a collaborative team of senior investigators for this project which has already generated preliminary experimental data, showing proof of concept. This grant has been reviewed by NIH, but has not been funded, although it received positive reviews. I will resubmit this grant in October. This has been a valuable training experience because I have been directly responsible for the design and execution of an experimental, hypothesis-driven study. I am also a co-investigator on two NIH R01 awards (Daszak, PI) that were awarded last year (each take (b) (6), (b) (4)) and two that are pending.

#### H. Other Activities

**Review Editor**, EcoHealth Journal ([www.ecohealth.com](http://www.ecohealth.com))

**Member**, Scientific Program & Scholarship Committee, EcoHealth International Forum 2008; IUCN Veterinary Specialist Group & Bat Species Specialist Group

**Invited Lectures/teaching (<5% time)**: Lectured on emerging zoonoses at Tufts School of Veterinary Medicine (Nov 2008) and Mt. Sinai School of Medicine, NY, MPH course (May 2009)

**Mentored** Tufts Veterinary student for summer research study on rabies seroprevalence in bats in Mexico (Jul-Aug 2009); University of Wisconsin PhD student on a comparative study of bat foraging and migration movement and land cover in Malaysia and Bangladesh (Jul-Aug 2009).

**Presented** at ASTMH, New Orleans (Dec 2008); EcoHealth Int'l Forum, Merida Mex (Dec 2008); NIH/NSF EEID meeting, Park City (Apr, 2009).

#### I. Research Development and Other Activities Planned for the Next Year.

In the next year I will finish my field data collection, and focus on the laboratory testing of the bat samples. Using these data I will begin parameterizing my disease models and looking for seasonal patterns in viral shedding. I will also continue to work under Dr. Ian Lipkin's supervision at the Center for Infection and Immunity at Columbia University to develop a serological assay – a new process for me and one that will allow me to pursue a larger-scale epidemiological study of bat GB-like virus in Bangladesh and other parts of the world. The discovery of a GBV-like flavivirus has opened up a new avenue for my career development in viral discovery and diagnostics. Next year I also plan to apply for grants to fund the development of a serological assay for the bat GB virus and begin gathering background information on the prevalence of non-A-E hepatitis in Bangladesh.

#### J. Mentor's report

Jon Epstein has continued along a rapid trajectory of professional development this year. It has been rewarding to see him work through the process of identifying and characterizing the new bat virus, and it comes at a time when there is increasing interest in the role bats play as natural reservoirs for emerging zoonoses. The experience and skill set Jon is developing in molecular virology, coupled with his existing proficiency in field epidemiology, will surely serve him well as his career progresses. In fact, we are seeing a growing demand for research scientists who can cut across disciplinary boundaries, which was the original basis for Jon's K08. He has now spent substantial time in the lab completing the work on characterizing the new virus he has discovered; he is efficiently coordinating the bat sample collection in Bangladesh and has completed the spatial surveillance from Specific Aim 1. He remains engaged with our collaborator Steve Luby and his team at ICDDR,B, and in fact we are now working together under an expanded Nipah virus study under an R01 awarded this past year, with me as PI and Jon as a named co-investigator. He has published four papers, including a first authored paper on bat ecology in Malaysia and is continuing to pursue an R03 grant for a new research angle which was planned, drafted and the preliminary experiments designed by himself. He remains actively involved with our academic partners by mentoring graduate students and giving occasional lectures. I have seen substantial improvement in his writing ability, both for papers and grants and he has done very well to balance the various demands on his time. This year, Wildlife Trust underwent some organizational changes, which included my promotion to President of the organization, and Jon's promotion to

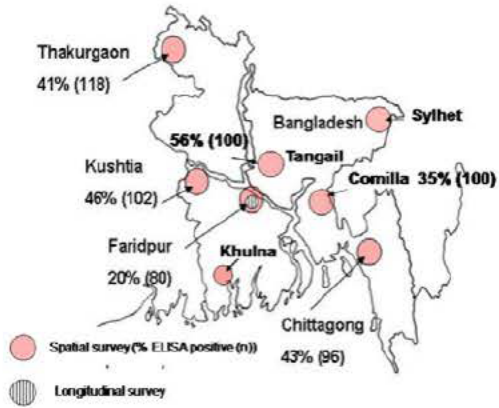
and private grants this year, have strengthened our ability to support Jon during his career development period.

Training support for Jon remains excellent. Dr Lipkin will continue to offer full use of his lab facilities at no cost, other than consumables. Jon is fully integrated into the lab group as a research fellow and attends weekly lab meetings. He has been working closely with the Associate Director of the lab and collaborators at Columbia University on his manuscript for the GB virus. Kingston University, where Jon is registered for a Ph.D remains very supportive of his application, and Jon will complete his viva this year which is a trial run for his final defense of his PhD. Dr Coulson remains committed to the schedule of mentoring that we set. Finally, Jon's future work related to viral discovery will be supported by a new R01 grant from NIAID to conduct viral discovery, pathogenesis studies in bats, and two major foundation grants from Google.org and the Rockefeller Foundation which are focused on viral discovery. While there is no direct overlap with Jon's K08 aims, these grants will add to the intellectual, field and lab support for Jon's work. All in all, though we set an ambitious agenda for Jon's K08 project, he has so far met the goals of the specific aims, is on track with his field work, and overall has exceeded expectations in terms of his productivity and growth towards becoming an independent research scientist.



**Figure 1.** Map showing completed and future bat surveillance locations and serology results.

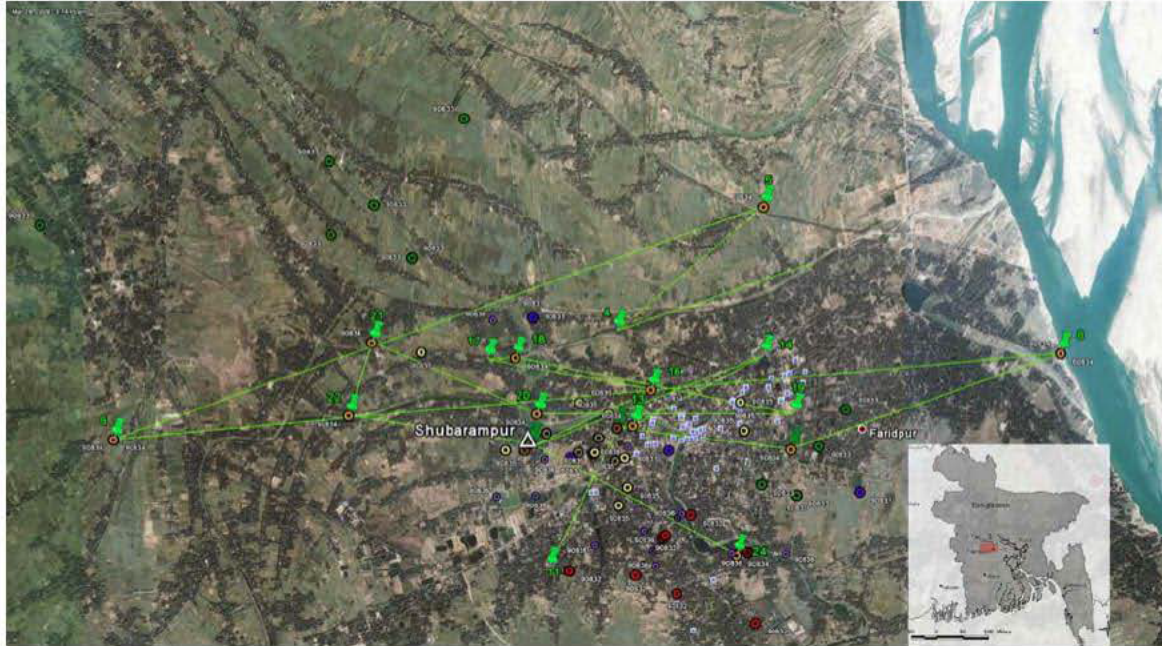
**Nipah virus surveillance in *Pteropus giganteus*, Bangladesh**



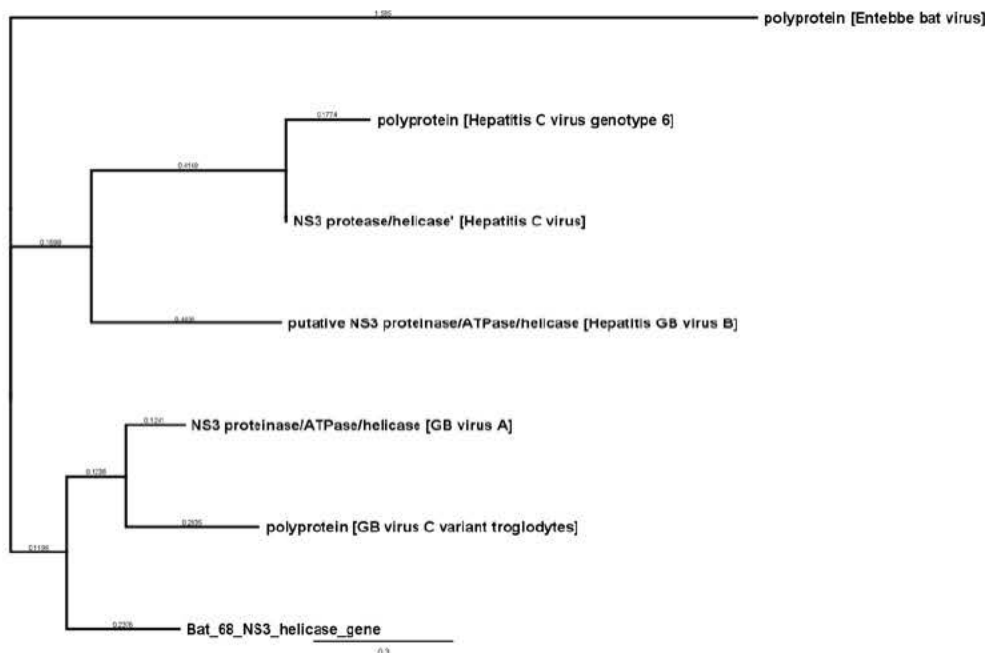
**Figure 2.** Releasing *P. giganteus* wearing a satellite collar.



**Figure 3.** Satellite telemetry map showing bat locations for six bats collared in Faridpur, Bangladesh. Each colored circle represents locations for an individual bat. The green line indicates flight trajectory for bat 90834, an adult male bat. The original point of capture and release is Shubarampur, which is indicated on the map by a white triangle.



**Figure 4.** Phylogenetic tree containing members of the family *Flaviviridae*. The tree is based on the NS3 gene amino acid sequence, showing the relationship between the newly discovered bat GB-like virus, members of the genus *Hepacivirus* (Hepatitis C virus) and other GB viruses. The bat GB-like virus is most related to GBVA (new world primates) and GBVC (Chimpanzees). Entebbe bat virus is used as an out-group.



Program Director/Principal Investigator (Last, first, middle): Epstein, Jonathan Harris

GRANT NUMBER  
K08AI067549-03

### CHECKLIST

#### 1. PROGRAM INCOME (See instructions.)

All applications must indicate whether program income is anticipated during the period(s) for which grant support is requested. If program income is anticipated, use the format below to reflect the amount and source(s).

Budget Period	Anticipated Amount	Source(s)
8/1/2009 – 7/31/2010	NONE	

#### 2. ASSURANCES/CERTIFICATIONS (See instructions.)

In signing the application Face Page, the authorized organizational representative agrees to comply with the policies, assurances and/or certifications listed in the application instructions when applicable. Descriptions of individual assurances/certifications are provided in Part III of the PHS 398, and listed in Part I, 4.1 under Item 14. If unable to certify compliance, where applicable, provide an explanation and place it after the Progress Report (Form Page 5).

#### 3. FACILITIES AND ADMINISTRATIVE (F&A) COSTS

Indicate the applicant or organization's most recent F & A cost rate established with the appropriate DHHS Regional Office, or, in the case of for-profit organizations, the rate established with the appropriate PHS Agency Cost Advisory Office.

F&A costs will **not** be paid on construction grants, grants to Federal organizations, grants to individuals, and conference grants. Follow any additional instructions provided for Research Career Awards, Institutional National Research Service Awards, Small Business Innovation Research/Small Business Technology Transfer Grants, foreign grants, and specialized grant applications.

- DHHS Agreement dated: 03/10/2008  No Facilities and Administrative Costs Requested.
- No DHHS Agreement, but rate established with \_\_\_\_\_ Date \_\_\_\_\_

#### CALCULATION\*

Entire proposed budget period: Amount of base \$ 121,250 x Rate applied 8 % = F&A costs \$ 9,700  
Add to total direct costs from Form Page 2 and enter new total on Face Page, Item 8b.

\*Check appropriate box(es):

- Salary and wages base  Modified total direct cost base  Other base (Explain)
- Off-site, other special rate, or more than one rate involved (Explain)

Explanation (Attach separate sheet, if necessary.):

## SENIOR/KEY PERSONNEL REPORT

**GRANT NUMBER**  
5 K08 AI067549-03

Place this form at the end of the signed original copy of the application. Do not duplicate.

**All Key Personnel for the Current Budget Period (do not include Other Significant Contributors)**

Name	Degree(s)	SSN (last 4 digits)	Role on Project (e.g. PD/PI, Res. Assoc.)	Months Devoted to Project		
				Cal	Acad	Summer
Daszak, Peter	PhD	N/A	Primary Mentor	(b) (6), (b) (4)		
Lipkin, Ian	MD	N/A	Mentor			
Coulson, Timothy	PhD	N/A	Mentor			
Stephen P. Luby	MD, MPH	N/A	Res. Collaborator			

**Daszak, P (Mentor)**ACTIVE

N01 AI-25490 (Kramer)

10/01/02 - 10/01/09

(b) (6), (b) (4)

NIH/NIAID

West Nile &amp; pox viruses: ecology, pathogenesis &amp; immunity

This subcontract provides partial salary for a postdoc to conduct field studies, mathematical modeling and analysis of the ecology of West Nile virus in the USA.

Role: PI on a subcontract, oversee research on WNV ecology.

NSF EF-062239 (Kilpatrick)

09/01/06 - 08/30/11

(b) (6), (b) (4)

National Science Foundation/National Institutes of Health: Ecology of Infectious Diseases program

Predicting spatial variation in West Nile virus transmission

This project is to assess the interaction between vector populations, reservoir host populations and West Nile virus across an urban-to-rural human density gradient in the northeastern USA.

Role: Co-PI, planning and executing research on WNV ecology.

1 R01-TW005869-05 (Daszak PI)

07/01/08 - 06/30/13

(b) (6), (b) (4)

NIH Fogarty Intl. Center: NSF/NIH Ecology of Infectious Diseases program

Ecology, Emergence and Pandemic Potential of Nipah virus in Bangladesh

This project is to examine the dynamics, drivers and emergence of Nipah virus in Bangladesh.

Role: PI, responsible for planning and executing overall program of work.

1 R01 AI079231-0 (Daszak)

07/01/08 - 06/30/13

(b) (6), (b) (4)

NIH/ NIAID

Risk of Viral Emergence from Bats.

This study is to model the regions most likely to generate new zoonoses from bats, to test samples from bat species for new viruses, and to examine their pathogenesis.

Role: PI, responsible for planning and executing overall program of work.

NSF/HSD (Daszak)

10/01/08-09/30/11

(b) (6), (b) (4)

NSF Human and Social Dynamics Program

Anthropogenic drivers of emerging infectious diseases

The major goal of this research is to map the global drivers of emerging diseases in collaboration with a socio-economic database group.

Role: PI, responsible for planning and executing overall program of work.

3R01TW005869-05S1 Daszak (PI)

09/01/08 – 08/31/09

(b) (6), (b) (4)

NIH EID (Fogarty International Center)

Supplemental funding: Predicting the risk of global H5N1 spread

This project will involve mathematical modeling and fieldwork in China to understand risk of H5N1 spread.

Role: PI

The Rockefeller Foundation

09/01/2008 – 01/31/2010  
(extended)

(b) (6), (b) (4)

Build capacity for trilateral wildlife surveillance and pathogen discovery in US, India, and Bangladesh.

Google.org Foundation

09/01/2009 – 08/31/2010

(b) (6), (b) (4)

Subaward from Columbia University

Pathogen discovery in wildlife



PENDING



(b) (6), (b) (4)


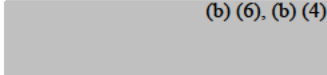
OVERLAP


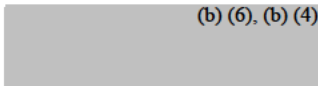
There is scientific overlap between NIH R01TW005869-05 and specific aim 2 of this grant where the R01 will extend the longitudinal survey beyond March 2010, which is when the K08 study ends. The R01 will also increase the number of satellite collars we will be able to purchase.

**Epstein, J (PI)**ACTIVE

 (b) (4)	09/01/2008 – 01/31/2010 (extended)	 (b) (6), (b) (4)
Build capacity for trilateral wildlife surveillance and pathogen discovery in US, India, and Bangladesh. Role: Co-PI		

 (b) (4)	09/01/2009 – 08/31/2010	 (b) (6), (b) (4)
Pathogen discovery in wildlife Role: Co-PI		

 (b) (4)	01/01/2009 – 12/31/2009 (b) (4)	 (b) (6), (b) (4)
Zoonotic Emergence Network (ZEN). This project looks at bushmeat hunters, wildlife Markets and zoonotic pathogen transmission in Malaysia and China Role: Co-PI		

 (b) (4)	05/01/2009 – 04/30/2010	 (b) (6), (b) (4)
Grant to characterize and map date palm sap collection and bat contact in Bangladesh.		

PENDING

NIH NIAID ARRA Administrative Supplement: 09/01/2009 – 08/31/2010 NOT OD-09-056 K08 AI067549 (Epstein)	
Funds to support a disease modeler post-doc position to increase Depth of analysis of Nipah epidemiology data in bats	\$100,000.00 (tot)

NIH NIAID R03 (Epstein) Bat Immunology and Nipah virus Superspreaders	
	\$100,000.00 (tot)

OVERLAP

The Supplemental award would enhance the quality of the disease modeling in the K08 base award.



**Grant Number:** 5K08AI067549-03

**Principal Investigator(s):**  
JONATHAN H EPSTEIN, DVM

**Project Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

aLEKSEI CHMURA  
SENIOR RESEARCH SPECIALIST  
WILDLIFE TRUST  
61 ROUTE 9W  
460 WEST 34TH ST, 17TH FL  
PALISADES, NY 109648000

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 09/15/2009 – 08/31/2010

**Project Period:** 09/15/2007 – 08/31/2011

Dear Business Official:

The National Institutes of Health hereby awards a grant in the amount of \$130,950 (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to WILDLIFE TRUST in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release or other document that cites results from NIH grant-supported research must include an acknowledgment of NIH grant support and disclaimer such as "The project described was supported by Award Number K08AI067549 from the National Institute Of Allergy And Infectious Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Allergy And Infectious Diseases or the National Institutes of Health."

Award recipients are required to comply with the NIH Public Access Policy. This includes submission to PubMed Central (PMC), upon acceptance for publication, an electronic version of a final peer-reviewed, manuscript resulting from research supported in whole or in part, with direct costs from National Institutes of Health. The author's final peer-reviewed manuscript is defined as the final version accepted for journal publication, and includes all modifications from the publishing peer review process. For additional information, please visit <http://publicaccess.nih.gov/>.

Award recipients must promote objectivity in research by establishing standards to ensure that the design, conduct and reporting of research funded under NIH-funded awards are not biased by a conflicting financial interest of an Investigator. Investigator is defined as the Principal Investigator and any other person who is responsible for the design, conduct, or reporting of NIH-funded research or proposed research, including the Investigator's spouse and dependent children. Awardees must have a written administrative process to identify and manage financial conflict of interest and must inform Investigators of the conflict of interest policy and of the Investigators' responsibilities. Prior to expenditure of these awarded funds, the Awardee must report to the NIH Awarding Component the existence of a conflicting interest and within 60 days of any new conflicting interests identified after the initial report. Awardees must comply with these and all other aspects of 42 CFR Part 50, Subpart F. These requirements also apply to subgrantees, contractors, or collaborators engaged by the Awardee under this award. The NIH website <http://grants.nih.gov/grants/policy/coi/index.htm> provides additional information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Theresa R. Jarosik  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows



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**SECTION I – AWARD DATA – 5K08AI067549-03****Award Calculation (U.S. Dollars)**

Federal Direct Costs	\$121,250
Federal F&A Costs	\$9,700
Approved Budget	\$130,950
Federal Share	\$130,950
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$130,950</b>

<b>AMOUNT OF THIS ACTION (FEDERAL SHARE)</b>	<b>\$130,950</b>
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SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
3	\$130,950	\$130,950
4	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

**CFDA Number:** 93.855  
**EIN:** 1311726494A1  
**Document Number:** KAI067549A  
**Fiscal Year:** 2009

IC	CAN	2009	2010
AI	8472401	\$130,950	\$130,950

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

**PCC:** M32A B / **OC:** 415P / **Processed:** (b) (6) 09/02/2009

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**SECTION II – PAYMENT/HOTLINE INFORMATION – 5K08AI067549-03**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

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**SECTION III – TERMS AND CONDITIONS – 5K08AI067549-03**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at 'http://grants.nih.gov/grants/policy/awardconditions.htm' for certain references cited above.)

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

**Treatment of Program Income:**  
Additional Costs

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**SECTION IV – AI Special Terms and Conditions – 5K08AI067549-03**

Grants Management must be notified at least 3 months in advance of any anticipated administrative changes on this award (for example change of institution, sponsor, and/or any type of sabbatical or leave of absence).

This Career Award requires a minimum of (b) (4) be devoted to the research project. The guidelines for this K award (see applicable Program Announcement at <http://www.niaid.nih.gov/ncn/training/k.htm>) state that your institution may supplement the NIH salary contribution up to a level that is consistent with your institution's salary scale; however, supplementation may not be from Federal funds unless specifically authorized by the Federal program from which such funds are derived. Because the salary amount provided by this award is based on the full-time institutional salary, no other PHS funds may be used for salary supplementation.

The research proposed in this grant may involve Select Agents and/or Highly Pathogenic Agents. NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that, under some circumstances, may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmb15/bmb15toc.htm>), your Institutional Biosafety Committee (IBC) or equivalent body, or appropriate designated institutional biosafety official. If there is ambiguity in the BMBL guidelines and/or there is disagreement among the BMBL, an institutional committee or institutional official, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If the work involves Select Agents and/or Highly Pathogenic Agents. Also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s);
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

For domestic work with Select Agents provide documentation of Registration status of all domestic organizations/entities where Select Agent(s) will be used

Please be advised that changes in the use of a Select Agent will likely be considered a change in scope and, therefore, require NIH awarding office prior approval.

**STAFF CONTACTS**

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These

individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Shadetra Robinson

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Cristina Casseti

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-496-8030

**SPREADSHEET SUMMARY**

**GRANT NUMBER:** 5K08AI067549-03

**INSTITUTION:** WILDLIFE TRUST

<b>Facilities and Administrative Costs</b>	<b>Year 3</b>	<b>Year 4</b>
F&A Cost Rate 1	8%	8%
F&A Cost Base 1	\$121,250	\$121,250
F&A Costs 1	\$9,700	\$9,700



THIS AWARD IS ISSUED UNDER THE AMERICAN RECOVERY AND REINVESTMENT ACT OF 2009 AND IS SUBJECT TO SPECIAL HHS TERMS AND CONDITIONS AS REFERENCED IN SECTION III

**Grant Number:** 3K08AI067549-03S1 REVISED

**Principal Investigator(s):**  
JONATHAN H EPSTEIN, DVM

**Project Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

aLEKSEI CHMURA  
SENIOR RESEARCH SPECIALIST  
WILDLIFE TRUST  
61 ROUTE 9W  
460 WEST 34TH ST, 17TH FL  
PALISADES, NY 109648000

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 09/22/2009 – 08/31/2011

**Project Period:** 09/22/2009 – 08/31/2011

Dear Business Official:

The National Institutes of Health hereby revises this award (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to WILDLIFE TRUST in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release or other document that cites results from NIH grant-supported research must include an acknowledgment of NIH grant support and disclaimer such as "The project described was supported by Award Number K08AI067549 from the National Institute Of Allergy And Infectious Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Allergy And Infectious Diseases or the National Institutes of Health."

Award recipients are required to comply with the NIH Public Access Policy. This includes submission to PubMed Central (PMC), upon acceptance for publication, an electronic version of a final peer-reviewed, manuscript resulting from research supported in whole or in part, with direct costs from National Institutes of Health. The author's final peer-reviewed manuscript is defined as the final version accepted for journal publication, and includes all modifications to the publishing peer review process. For additional information, please visit <http://publicaccess.nih.gov/>.

Award recipients must promote objectivity in research by establishing standards to ensure that the design, conduct and reporting of research funded under NIH-funded awards are not biased by a conflicting financial interest of an Investigator. Investigator is defined as the Principal Investigator and any other person who is responsible for the design, conduct, or reporting of NIH-funded research or proposed research, including the Investigator's spouse and dependent children. Awardees must have a written administrative process to identify and manage financial conflict of interest and must inform Investigators of the conflict of interest policy and of the Investigators' responsibilities. Prior to expenditure of these awarded funds, the Awardee must report to the NIH Awarding Component the existence of a conflicting interest and within 60 days of any new conflicting interests identified after the initial report. Awardees must comply with these and all other aspects of 42 CFR Part 50, Subpart F. These requirements also apply to subgrantees, contractors,

or collaborators engaged by the Awardee under this award. The NIH website <http://grants.nih.gov/grants/policy/coi/index.htm> provides additional information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Laura C. Eisenman  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

**SECTION I – AWARD DATA – 3K08AI067549-03S1 REVISED**

**Award Calculation (U.S. Dollars)**

Salaries and Wages \$37,067  
Fringe Benefits \$9,224  
Personnel Costs (Subtotal) \$46,291

Federal Direct Costs \$46,291  
Federal F&A Costs \$3,703  
Approved Budget \$49,994  
Federal Share \$49,994  
**TOTAL FEDERAL AWARD AMOUNT \$49,994**

**AMOUNT OF THIS ACTION (FEDERAL SHARE) \$0**

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
3	\$49,994	\$49,994
4	\$0	\$0

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

CFDA Number: 93.701  
EIN: 1311726494A1  
Document Number: KAI067549Z  
Fiscal Year: 2009

IC	CAN	2009
AI	8485162	\$49,994

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

PCC: M32A B / OC: 415N / Processed: (b) (6) 09/29/2010

**SECTION II – PAYMENT/HOTLINE INFORMATION – 3K08AI067549-03S1 REVISED**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

**SECTION III – TERMS AND CONDITIONS – 3K08AI067549-03S1 REVISED**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- a. The grant program legislation and program regulation cited in this Notice of Award.
- b. Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- c. 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- d. The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- e. This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at 'http://grants.nih.gov/grants/policy/awardconditions.htm' for certain references cited above.)

**ARRA TERM OF AWARD:** This award provides additional funding for K08AI067549-03. This additional funding is provided under the American Recovery and Reinvestment Act of 2009 (ARRA) and is subject to the HHS-Approved Standard Terms and Conditions for ARRA. Approved text for

NIH awards can be found at:

[http://grants.nih.gov/grants/policy/NIH\\_HHS\\_ARRA\\_Award\\_Terms.pdf](http://grants.nih.gov/grants/policy/NIH_HHS_ARRA_Award_Terms.pdf). Recipients should pay particular attention to the special quarterly reporting requirements required by Section 1512 of the Recovery Act as specified in Term #2. Unless the parent grant is also awarded with ARRA funds, these special quarterly reporting requirements apply only to this additional funding. Recipients should not include any information about the parent grant when responding to the quarterly reporting requirements. When both the parent grant and these additional funds are awarded with ARRA funding, the quarterly reporting requirement applies to the entire ARRA funding and can be reported as a single quarterly report.

Grantees are reminded to include specific information on the ARRA additional funding as part of the annual progress report(s) of the parent grant.

Separate financial reporting (SF 272 and Financial Status Reports) will be required to be submitted covering this additional funding. These will be in addition to any required financial reports for the parent grant. Regarding the Financial Status Report, when multiple competitive revisions/administrative supplements are awarded to the same parent grant, only one ARRA-specific report is required at the time the project period of the last ARRA revision/supplement ends.

Separate closeout documents (Final Progress Report, Final Financial Status Report, and Final Invention Statement) will also be required to closeout the Recovery Act funding at the time the ARRA funding ends. These closeout reports for the ARRA funding are required even when the parent grant continues. When multiple competitive revisions/administrative supplements are awarded to the same parent grant, only one ARRA-specific Final financial report is required at the time the project period of the last ARRA revision/supplement ends. Separate Final Progress Reports and Final Invention Statements are still required.

Note, if the parent grant is also awarded with ARRA funds, separate financial and other closeout documents described above are **not** required. Any reporting on the additional funds provided in this award will be required as part of normal reporting of the parent grant

Unless the parent grant is also awarded with ARRA funds, the ARRA funds provided under this award are not available for rebudgeting or carryover into the parent grant. Any ARRA funding remaining at the end of the funding period for this award must be reported as an unobligated balance.

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

This award represents the final year of the competitive segment for this grant. Therefore, see the NIH Grants Policy Statement (12/1/2003 version) for closeout requirements at: [http://grants.nih.gov/grants/policy/nihgps\\_2003/NIHGPS\\_Part8.htm#\\_Toc54600151](http://grants.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part8.htm#_Toc54600151).

A final Financial Status Report (FSR) (SF 269) must be submitted through the eRA Commons (Commons) within 90 days of the expiration date; see NIH Guide Notice [NOT-OD-07-078](#) for additional information on this electronic submission requirement. The final FSR must indicate the exact balance of unobligated funds and may not reflect any unliquidated obligations. There must be no discrepancies between the final FSR and the Payment Management System's (PMS) Federal Cash Transaction Report (SF-272).

Furthermore, unless an application for competitive renewal is submitted, additional grant closeout documents consisting of a Final Invention Statement and Certification form (HHS 568), (not applicable to training, construction, conference or cancer education grants) and a final progress report must also be submitted within 90 days of the expiration date.

NIH also strongly encourages electronic submission of the final progress report and the final invention statement through the Closeout feature in the Commons. If the final progress report and final invention statement are not submitted electronically, copies of the HHS 568 form may be downloaded at: <http://grants.nih.gov/grants/forms.htm>.

Submissions of the final progress report and HHS 568 may be e-mailed as PDF attachments to the NIH Central Closeout Center at: [deascentralized@od.nih.gov](mailto:deascentralized@od.nih.gov)

Paper submissions of the final progress report and the HHS 568 may be faxed to the NIH Central Closeout Center at 301-480-2304 or mailed to the NIH Central Closeout Center at the following address:

NIH/OD/OER/DEAS  
Central Closeout Center  
6705 Rockledge Drive, Room 2207  
Bethesda, MD 20892-7987 (for regular or U.S. Postal Service Express mail)  
Bethesda, MD 20817 (for other courier/express mail delivery only)

The final progress report should include, at a minimum, a summary of progress toward the achievement of the originally stated aims, a list of significant results (positive and/or negative), a list of publications and the grant number. If human subjects were included in the research, the final progress report should also address the following:

- Report on the inclusion of gender and minority study subjects (using the gender and minority Inclusion Enrollment Form as provided in the PHS 2590 and available at <http://grants.nih.gov/grants/forms.htm>).
- Where appropriate, indicate whether children were involved in the study or how the study was relevant for conditions affecting children (see "Public Policy Requirements and Objectives-Requirements for Inclusiveness in Research Design-Inclusion of Children as Subjects in Clinical Research" in the PHS 398 at URL [http://grants.nih.gov/grants/policy/nihgps\\_2003/NIHGPS\\_Part5.htm#\\_Toc54600090](http://grants.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part5.htm#_Toc54600090)).
- Describe any data, research materials (such as cell lines, DNA probes, animal models), protocols, software, or other information resulting from the research that is available to be shared with other investigators and how it may be accessed.

Note, if this is the final year of a competitive segment due to the transfer of the grant to another institution, then not all the requirements stated above are applicable. Specifically a Final Progress Report is not required. However, a final FSR is required and should be submitted electronically as noted above. In addition, if not already submitted, the Final Invention Statement is required and should be sent directly the assigned Grants Management Specialist.

**Treatment of Program Income:**  
Additional Costs

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**SECTION IV – AI Special Terms and Conditions – 3K08AI067549-03S1 REVISED**

REVISED AWARD: This revised Notice of Award (NoA) is issued to extend the -05 year in accordance with letter of 09/28/2010 from Aleksei Chmura/WILDLIFE TRUST. The grantee institution is responsible for ensuring that all necessary human subjects and/or vertebrate animal reviews are performed as required during the extension period.

Supersedes NoA issued 09/21/2009.

\*\*\*\*\*

This award provides supplemental funds of \$49,994 Total Costs (\$46,291 Direct Costs and \$3,703 F&A Costs) for Research and Development Support costs. These funds provide support for the period 09/22/09 - 08/31/10. These funds are restricted for stated purpose, in request dated 04/2009, from Aleksei Chmura, Senior Program Coordinator, Wildlife trust, and may not be rebudgeted or used for any other purpose, without NIAID awarding unit approval.

The research proposed in this grant may involve Select Agents and/or Highly Pathogenic Agents. NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that, under some circumstances, may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmb15/bmb15toc.htm>), your Institutional Biosafety Committee (IBC) or equivalent body, or appropriate designated institutional biosafety official. If there is ambiguity in the BMBL guidelines and/or there is disagreement among the BMBL, an institutional committee or institutional official, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:



If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If the work involves Select Agents and/or Highly Pathogenic Agents. Also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s);
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

For domestic work with Select Agents provide documentation of Registration status of all domestic organizations/entities where Select Agent(s) will be used

Please be advised that changes in the use of a Select Agent will likely be considered a change in scope and, therefore, require NIH awarding office prior approval.

**STAFF CONTACTS**

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Jennifer L. Schermerhorn  
**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Cristina Cassetti  
**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-496-8030

**SPREADSHEET SUMMARY**

**GRANT NUMBER:** 3K08AI067549-03S1 REVISED

**INSTITUTION:** WILDLIFE TRUST

<i>Budget</i>	<i>Year 3</i>	<i>Year 4</i>
Salaries and Wages	\$37,067	
Fringe Benefits	\$9,224	
Personnel Costs (Subtotal)	\$46,291	
TOTAL FEDERAL DC	\$46,291	
TOTAL FEDERAL F&A	\$3,703	
TOTAL COST	\$49,994	\$0

<i>Facilities and Administrative Costs</i>	<i>Year 3</i>	<i>Year 4</i>
F&A Cost Rate 1	8%	
F&A Cost Base 1	\$46,291	
F&A Costs 1	\$3,703	



## EcoHealth Alliance

**Date:** 05 February 2012

**Final Report for Grant Number:** 3K08AI067549-03S1

**PD/PI Name:** Dr. Jonathan H. Epstein

**Parent Proposal Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

### **Final Report:**

This award has been used to expedite the testing of clinical bat samples from Bangladesh under Dr. Jonathan H. Epstein's original K08 award (i.e. parent award: 5K08AI067549). A full-time lab technician named Maria Sanchez was hired and based at the Center for Infection and Immunity (CII) at Columbia University's Mailman Center for Public Health in New York City. Maria ran assays on bat samples for Nipah virus. Maria has excellent prior experience in molecular biology and with diagnostic techniques. She performed exceptionally well in the tasks set to her. She has completed the testing of approximately 2,500 samples using RT-PCR and ELISA assays, which are now being used by the PI (Epstein) for epidemiological analyses.

Maria has received training in advanced molecular techniques such as MassTag PCR and next generation sequencing. Her excellent performance under this ARRA has led to the creation of a permanent full-time technician position for her at CII under Director Dr. W. Ian Lipkin. Maria will continue to work with Dr. Epstein on the Nipah virus project, as well as other ongoing research using next generation sequencing. She will also participate in the writing of manuscripts related to the samples that she has tested.

Please note that this final report was uploaded previously via Grant.gov in July 2011. Do not hesitate to contact me, if further details should be required.

Sincerely,

Dr. Jonathan Epstein  
*Associate Vice President, Conservation Medicine*

EcoHealth Alliance  
460 West 34th Street  
17th floor New York, NY 10001

(t) [REDACTED] (b) (6)

(m) [REDACTED] (b) (6)

(f) 1.212.380.4465

(e) [REDACTED] (b) (6)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)



**Grant Number:** 5K08AI067549-04

**Principal Investigator(s):**  
JONATHAN H EPSTEIN, DVM

**Project Title:** Risk for Future Outbreaks of Henipaviruses in South Asia

ALEKSEI CHMURA  
SENIOR RESEARCH SPECIALIST  
WILDLIFE TRUST  
460 WEST 34TH ST, 17TH FL  
New York, NY 10001

**Award e-mailed to:** [REDACTED] (b) (6)

**Budget Period:** 09/01/2010 – 08/31/2011

**Project Period:** 09/15/2007 – 08/31/2011

Dear Business Official:

The National Institutes of Health hereby awards a grant in the amount of \$130,950 (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to WILDLIFE TRUST in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release or other document that cites results from NIH grant-supported research must include an acknowledgment of NIH grant support and disclaimer such as "The project described was supported by Award Number K08AI067549 from the National Institute Of Allergy And Infectious Diseases. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute Of Allergy And Infectious Diseases or the National Institutes of Health."

Award recipients are required to comply with the NIH Public Access Policy. This includes submission to PubMed Central (PMC), upon acceptance for publication, an electronic version of a final peer-reviewed, manuscript resulting from research supported in whole or in part, with direct costs from National Institutes of Health. The author's final peer-reviewed manuscript is defined as the final version accepted for journal publication, and includes all modifications from the publishing peer review process. For additional information, please visit <http://publicaccess.nih.gov/>.

Award recipients must promote objectivity in research by establishing standards to ensure that the design, conduct and reporting of research funded under NIH-funded awards are not biased by a conflicting financial interest of an Investigator. Investigator is defined as the Principal Investigator and any other person who is responsible for the design, conduct, or reporting of NIH-funded research or proposed research, including the Investigator's spouse and dependent children. Awardees must have a written administrative process to identify and manage financial conflict of interest and must inform Investigators of the conflict of interest policy and of the Investigators' responsibilities. Prior to expenditure of these awarded funds, the Awardee must report to the NIH Awarding Component the existence of a conflicting interest and within 60 days of any new conflicting interests identified after the initial report. Awardees must comply with these and all other aspects of 42 CFR Part 50, Subpart F. These requirements also apply to subgrantees, contractors, or collaborators engaged by the Awardee under this award. The NIH website <http://grants.nih.gov/grants/policy/coi/index.htm> provides additional information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Laura C. Eisenman  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

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**SECTION I – AWARD DATA – 5K08AI067549-04****Award Calculation (U.S. Dollars)**

Federal Direct Costs	\$121,250
Federal F&A Costs	\$9,700
Approved Budget	\$130,950
Federal Share	\$130,950
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$130,950</b>
<b>AMOUNT OF THIS ACTION (FEDERAL SHARE)</b>	<b>\$130,950</b>

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
4	\$130,950	\$130,950

**Fiscal Information:**

CFDA Number: 93.855  
EIN: 1311726494A1  
Document Number: KAI067549A  
Fiscal Year: 2010

IC	CAN	2010
AI	8472401	\$130,950

**NIH Administrative Data:**

PCC: M32A B / OC: 415P / Processed: (b) (6) 09/09/2010

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**SECTION II – PAYMENT/HOTLINE INFORMATION – 5K08AI067549-04**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

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**SECTION III – TERMS AND CONDITIONS – 5K08AI067549-04**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as those included in appropriations acts.
- 45 CFR Part 74 or 45 CFR Part 92 as applicable.
- The NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at 'http://grants.nih.gov/grants/policy/awardconditions.htm' for certain references cited above.)

An unobligated balance may be carried over into the next budget period without Grants Management Officer prior approval.

This grant is subject to Streamlined Noncompeting Award Procedures (SNAP).

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

This award represents the final year of the competitive segment for this grant. Therefore, see the NIH Grants Policy Statement (12/1/2003 version) for closeout requirements at: [http://grants.nih.gov/grants/policy/nihgps\\_2003/NIHGPS\\_Part8.htm#\\_Toc54600151](http://grants.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part8.htm#_Toc54600151).

A final Financial Status Report (FSR) (SF 269) must be submitted through the eRA Commons (Commons) within 90 days of the expiration date; see NIH Guide Notice [NOT-OD-07-078](#) for additional information on this electronic submission requirement. The final FSR must indicate the exact balance of unobligated funds and may not reflect any unliquidated obligations. There must be no discrepancies between the final FSR and the Payment Management System's (PMS) Federal Cash Transaction Report (SF-272).

Furthermore, unless an application for competitive renewal is submitted, additional grant closeout documents consisting of a Final Invention Statement and Certification form (HHS 568), (not applicable to training, construction, conference or cancer education grants) and a final progress report must also be submitted within 90 days of the expiration date.

NIH also strongly encourages electronic submission of the final progress report and the final invention statement through the Closeout feature in the Commons. If the final progress report and final invention statement are not submitted electronically, copies of the HHS 568 form may be downloaded at: <http://grants.nih.gov/grants/forms.htm>.

Submissions of the final progress report and HHS 568 may be e-mailed as PDF attachments to the NIH Central Closeout Center at: [deascentralized@od.nih.gov](mailto:deascentralized@od.nih.gov)

Paper submissions of the final progress report and the HHS 568 may be faxed to the NIH Central Closeout Center at 301-480-2304 or mailed to the NIH Central Closeout Center at the following address:

NIH/OD/OER/DEAS  
Central Closeout Center  
6705 Rockledge Drive, Room 2207  
Bethesda, MD 20892-7987 (for regular or U.S. Postal Service Express mail)  
Bethesda, MD 20817 (for other courier/express mail delivery only)

The final progress report should include, at a minimum, a summary of progress toward the achievement of the originally stated aims, a list of significant results (positive and/or negative), a list of publications and the grant number. If human subjects were included in the research, the final progress report should also address the following:

- Report on the inclusion of gender and minority study subjects (using the gender and minority Inclusion Enrollment Form as provided in the PHS 2590 and available at <http://grants.nih.gov/grants/forms.htm>).
- Where appropriate, indicate whether children were involved in the study or how the study was relevant for conditions affecting children (see "Public Policy Requirements and Objectives-Requirements for Inclusiveness in Research Design-Inclusion of Children as Subjects in Clinical Research" in the PHS 398 at URL [http://grants.nih.gov/grants/policy/nihgps\\_2003/NIHGPS\\_Part5.htm#\\_Toc54600090](http://grants.nih.gov/grants/policy/nihgps_2003/NIHGPS_Part5.htm#_Toc54600090))
- Describe any data, research materials (such as cell lines, DNA probes, animal models), protocols, software, or other information resulting from the research that is available to be shared with other investigators and how it may be accessed.

Note, if this is the final year of a competitive segment due to the transfer of the grant to another institution, then not all the requirements stated above are applicable. Specifically a Final Progress Report is not required. However, a final FSR is required and should be submitted electronically as noted above. In addition, if not already submitted, the Final Invention Statement is required and should be sent directly to the assigned Grants Management Specialist.

**Treatment of Program Income:**  
Additional Costs

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**SECTION IV – AI Special Terms and Conditions – 5K08AI067549-04**

Grants Management must be notified at least 3 months in advance of any anticipated administrative changes on this award (for example change of institution, sponsor, and/or any type of sabbatical or leave of absence).

NIAID provides salary support on K08 awards up to a maximum of \$75,000 per year. This award is funded accordingly.

This Career Award requires a minimum of 9.00 person months' effort (75%) be devoted to the research project.

The guidelines for this K award (see applicable Program Announcement at <http://www.niaid.nih.gov/ncn/training/k.htm>) state that your institution may supplement the NIH salary contribution up to a level that is consistent with your institution's salary scale; however, supplementation may not be from Federal funds unless specifically authorized by the Federal program from which such funds are derived. Because the salary amount provided by this award is based on the full-time institutional salary, no other PHS funds may be used for salary supplementation.

The research proposed in this grant may involve Select Agents and/or Highly Pathogenic Agents. NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that, under some circumstances, may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmbl5/bmbl5toc.htm>), your Institutional Biosafety Committee (IBC) or equivalent body, or appropriate designated institutional biosafety official. If there is ambiguity in the BMBL guidelines and/or there is disagreement among the BMBL, an institutional committee or institutional official, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If the work involves Select Agents and/or Highly Pathogenic Agents. Also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s);
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

For domestic work with Select Agents provide documentation of Registration status of all domestic organizations/entities where Select Agent(s) will be used

Please be advised that changes in the use of a Select Agent will likely be considered a change in scope and, therefore, require NIH awarding office prior approval.

## **STAFF CONTACTS**

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Jennifer L. Schermerhorn

Email: (b) (6) Phone: (b) (6) Fax: 301-493-0597

Program Official: Cristina Cassetti

Email: (b) (6) Phone: (b) (6) Fax: 301-496-8030

**SPREADSHEET SUMMARY**

**GRANT NUMBER:** 5K08AI067549-04

**INSTITUTION:** WILDLIFE TRUST

<b>Budget</b>	<b>Year 4</b>
TOTAL FEDERAL DC	\$121,250
TOTAL FEDERAL F&A	\$9,700
TOTAL COST	\$130,950

<b>Facilities and Administrative Costs</b>	<b>Year 4</b>
F&A Cost Rate 1	8%
F&A Cost Base 1	\$121,250
F&A Costs 1	\$9,700



**Final report for award K08AI067549**  
**Risk for Future Outbreaks of Henipaviruses in South Asia**  
**PI: Jonathan H. Epstein**  
**Project period: 9/15/2007-8/31/2011**

## **OVERVIEW**

### **Success of this award**

This award was highly successful in achieving the aim of providing me advanced multidisciplinary training, which included molecular virology, epidemiological modeling, and disease ecology. In the five-year period between 2007 and 2012, I developed and managed a large-scale ecological study of Nipah virus in bats in Bangladesh, which meshed with a larger study looking at the pandemic potential of Nipah virus under an R01 award led by my supervisor and mentor, Dr. Peter Daszak. Due to an excellent group of mentors, and the strong financial support for this project, I was able to be highly productive and learn the techniques and skills outlined in my original proposal (molecular virology, serology, epidemiology, and ecological modeling). I spent a substantial amount of time between 2007 and 2010 working under the guidance of Dr. Ian Lipkin at the Center for Infection and Immunity at Columbia University, where I learned to perform PCR and ELISA techniques to test bat samples for Nipah virus and antibodies, as well as state-of-the art next generation sequencing (NGS) techniques, which I used to discover and characterize a novel virus in bats, GBV-D virus, related to hepatitis C virus (<sup>1</sup> and **see publications list**). This finding has led to further studies of hepatitis C-like viruses in bats by me and other colleagues at the Center for Infection and Immunity. These studies have found that bats may be an ancient natural host for all human hepatitis C-like viruses<sup>2</sup>. I have also continued to engage with ecological modelers, including Dr. Marm Kilpatrick at UC Santa Cruz (a co-investigator on our larger Nipah virus study), and have increased my basic competence in the use and interpretation of mathematical models in the context of disease dynamics. The data generated and analyses conducted under this award has significantly increased our understanding of Nipah virus dynamics in bats. This study coupled with ongoing epidemiological studies being undertaken by us and colleagues in Bangladesh have made it increasingly evident that contact between people and bats, specifically consumption of date palm juice, is the major driver of Nipah virus spillover. Human-to-human transmission, which has been limited so far, is a significant contributor to the pandemic potential of Nipah virus.

This award has placed me in a strong position to establish myself as an independent scientist and leader in the field of disease ecology and emerging zoonoses. Over the past six years, I have become increasingly recognized for my expertise on Nipah virus and other bat-borne emerging viral zoonoses (e.g. MERS CoV) and, as a result, I have been able to contribute significantly to international field and laboratory studies of emerging zoonoses. As a direct result of this award, I have authored or co-authored 11 papers published in high impact factor journals (including *PNAS*, *PLoS Pathogens*, and *EID*). In addition, I am centrally involved with several global programs that specifically use the experience and expertise that I acquired from the research activities under this award. Specifically, I currently serve as the Asia Regional Coordinator for a global, multimillion dollar initiative funded by the US Agency for International Development (USAID) called the Emerging Pandemic Threats program ([www.usaid.gov/news-information/fact-sheets/emerging-pandemic-threats-program](http://www.usaid.gov/news-information/fact-sheets/emerging-pandemic-threats-program)). The goal of this program is to create an early warning system for emerging zoonotic viruses with pandemic potential in EID hotspots around the world, including Bangladesh. Under this program, I coordinate field and lab surveillance activities in seven countries and have helped develop standardized wildlife surveillance strategies and standard operating procedures used throughout all 20 participating countries. Further, I

have trained field teams throughout Asia on the techniques used for safe handling and sampling of bats and other wildlife, many of which were developed under this K08 program. In 2012, I was invited by the Kingdom of Saudi Arabia's Ministry of Health and Columbia University (Dr. Lipkin) to join a response team tasked with determining the origins of the Middle East Respiratory Syndrome coronavirus (MERS CoV). We were able to detect MERS CoV RNA in an Egyptian Tomb bat during the investigation, and we continue to work with the Saudi government to study the dynamics of this virus in wildlife and livestock in order to prevent spillover to humans. Under the supervision of Dr. Daszak, I continue to work on the NSF-funded Nipah virus research program in Bangladesh (2R01TW005869-06), where I direct wildlife surveillance and diagnostics. Currently, I am developing new research programs at EcoHealth Alliance and have applied for grants from NIH and other sources as a principle investigator.

### Summary of achievements

- Completed Nipah virus survey of eight bat populations across Bangladesh
- Completed 5-year longitudinal NiV survey of a single population
- Detected Nipah virus in individual wild-caught bats and analyzed strain diversity
- Identified other non-Nipah henipaviruses in *Pteropus giganteus*
- Used satellite telemetry to track pteropid bat movement over 2-year period
- Trained in the development and use of molecular and serological assays
- Used next generation sequencing techniques to discover and characterize the first member of a new genus, called *Pegivirus*, of the viral family Flaviviridae from bats
- Completed an immunology study of pteropid bats to determine the duration of maternal antibodies in neonates
- Published 11 papers in high impact journals including *PNAS*, *PLoS Pathogens*, and the *Journal of Applied Ecology*

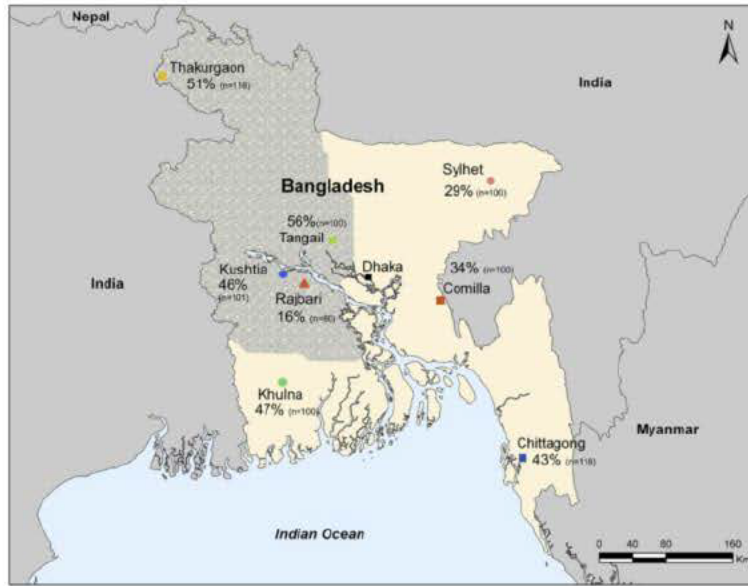
### Summary of Research

#### Specific Aims

The specific aims of this project were to:

- 1) Examine the distribution of NiV in flying foxes (*Pteropus giganteus*) in Bangladesh and host migration between colonies using serology, molecular techniques and satellite telemetry.
- 2) Test the hypothesis that seasonal NiV outbreaks in Bangladesh correspond to seasonal spikes in viral prevalence in fruit bat reservoirs during pregnancy and synchronous birthing.
- 3) Develop a parameterized predictive model for Nipah virus emergence in Bangladesh.

Under **Specific Aim 1** I tested the hypothesis that *Pteropus giganteus* was the natural reservoir for Nipah virus in Bangladesh and that there was no difference between Nipah virus prevalence in *P. giganteus* colonies inside the "Nipah Belt" (e.g. the region where all of the human clusters had so far occurred in western Bangladesh) and outside the "Belt." Data was collected from eight colonies across Bangladesh, four inside the Belt and four outside the Belt (**Figures 1-3**). Between 99 and 118 bats we sampled from each colony and morphometric and physiologic data (e.g. sex, mass, age and reproductive status), as well as, biological samples for virology and serology (throat swabs, urine, and blood) were collected. In total, 795 bats were tested under specific aim 1 (**Table 1**). A longitudinal study was conducted from



**Figure 1.** Nipah virus seroprevalence in *P. giganteus* colonies inside the Nipah Belt (shaded area) and outside. There was no difference in prevalence between these regions.

2007-2012 in order to test the hypothesis, under **Specific Aim 2**, that seasonal outbreaks in humans correlated to seasonal dynamics in bats. Data from the longitudinal study is also being used to parameterize a dynamic disease model, as represented by **Specific Aim 3**. For the longitudinal study, bats were repeatedly sampled from a single population (comprising multiple roosts in Faridpur and Rajbari districts located with a 10km radius of each other). One hundred bats were sampled approximately every 3 months throughout the longitudinal study. In order to identify individual bats in case of recapture, an RFID microchip containing a unique ID number was placed under the skin between the bat's shoulder blades. In addition to the samples collected from individual bats,

approximately 200 pooled urine samples were collected from underneath bat colonies across eight districts in Bangladesh as part of the spatial and longitudinal studies under **Specific Aims 1 and 2**. Three of the districts within the Nipah Belt are areas that have had one or more Nipah virus outbreaks in people. The environmental urine sample set includes approximately 60 samples from active outbreak investigations where urine samples (only) were collected at roost sites in villages where spillover was suspected to have occurred.

### Sample testing

As part of my training under this program, I spent time at the Center for Infection and Immunity at



**Figure 2.** Sampling *Pteropus giganteus* using isoflurane gas anesthesia to safely restrain the bat.

Columbia University, under Dr. Ian Lipkin's guidance, where I learned to use molecular and serological assays, such as polymerase chain reaction (PCR), real-time quantitative PCR, Enzyme-linked Immunosorbant Assay (ELISA), Luminex, and next generation sequencing (454 pyrosequencing). I ran bat samples that I collected in Bangladesh as part of my training, until I had mastered each technique. Saliva and urine samples were screened for Nipah virus RNA using conventional PCR. Serum from the spatial study was screened using the Nipah virus ELISA developed at the

Australian Animal Health Laboratory<sup>3</sup>. The ELISA reagents were provided by the Australian Animal Health Laboratory in Geelong, Victoria as part of our broader Nipah virus research collaboration. Sera from the longitudinal study

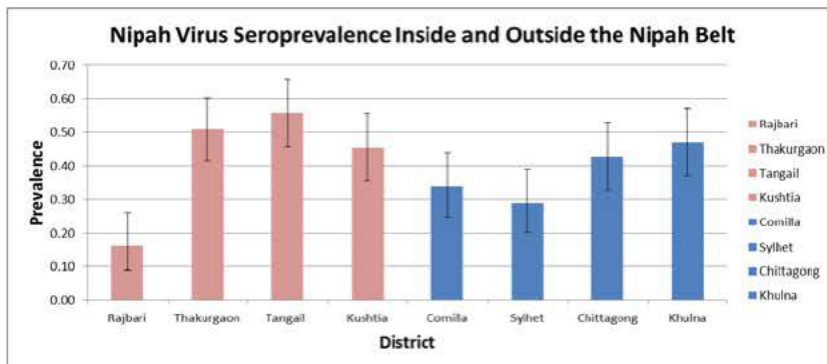
was screened for antibodies to Nipah virus using a Luminex assay based on a purified soluble G protein.<sup>4</sup> Initially, I developed my own PCR primers and protocols as part of my training, though eventually found that the most sensitive protocol was the nested PCR developed by Wacharaplasadee et al.<sup>5</sup>

## Nipah virus dynamics

Eight colonies that were sampled as part of the spatial survey have been tested for anti-NiV antibodies by ELISA and two of those, Thakurgaon and Kushtia, have been confirmed by a serum neutralization test at AAHL, which is considered to be the gold standard serological assay for Nipah virus<sup>6</sup>. Initially, the intention was to complete all ELISAs at the Center for Infection and Immunity in New York, however, there were delays in obtaining test reagents from Australia, so six of eight sets were screened by me at CII and the remaining two at AAHL using the same assay. Ultimately, due to timing and budgetary constraints, we shifted all remaining samples to AAHL in late 2012 for serological and molecular testing under the parent Nipah virus R01 (TW005869 PI Daszak). Testing was completed in October 2013.

## Serology

IgG seroprevalence as determined by the NiV ELISA assay ranged from 20-56% (mean = 40%) and there was not a significant difference between locations inside and outside the belt (Wilcoxon test;  $W=11$ ,  $p=0.4857$ ) (Figures 1 & 3 and Table 1). Preliminary analyses of age-stratified data suggest that juvenile seroprevalence (bats 0.5-2 years of age) is typically lower than adults. Experimental studies, including one conducted by me during this award period, suggest that pteropid bats lose their maternal antibodies to henipaviruses by around 7.5 months of age<sup>7</sup>. These juvenile bats are presumed to have lost their maternal antibodies, and so the seroprevalence in this population may be an indicator of how



**Figure 3** - NiV Seroprevalence in *Pteropus giganteus* colonies at each location within the Nipah Belt (red) and outside (blue). Approximately 100 bats were sampled from each colony between January 2006 and January 2009.

recently an outbreak occurred in a particular population. Colonies with significantly low overall seroprevalence relative to the mean may be more susceptible to an outbreak within bats. Increased Nipah virus shedding in bats appears to be a risk factor for spillover to humans, based on our studies finding high shedding rates in urine in colonies proximal to a human outbreak (unpublished data). Low total seroprevalence (juvenile and adult seroprevalence) may be attributable to time since last

outbreak; emigration of seropositive individuals; high mortality from an outbreak, or immigration (or birth) of naïve individuals. Data from experimental infections of henipaviruses in pteropid bats suggests that infection is not fatal and so a die-off of infected individuals from a population would be less plausible<sup>8,9</sup>.

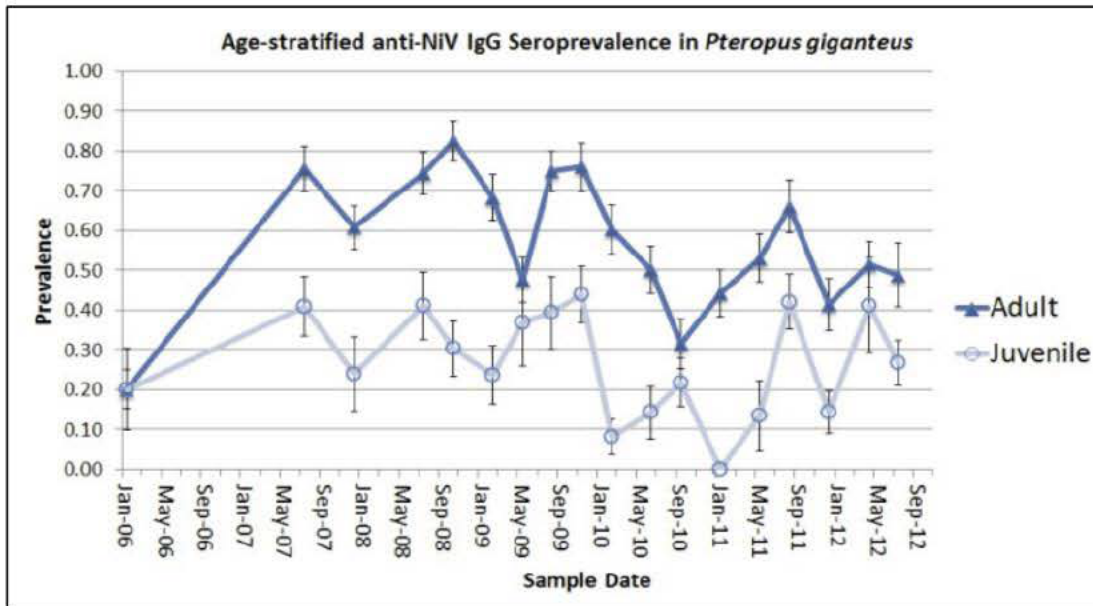
**Table 1.** NiV Seroprevalence in *Pteropus giganteus* colonies inside and outside the Nipah Belt (the region that includes all human clusters of NiV encephalitis)

Site	Date	N	Tot Prev	95% CI
Rajbari	1/31/2006	80	0.16	0.09-0.26
Thakurgaon	2/24/2007	118	0.51	0.41-0.60
Tangail	8/6/2008	100	0.56	0.46-0.66
Kushtia	8/4/2007	101	0.46	0.36-0.56
Comilla	2/5/2008	100	0.34	0.25-0.44
Sylhet	9/13/2008	100	0.29	0.20-0.44
Chittagong	8/4/2006	96	0.43	0.33-0.53
Khulna	1/24/2009	100	0.47	0.37-0.57

For the longitudinal survey, 1800 bats were sampled at 18 different time points from the Faridpur colony. Age-stratified analysis was conducted and results are summarized in **Figure 4**. Seroprevalence ranged from 20%-82% in adults and from 10% - 45% in juveniles. At each time point, prevalence in adults was either equal to or higher than juvenile seroprevalence. Seasonal oscillations

appear to occur in adults, though it is unclear what accounts for drop-offs in seroprevalence. This could be due to extinction of anti-NiV titers or mortality or emigration of adults. Annual increases in adult seroprevalence is likely due to recruitment of seropositive juveniles into the adult class; or could also be from novel or recrudescient infections among adults.

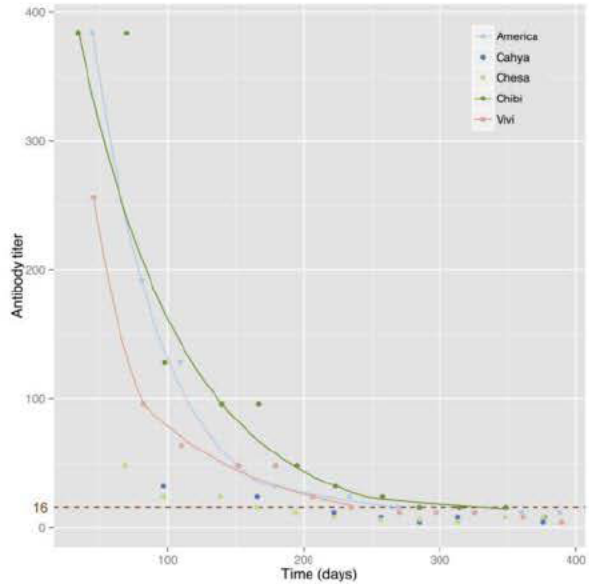
All bats were marked for future identification by inserting an RFID microchip subcutaneously between the scapulae. At each capture session, bats were scanned and recaptures were documented. We observed an overall recapture rate of 5% (115 recapture events in 2217 total captures). Roost shifting is commonly observed in other *Pteropus* species. For the purpose of this study, we considered bats roosting within a 10km radius to be of the same population. This assumption was supported by our observation of bats at one location that were marked at another.



**Figure 4.** Age-stratified longitudinal study of Nipah virus serology in a single *Pteropus giganteus* population in Faridpur and Rajbari districts over a 6-year period. Beginning in July 2007, 100 bats were sampled approximately every 3 months.

### Duration of maternal antibodies in juvenile pteropid bats

In order to improve interpretation of the serological results in juveniles, I conducted an experimental study in captive pteropid bats at the Lubee Bat conservancy in Gainesville Florida. Briefly, a cohort of *Pteropus hypomelanus* (Variable flying fox) from a breeding colony at Luby were vaccinated against canine distemper virus, a paramyxovirus related to Nipah. CDV vaccine was used as a proxy for NiV in order to avoid the need for biosafety level 4 facilities needed for work with henipaviruses. I measured the antibody response in adults, and then followed the titers over time. Among the bats that were vaccinated were breeding females. I measured their titers throughout pregnancy and then measured the titers monthly in their pups from 1 month of age until three negative titers were obtained. I then calculated the half-life of antibodies and the mean duration of maternally-derived immunity, which was about 7.5 months



**Figure 5.** Maternal antibody titers against canine distemper virus in five neonate *Pteropus hypomelanus* beginning at 1 month post-parturition. The red dashed line indicates a negative titer cutoff of 16.

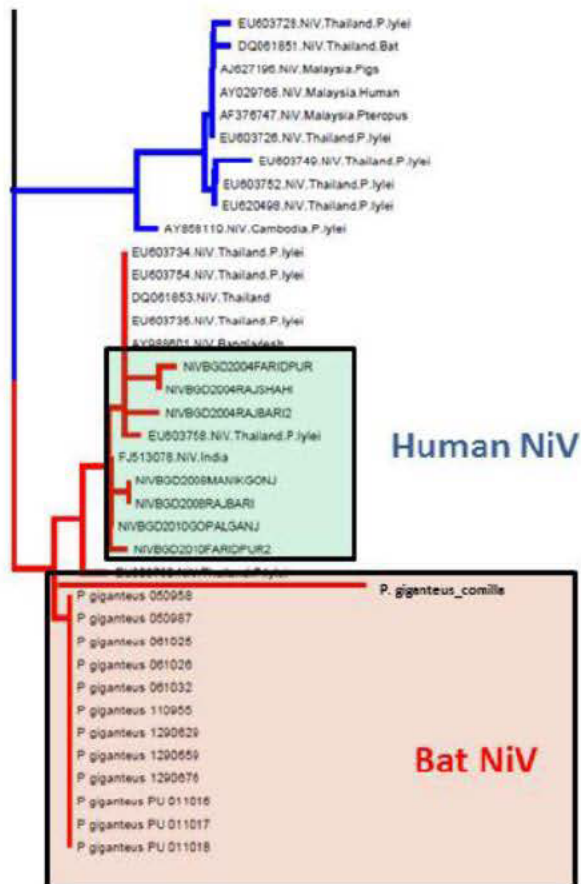
(**Figure 5**). This data set was co-analyzed with a parallel experiment being conducted at the Australian Animal Health Laboratory that measured the duration of Hendra virus antibodies in pups born to wild-caught dams that had been naturally infected with Hendra virus. Together, these two studies provided important insight into the age at which pteropid bats lose their maternally-derived immunity to henipaviruses, which helps differentiate juvenile bats in Bangladesh that were sero-positive due to infection, rather than maternal antibodies. This information was used to parameterize the model for **Specific Aim 3**.

**Molecular testing and viral culture** 1359 throat swabs, 1468 urine samples, 79 rectal swabs, and 472 pooled urine samples from underneath roosts (n=3378) were tested for sequence from the N gene using a nested PCR. A total of fifteen samples were positive, resulting in a detection rate of ~0.44%. **Table 2** summarizes the prevalence estimates for the roost that generated one or more positive samples. Low prevalence is consistent with other studies of henipaviruses.

**Table 2.** Prevalence of Nipah virus in bats sampled between 2006 and 2011.

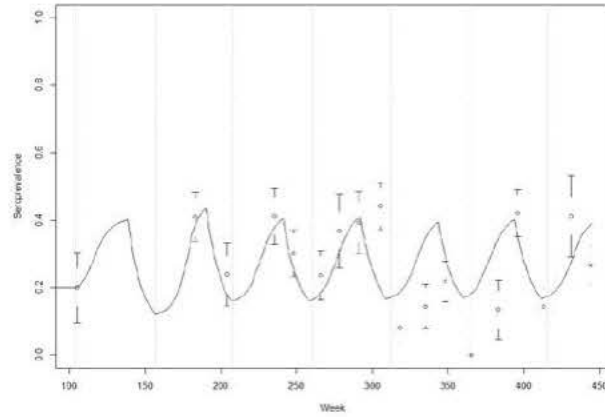
Location	Date	Sample type	n	prev	CI
Faridpur	Jan-06	rectal swab	59	1.69%	0.0004 - 0.091
		throat	79	2.53%	0.003 - 0.089
Faridpur	May-09	urine	100	2.00%	0.024 - 0.07
Faridpur	Nov-09	urine	82	1.22%	0.0003 - 0.0661
Faridpur	Jun-10	urine	100	3.00%	0.006 - 0.085
Faridpur	May-11	urine	4	25.00%	0.006 - 0.806
Bhanga, Faridpur*	Jan-10	Roost Urine	18	16.60%	0.036 - 0.414

However, this is the first study to detect Nipah virus RNA from individually captured bats as opposed to pooled urine samples. A phylogenetic analysis was done using the sequences of the positive bat samples. These were compared to known human sequences from Bangladesh. Results are summarized in **Figure 6**. Of particular interest was that all of the sequences, sampled from bats in Faridpur at different times during the longitudinal study, were monophyletic, suggesting a similar strain may persist in local populations. The sequence is only 200 nucleotides and the variability in the rest of the genome is unknown. However, Nipah virus sequences from the same gene region obtained from human cases in different districts during the same 3-year time period showed significantly more variation. This supports the hypothesis that localized strains may exist in different bat populations which then may spill over into local human populations. Understanding the diversity of Nipah virus strains in bats and humans, and their associated clinical severity in humans, may ultimately lead to insights regarding the genetic determinants of lethality, as well as mechanisms for reduced pathology in bats. All PCR positive samples were cultured at AAHL, but were negative.



**Figure 6.** Nipah virus RNA in bats and humans. Phylogenetic analysis of bat sequences 370nt in length from the N gene. Nipah virus sequences from bats sampled from the same population in Faridpur between 2007 and 2010 (pink shading) are monophyletic compared to human sequences (green shading) from various locations in Bangladesh over the same time period which show more variation in the same gene region. This suggests that distinct Nipah virus strains may be circulating in local bat populations which then spill over to humans.

**Specific Aim 3.** A Susceptible-Infected-Recovered-Susceptible (SIRS) model was used to model the age-stratified data from the longitudinal study. Under the guidance of Dr. A. Marm Kilpatrick, a conceptual framework was developed that describes infection dynamics and then a WAIFW (Whom Acquires Infection From Whom) matrix approach was used. The parameters were as follow:  $\beta$  is the rate at which susceptible individuals encounter infected individuals and become infected,  $N$  ( $=S+I+R$ ) is the population size,  $b$  is the per capita birth rate,  $\delta$  is the per capita death rate in the absence of disease,  $\mu$  is the per capita death rate due to infection (assumed to be 0), and  $r$  is the rate of recovery ( $=1/\text{infectious period}$ , assumed to be 10 days). In this model, transmission is density dependent, and as a result, higher densities of fruit bats will lead to higher Nipah virus transmission. I assumed



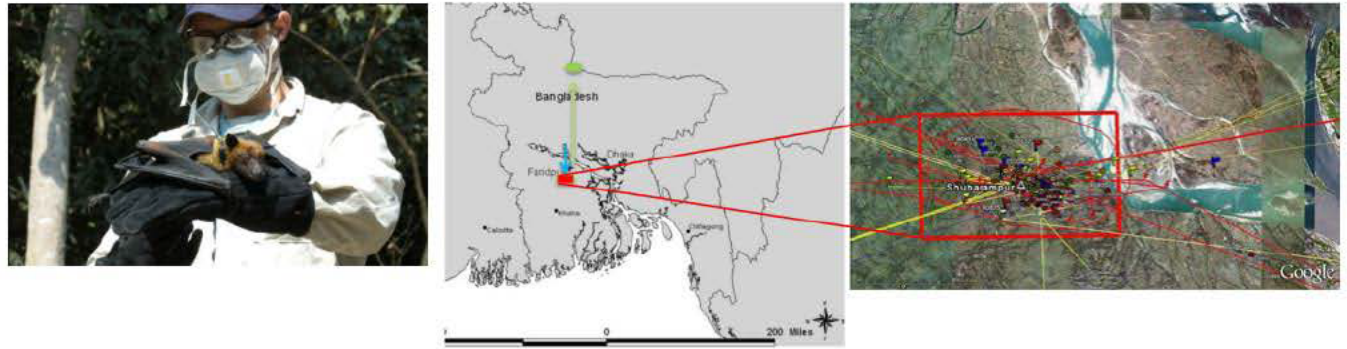
**Figure 7.** Preliminary results from an SIRS model using serology data from juvenile bats suggests that peak infectious periods in this bat colony may occur in June. If true, human outbreaks could potentially have been larger if date palm sap, a key route of transmission to humans, was harvested in summer.

that birth and death rates were equal ( $b=d$ ) so that the population size was constant. I assumed that there was no mortality to infection ( $\mu=0$ ) and that it was possible for adults to lose their acquired immunity over time and for the virus to recrudescence<sup>10,11</sup>. I used parameter values estimated from the literature, a range of values for difficult to estimate parameters (e.g. birth and death rates) for *P. giganteus* based on data published on Australian flying foxes<sup>12</sup>. I used estimates of the rate of recovery ( $r$ ) from experimental infections with HeV and NiV<sup>8,13</sup>.

The model is still being refined, but preliminary modeling of the juvenile cohort over the five-year time period supports the hypothesis of seasonal dynamics with year-to-year variation (**Figure 7**). It appears that the annual peak infectious time in juveniles is in July. The juvenile class in July would include 14-month old bats and potentially 26-month old bats that are still sexually immature – all of whom would be susceptible to infection, having lost maternal antibodies at approximately 8 months of age. Adult dynamics have not yet been fitted to the model. In July, dams are lactating and experiencing maximum energy expenditure (and physiologic stress) which may support higher rates of viral circulation. I am currently in the process of working with Dr. Kilpatrick to incorporate the PCR results into the model. We anticipate completing this analysis by April 2014.

**Satellite Telemetry.** Results from our satellite telemetry study (**Figure 8**) suggest that *Pteropus giganteus* may have a more restricted home range than *P. vampyrus* in Malaysia. If there is less connectivity among bat roosts, then there may be different viral dynamics in different parts of Bangladesh – a question that the molecular diagnostics may help resolve (**Specific Aim 1**). If Nipah virus is actively circulating in the western part of the country, but there is limited contact between bats in the West and East, it may explain the spatial clustering of human cases. The telemetry data must be interpreted with caution, as the study was limited to 16 individuals





**Figure 8.** *Pteropus giganteus* with a satellite collar prior to release (left); map of Bangladesh showing long-range movement of two bats, one of which traveled to the border of India and back to its roost in Faridpur over a period of two months (center); and an enlarged view of the Faridpur roost. The majority of location data has been within a 10 km radius of the roost, indicating localized foraging patterns and multiple locations seen for day time roosting activity. *P. giganteus* showed significantly less long-range movement compared to *Pteropus vampyrus* in Malaysia (right).

### **Discovery of GBV-D, a flavivirus related to Hepatitis C virus and member of a new genus: *Pegivirus***

As one of the final components of my training in molecular virology, I learned to use 4-5-4 high throughput pyrosequencing. I developed a metagenomics study that used *P. giganteus* serum samples from the longitudinal study to determine what viruses were present. Serum was selected because it had the least likelihood of bacterial contamination which would decrease the assay's ability to detect viruses in relatively trace amounts. I used 98 samples from a colony of approximately 1800 individuals in the Faridpur district of Bangladesh collected in December 2007. I published the study in *PLoS Pathogens* in 2009<sup>1</sup> which led to a broader study of GB viruses in bats and found that both pegiviruses and hepaciviruses (e.g. Hepatitis C virus), likely originated in bats. This study was published in *PNAS* in 2013<sup>2</sup>.

Briefly, for the original GBV-D study, total RNA from serum was extracted for Unbiased High Throughput Sequencing (UHTS) analysis to screen for the presence of microorganisms. Five microliters of total RNA from each bat were combined into 4 pools: 4 pregnant bats; 4 non-pregnant female bats, and 2 pools of 4 adult male bats, respectively. Reverse transcription (RT) was performed on DNase I-treated (DNA-free, Ambion Inc., Austin, TX, USA) RNA pools to generate cDNA using Superscript II RT (Invitrogen, Carlsbad, CA, USA) and random octamers linked to a defined arbitrary, 17-mer primer sequence tail (MWG, Huntsville, AL, USA)<sup>14</sup>. Sequences were analyzed using software applications implemented at the GreenePortal website (<http://tako.cpmc.columbia.edu/Tools/>).

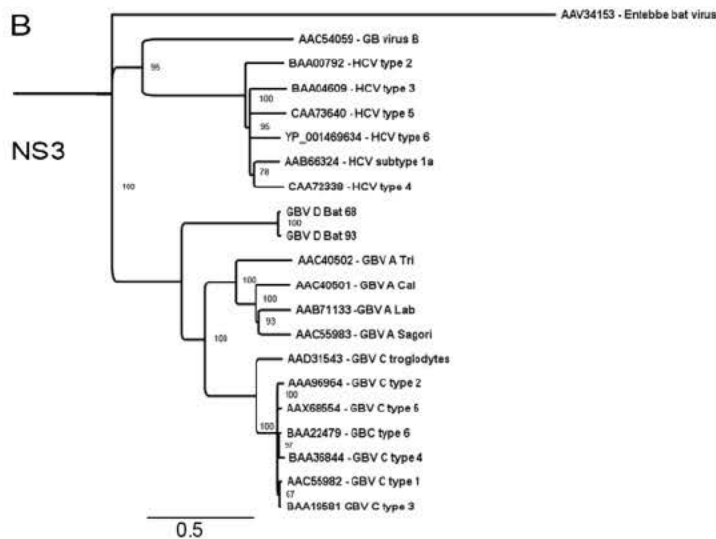
**Genome sequencing.** Multiple forward and reverse primers for RT-PCR were designed using the sequences obtained by UHTS in order to fill gaps between fragments. Amplifications were performed with Bio-X-act (Bioline, London, UK) according to manufacturer's protocols. Products were size fractionated by electrophoresis and directly sequenced in both directions with ABI PRISM Big Dye Terminator 1.1 Cycle Sequencing kits (Perkin-Elmer Applied Biosystems, Foster City, CA, USA) at a commercial facility (Genewiz, South Plainfield, NJ, USA). Additional methods applied to obtain the genome sequence included touch-down PCR<sup>15</sup>, 2-step walking PCR<sup>16</sup>, and 3'- and 5'- RACE (Invitrogen).

**Quantitative real-time PCR.** A real time Taqman PCR assay was developed to screen bat samples for GBV-D. Reactions were performed in a 25  $\mu$ L volume by using commercial Taqman Universal Master Mix (Applied Biosystems, Foster City, CA, USA). Primers and probe were designed to target a 60 nt region in the NS4A gene region: Fadi-forward, 5'- gCAgCTgCgTgTgCCA; Fadi-reverse, 5'- ACACCCATgATgTTACCACgAC; Fadi-probe, 5'- FAM- AggACCCggTCgCTCCAgCA-T-BQX (TIB Molbiol, Adelpia, NJ, USA). Cycling conditions were: 50°C for 2 min, and 95°C for 10 min, followed by 45 cycles

at 95°C for 15 sec and 60°C for 1 min. Thermal cycling was performed in an ABI 7300 real-time PCR system (Applied Biosystems).

**Phylogenetic and sequence analyses.** Sequence alignments were generated with ClustalW software<sup>17</sup> and phylogenetic relationships deduced using Geneious software<sup>18</sup>. Statistical significance was assessed by bootstrap re-sampling of 1000 pseudoreplicate data sets. Sequence relations were determined from p-distance matrices calculated with pairwise deletion for missing data and homogeneous patterns among lineages based on ClustalW alignments as implemented in MEGA software<sup>19</sup>. Sliding window similarity analysis was performed using SimPlot<sup>20</sup>. Potential signalase cleavage sites, glycosylation sites, and phosphorylation sites were analyzed using the respective prediction servers available at the Center for Biological Sequence Analysis (<http://www.cbs.dtu.dk/services/>).

Extracts of 16 individual bats were combined into 4 pools consisting of 4 pregnant adult bats, 4 non-pregnant adult female bats, or 2 x 4 adult male bats. Each pool yielded between 1,400 and 2,000 sequence reads. Two reads of 238 and 215 nucleotides (nt) derived from the pregnant bat pool had distant homology to GBV-A sequences at the deduced amino acid (aa) level in the E2 and NS4A gene regions respectively (BLASTX); no homology was detected by searches at the nt level (BLASTN). No viral sequences were detected in other pools at the nucleotide or amino acid levels. Screening of the individual RNA preparations from the pregnant bat pool using primers derived from the UHTS reads confirmed the presence of the GBV-like sequence in the serum of bat 93. A quantitative real time PCR assay indicated a load of approximately 30 000 RNA copies in bat-93 sera extract, and identified an additional 4 positive bat sera from the original 98 samples (5/98; 5%), indicating serum loads ranging from 350 to 70,000-RNA copies per assay. These positive samples came from male bats that were not included in the initial UHTS pools. Extracts of saliva from the five positive bats indicated a load of approximately 200 RNA copies in bat 93; no signal was obtained with urine extracts from the five positive bats. Figure 9 shows the relationship between GBV-D and other flaviviruses using sequence from the NS3 gene region.



**Figure 9.** Phylogenetic relationship of GBV-D to other GBV and hepaciviruses. GBV-D amino acid sequences for NS3. Entebbe bat virus was used as an outgroup; distance in substitutions per site is indicated by scale bars; percent bootstrap support for values greater than 85% is indicated at respective nodes. Polyproteins (PPT) were analyzed in comparison to representative sequences of GBV-A, -B, -C and hepatitis C viruses. Adapted from<sup>1</sup>

This was the first description of a GBV virus in bats. Previously, they had only been identified in primate and human hosts and had been associated with hepatitis in human some cases. Interestingly, the bats

that were carrying GBV-D did not have any evidence of impaired liver function and otherwise appeared healthy. This would not be surprising if it's a virus they have co-evolved with over time, just as they have with Nipah virus. It appears that GBV-D is a chronic infection, which would be consistent with other GB viruses and hepatitis C virus. In 2013, we used the sample set generated by this study to conduct an in-depth study of viral diversity in *Pteropus giganteus* and found more than 55 novel viruses representing several viral families including paramyxoviruses, coronaviruses, herpesviruses, and adenoviruses<sup>21</sup>. This was the first in-depth look at viral diversity in this important bat species and it generated the first estimate of the total viral diversity in mammalian hosts.

### Overall Significance

**The data I've collected under this award has provided evidence to support the following conclusions regarding the ecology of Nipah virus in Bangladesh: 1) *Pteropus giganteus* is the natural reservoir for Nipah virus; 2) there is no difference between infection rates in *P. giganteus* inside and outside the Nipah Belt and other factors such as date palm sap consumption is probably more important for driving human outbreaks; 3) there is a predictable, seasonal pattern to Nipah virus infection, and therefore shedding, in bats; and 4) there are other viruses in *P. giganteus*, including GB viruses, that may be zoonotic, and interventions designed to exclude bats from human food resources like date palm sap will be protective against Nipah virus, as well as, yet unknown zoonotic agents in pteropid bats.**

The study has provided substantial evidence that *Pteropus giganteus* is the natural reservoir of Nipah virus in Bangladesh (and India, by extension). The data suggest that NiV circulates widely among *Pteropus giganteus* in Bangladesh, as it does with *Pteropus vampyrus* and *hypomelanus* in Malaysia and as Hendra virus circulates widely among pteropid species in Australia. This study has provided evidence that there is no difference between infection rates within and outside of the Nipah Belt, thereby pointing to the human-bat interface (e.g. date palm sap) as a significant determinant of the spatial and temporal patterns associated with human outbreaks, which is supported by the epidemiological data generated by colleagues at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B). The determination of the duration of maternal antibodies helped significantly with the interpretation of serological data from the juvenile cohort. Knowing the approximate time of year when juveniles convert from "recovered" to "susceptible" is critical for modeling seasonal dynamics. Identifying a potential seasonal pattern of infection from my ecological study may provide new insight into how we could identify high risk regions for spillover based on bat colonies that are most susceptible to a Nipah virus outbreak. Detection of viral RNA in individual bats was rare, which is not surprising given the short infectious period (~10 days). The longitudinal study generated a tremendously rich data set, which has provided early evidence of a predictable, seasonal pattern of infection in bats, as well as the first sequences obtained from individual bats. The use of the Luminex platform at AAHL allowed us to test for antibodies to a range of pathogens in addition to Nipah virus in each sample. While I have not included this data here, we have screened all the bat sera for antibodies to Hendra virus, Cedar virus, Ebola virus (Zaire and Reston strains), and Marburg virus. We have also screened the oral and urine samples for other viruses (under the USAID PREDICT program), and have found evidence for other paramyxoviruses, included novel Nipah-like henipaviruses. Serological investigations of livestock in Bangladesh under Dr. Daszak's R01 have detected non-neutralizing antibodies to a Nipah-like virus in cattle, which could be evidence of spillover occurring from bats to cows. Livestock represent a potential intermediate host for Nipah virus and other henipaviruses.

We are currently working to further characterize these novel paramyxoviruses as well as other viral agents from other families to determine whether a range of pathogens from *P. giganteus* are indeed spilling over into livestock and people. If so, then interventions such as covering date palm sap pots will not only help prevent Nipah virus transmission, but also any other viral agents that may be excreted by these or other frugivorous bats that feed on date palm sap.

### Research Career Development

I am planning to complete my doctoral dissertation in 2014. My thesis covers the topics funded by this K08 award including Nipah virus ecology, bat immunology, and using high throughput sequencing to discover novel pathogens.

I am also pursuing funding to develop independent lines of research at EcoHealth Alliance. In November 2012, I submitted an R01 grant application to NIAID as an early stage investigator, entitled “The bat immune response to viral infection: are bats special?” The study is designed to determine whether bats are different from other mammals in the way that they handle viral infection. This aspect of my research interests stems from the increasing number of emerging zoonotic viruses that have been associated with bat hosts, and a desire to test the hypothesis that bats are better able to handle viral infections than other mammalian hosts, and therefore represent an exceptionally important reservoir for viral zoonoses. I have also developed a research study to test that hypotheses that Macacine herpes B virus is responsible for a portion of undiagnosed encephalitides in Bangladesh. I have submitted a research proposal to NIAID for an epidemiological study of Herpes B virus in macaques and people in Bangladesh.

Meanwhile, I continue to be heavily involved in the investigation of emerging pathogens, including MERS CoV. Beginning in 2012 I have been working in collaboration with Columbia University, the Kingdom of Saudi Arabia’s Ministry of Health, and King Saud University to study the ecology of MERS CoV. In 2012, we discovered MERS CoV RNA in Egyptian Tomb bats (*Taphozous perforatus*) near the index case in Saudi Arabia<sup>22</sup>. I continue to be involved in the study of MERS in livestock and bats, and have been invited to provide updates on MERS to NIAID and to the Institute of Medicine’s Forum on Microbial Threats.

### Publications supported by this award

\*indicates corresponding author

1. **Epstein JH\***, Baker ML, Zambrana-Torrel C, Middleton D, Barr JA, et al. (2013) Duration of Maternal Antibodies against Canine Distemper Virus and Hendra Virus in Pteropid Bats. *PLoS ONE* 8(6): e67584. doi:10.1371/journal.pone.0067584
2. Anthony SJ, **Epstein JH**, Murray KA, Navarrete-Macias I, Zambrana-Torrel CM, Solovyov A, Ojeda-Flores R, Arrigo NC, Islam A, Ali Khan S, Hosseini P, Bogich TL, Olival KJ, Sanchez-Leon MD, Karesh WB, Goldstein T, Luby SP, Morse SS, Mazet JAK, Daszak P, Lipkin WI. 2013. A strategy to estimate unknown viral diversity in mammals. *mBio* 4(5):e00598-13. doi:10.1128/mBio.00598-13.
3. Peter Daszak, Carlos Zambrana-Torrel, Tiffany L Bogich, Miguel Fernandez, **Jonathan H. Epstein**, Kris A. Murray, and Healy Hamilton. Interdisciplinary approaches to understanding

disease emergence: The past, present and future drivers of Nipah virus emergence. 2012. *PNAS* doi:10.1073/pnas.1201243109

4. **Epstein JH\***, Zambriski JA, Rostal MK, Heard DJ, Daszak P. (2011) Comparison of Intravenous Medetomidine and Medetomidine/Ketamine for Immobilization of Free-Ranging Variable Flying Foxes (*Pteropus hypomelanus*). *PLoS ONE* 6(10): e25361. doi:10.1371/journal.pone.0025361
5. Pulliam JR, **Epstein JH**, Dushoff J, Rahman SA, Meehan G, Bunning M, HERG, Jamaluddin AA, Hyatt AD, Field HE, Dobson AP & Daszak P. Agricultural intensification, priming for persistence, and the emergence of Nipah virus: a lethal bat-borne zoonoses. *Journal of the Royal Society, Interface*. 2011. Doi:10.1098/rsif.2011.0223 (**journal's most cited article in 2012**)
6. Vandegrift, K.J.; Wale, N.; **Epstein, J.H.\*** (2011). An Ecological and Conservation Perspective on Advances in the Applied Virology of Zoonoses. *Viruses* 3:379-397.
7. **Epstein JH\***, Quan P-L, Briese T, Street C, Jabado O, et al. (2010) Identification of GBV-D, a Novel GB-like Flavivirus from Old World Frugivorous Bats (*Pteropus giganteus*) in Bangladesh. *PLoS Pathog* 6(7): e1000972. doi:10.1371/journal.ppat.1000972
8. N. Homaira, M. Rahman, M. J. Hossain, **J. H. Epstein**, R. Sultana, M.S.U Khan, G. Podder, K. Nahar, E. S. Gurley, P. Daszak, W. I. Lipkin, P. E. Rollin, J. A. Comer, T. G. Ksiazek, S. P. Luby. Nipah outbreak with person-to-person transmission in Thakurgaon, Bangladesh 2007. *Epidemiology and Infection (Journal of Epidemiology and Infection)*. 2010 *Epidemiol. Infect.*, 138 (11) 1630-6.
9. **Epstein, J.H.E.\*** and J. Price. The Significant but Understudied Impact of Pathogen Transmission from Humans to Animals. *Mt Sinai J Med*. 2009; 76(5):448-55.
10. **Epstein J.H.\***, Olival KJ, Pulliam JRC, Smith C, Westrum J, Hughes T, et al. *Pteropus vampyrus*, a hunted migratory species with a multinational home-range and a need for regional management. *Journal of Applied Ecology*. 2009 Oct;46(5):991-1002.
11. Kaufman, G.E., **J.H. Epstein**, J Paul-Murphy, and J.D. Modrall. Designing graduate training programs in conservation medicine - producing the right professionals with the right tools. 2008. *EcoHealth* vol 5. Pp. 519-27

#### Other relevant activities

**Review Editor**, EcoHealth Journal ([www.ecohealth.com](http://www.ecohealth.com))

**Member**, International Association of Ecology and Health; IUCN Veterinary Specialist Group & IUCN Bat Species Specialist Group

**Director**: NSF Research Coordination network EcoHealthNet multidisciplinary training program for health and ecological science graduate students; One Health Alliance of South Asia (regional One Health science and policy Network covering India, Nepal, Pakistan, and Bangladesh)

**Invited Lectures/teaching**: I have been invited to present on Nipah virus at both US and International meetings, including: The WHO/FAO/OIE Consultation on Henipaviruses and Ebolavirus (Nov 2009);

Queensland, Australia; The Emerging Infectious Disease Symposium, Geelong Australia (2012); Nipah virus ecology at the American Society for Microbiology, Washington D.C. (2012); The International Meeting on Emerging Diseases (IMED), Vienna. (2013); on MERS CoV at the Institute of Medicine's Forum on Microbial Threats (2013,2014).

I give annual lectures on emerging zoonoses at Columbia University, Tufts School of Veterinary Medicine, Mt. Sinai School of Medicine, and Harvard University.

**Oral Presentations at conferences:** I have presented at US and international conferences including: ASTMH (2010, 2011); Wildlife Disease Association, Argentina, (April 2010); ICEID 2012, EcoHealth 2012

**Supervised:** University of Wisconsin PhD student on a comparative study of bat foraging and migration movement and land cover in Bangladesh (Jul-Aug 2009).

**Mentored:** Graduate students from medical, veterinary and ecological disciplines through EcoHealthNet, an NSF-funded Research Coordination Network award that I direct at EHA (PI: Daszak).

## Literature cited

- 1 Epstein, J. H., Quan, P. L., Briese, T., Street, C., Jabado, O., Conlan, S., Khan, S. A., Verdugo, D., Hossain, M. J., Hutchison, S. K., Egholm, M., Luby, S. P., Daszak, P. & Lipkin, W. I. Identification of GBV-D, a Novel GB-like Flavivirus from Old World Frugivorous Bats (*Pteropus giganteus*) in Bangladesh. *Plos Pathogens* **6**, doi:10.1371/journal.ppat.1000972 (2010).
- 2 Quan, P.-L., Firth, C., Conte, J. M., Williams, S. H., Zambrana-Torrel, C. M., Anthony, S. J., Ellison, J. A., Gilbert, A. T., Kuzmin, I. V., Niezgodna, M., Osinubi, M. O. V., Recuenco, S., Markotter, W., Breiman, R. F., Kalemba, L., Malekani, J., Lindblade, K. A., Rostal, M. K., Ojeda-Flores, R., Suzan, G., Davis, L. B., Blau, D. M., Ogunkoya, A. B., Alvarez Castillo, D. A., Moran, D., Ngam, S., Akaibe, D., Agwanda, B., Briese, T., Epstein, J. H., Daszak, P., Rupprecht, C. E., Holmes, E. C. & Lipkin, W. I. Bats are a major natural reservoir for hepaciviruses and pegiviruses. *Proceedings of the National Academy of Sciences*, doi:10.1073/pnas.1303037110 (2013).
- 3 Epstein, J. H., Prakash, V., Smith, C. S., Daszak, P., McLaughlin, A. B., Meehan, G., Field, H. E. & Cunningham, A. A. Henipavirus infection in fruit bats (*Pteropus giganteus*), India. *Emerging Infectious Diseases* **14**, 1309-1311, doi:10.3201/eid1408.071492 (2008).
- 4 Hayman, D. T. S., Suu-Ire, R., Breed, A. C., McEachern, J. A., Wang, L. F., Wood, J. L. N. & Cunningham, A. A. Evidence of Henipavirus Infection in West African Fruit Bats. *PLoS One* **3**, doi:e2739 10.1371/journal.pone.0002739 (2008).
- 5 Wacharapluesadee, S. & Hemachudha, T. Duplex nested RT-PCR for detection of Nipah virus RNA from urine specimens of bats. *Journal of Virological Methods* **141**, 97-101 (2007).
- 6 Daniels, P., Ksiazek, T. & Eaton, B. T. Laboratory diagnosis of Nipah and Hendra virus infections. *Microbes and Infection* **3**, 289-295 (2001).
- 7 Epstein, J. H., Baker, M. L., Zambrana-Torrel, C., Middleton, D., Barr, J. A., Dubovi, E., Boyd, V., Pope, B., Todd, S., Cramer, G., Walsh, A., Pelican, K., Fielder, M. D., Davies, A. J., Wang, L. F. & Daszak, P. Duration of Maternal Antibodies against Canine Distemper Virus and Hendra Virus in Pteropid Bats. *PLoS One* **8**, e67584, doi:10.1371/journal.pone.0067584 (2013). pmcid 3695084
- 8 Halpin, K., Hyatt, A. D., Fogarty, R., Middleton, D., Bingham, J., Epstein, J. H., Rahman, S. A., Hughes, T., Smith, C., Field, H. E., Daszak, P. & Henipavirus Ecology Res. G. Pteropid Bats are Confirmed as the Reservoir Hosts of Henipaviruses: A Comprehensive Experimental Study of Virus Transmission. *American Journal of Tropical Medicine and Hygiene* **85**, 946-951, doi:10.4269/ajtmh.2011.10-0567 (2011).
- 9 Middleton, D. J., Morrissy, C. J., van der Heide, B. M., Russell, G. M., Braun, M. A., Westbury, H. A., Halpin, K. & Daniels, P. W. Experimental Nipah virus infection in pteropid bats (*Pteropus poliocephalus*). *Journal of Comparative Pathology* **136**, 266-272 (2007).
- 10 Field, H. *The ecology of Hendra virus and Australian bat Lyssavirus*. PhD thesis, The University of Queensland, (2005).
- 11 Rahman, S. A., Hassan, L., Sharifah, S. H., Lazarus, K., Zaini, C. M., Epstein, J. H., Naim, N. S., Field, H. E., Arshad, S. S., Aziz, J. A., Daszak, P. & EcoHlth, A. Evidence for Nipah virus recrudescence and serological patterns of captive *Pteropus vampyrus*. *Epidemiology and Infection* **139**, 1570-1579, doi:10.1017/s0950268811000550 (2011).
- 12 Vardon, M. T., CR. The black flying-fox (*Pteropus alecto*) in north Australia: juvenile mortality and longevity. *Australian Journal of Zoology* **48**, 91-97 (1999).
- 13 Williamson, M. M., Hooper, P. T., Selleck, P. W., Westbury, H. A. & Slocombe, R. F. Experimental hendra virus infection in pregnant guinea-pigs and fruit Bats (*Pteropus poliocephalus*). *Journal of comparative pathology* **122**, 201-207 (2000).
- 14 Palacios, G., Quan, P. L., Jabado, O. J., Conlan, S., Hirschberg, D. L., Liu, Y., Zhai, J., Renwick, N., Hui, J., Hegyi, H., Grolla, A., Strong, J. E., Towner, J. S., Geisbert, T. W., Jahrling, P. B., Buechen-Osmond, C., Ellerbrok, H., Sanchez-Seco, M. P., Lussier, Y., Formenty, P., Nichol, S. T., Feldmann, H., Briese, T. & Lipkin, W. I. Panmicrobial oligonucleotide array for diagnosis of infectious diseases. *Emerging Infectious Diseases* **13**, 73-81 (2007).
- 15 Korbie, D. J. & Mattick, J. S. Touchdown PCR for increased specificity and sensitivity in PCR amplification. *Nat Protoc* **3**, 1452-1456 (2008).
- 16 Pilhofer, M., Bauer, A. P., Schrollhammer, M., Richter, L., Ludwig, W., Schleifer, K. H. & Petroni, G. Characterization of bacterial operons consisting of two tubulins and a kinesin-like gene by the novel Two-Step Gene Walking method. *Nucleic Acids Res.* **35**, 8, doi:e135 10.1093/nar/gkm836 (2007).

- 17 Chenna, R., Sugawara, H., Koike, T., Lopez, R., Gibson, T. J., Higgins, D. G. & Thompson, J. D. Multiple sequence alignment with the Clustal series of programs. *Nucleic Acids Res.* **31**, 3497-3500, doi:10.1093/nar/gkg500 (2003).
- 18 Geneious v4.6 (2009<http://www.geneious.com/>).
- 19 Tamura, K., Dudley, J., Nei, M. & Kumar, S. MEGA4: Molecular Evolutionary Genetics Analysis (MEGA) software version 4.0. *Molecular Biology and Evolution* **24**, 1596-1599 (2007).
- 20 Lole, K. S., Bollinger, R. C., Paranjape, R. S., Gadkari, D., Kulkarni, S. S., Novak, N. G., Ingersoll, R., Sheppard, H. W. & Ray, S. C. Full-length human immunodeficiency virus type 1 genomes from subtype C-infected seroconverters in India, with evidence of intersubtype recombination. *Journal of Virology* **73**, 152-160 (1999).
- 21 Anthony, S. J., Epstein, J. H., Murray, K. A., Navarrete-Macias, I., Zambrana-Torrel, C. M., Solovoyov, A., Ojeda-Flores, R., Arrigo, N., Islam, A., Ali Khan, S., Hosseini, P., Bogich, T. L., Olival, K. J., Sanchez-Leon, M. D., Karesh, W., Goldstein, T., Luby, S. P., Morse, S. S., Mazet, J., Daszak, P. & Lipkin, W. I. A Strategy to Estimate Unknown Viral Diversity in Mammals. *mBio* **4** (2013).
- 22 Memish, Z. A., Mishra, N., Olival, K. J., Fagbo, S. F., Kapoor, V., Epstein, J. H., AlHakeem, R., Asmari, M. A., Islam, A., Kapoor, A., Briese, T., Daszak, P., Rabeeah, A. A. A. & Lipkin, W. I. Middle East Respiratory Syndrome Coronavirus in Bats, Saudi Arabia. *Emerging Infectious Diseases* **19** (2013). < <http://dx.doi.org/10.3201/eid1911.131172>>.



**From:** Gupta, Ranjan (NIH/NIAID) [E]  
**Sent:** Fri, 29 Jun 2007 13:23:49 -0400  
**To:** Jarosik, Terri (NIH/NIMH) [E]  
**Cc:** England, Howard (NIH/NIAID) [E];Cassetti, Cristina (NIH/NIAID) [E];Herz, Katie (NIH/NIAID) [C]  
**Subject:** RE: 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:BANGADESH; OGR CONTACT: RANJAN GUPTA

This record has been released to the FIC.  
Thanks.

Ranjan Gupta, Ph.D.  
Office of Global Research (OGR)  
DHHS/NIH/NIAID/OCGR/OGR  
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Fax: 301-480-2954

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**From:** Barksdale, Da Rel (NIH/NIAID) [C]  
**Sent:** Friday, June 29, 2007 10:09 AM  
**To:** Jarosik, Theresa (NIH/NIAID) [E]; NIAID State Dept Clearance; Gupta, Ranjan (NIH/NIAID) [E]  
**Cc:** England, Howard (NIH/NIAID) [E]; Cassetti, Cristina (NIH/NIAID) [E]; Herz, Katie (NIH/NIAID) [C]  
**Subject:** RE: 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:BANGADESH; OGR CONTACT: RANJAN GUPTA

This clearance request has been received and has been passed on to Dr. Ranjan Gupta for OGR review.  
Thanks!

DaRel M. Barksdale, MPH  
Contractor, Administrative Support  
Office of Global Research  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
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**From:** Jarosik, Theresa (NIH/NIAID) [E]  
**Sent:** Thursday, June 28, 2007 9:52 AM  
**To:** NIAID State Dept Clearance  
**Cc:** England, Howard (NIH/NIAID) [E]; Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:BANGADESH

An 1820 is ready for review for the following:

Grant Number: 1 K08 AI67549-01A2  
P.I. Jonathan Epstein  
Applicant organization:  
Foreign Country: BANGADESH  
GMS: Howard England  
PO: Christina Cassetti

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**From:** Gupta, Ranjan (NIH/NIAID) [E]  
**Sent:** Fri, 29 Jun 2007 13:22:47 -0400  
**To:** Jarosik, Terri (NIH/NIMH) [E]  
**Cc:** England, Howard (NIH/NIAID) [E]; Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:UNITED KIGDOM; OGR CONTACT: RANJAN GUPTA

This record has been released to the FIC.  
Thanks.

Ranjan Gupta, Ph.D.  
Office of Global Research (OGR)  
DHHS/NIH/NIAID/OCGR/OGR  
Phone: (b) (6)  
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**From:** Barksdale, Da Rel (NIH/NIAID) [C]  
**Sent:** Friday, June 29, 2007 10:05 AM  
**To:** Jarosik, Theresa (NIH/NIAID) [E]; NIAID State Dept Clearance; Gupta, Ranjan (NIH/NIAID) [E]  
**Cc:** England, Howard (NIH/NIAID) [E]; Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:UNITED KIGDOM; OGR CONTACT: RANJAN GUPTA

This clearance request has been received and has been passed on to Dr. Ranjan Gupta for OGR review.  
Thanks!

**DaRel M. Barksdale, MPH**  
Contractor, Administrative Support  
Office of Global Research  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
6700B Rockledge Drive, Room 4245  
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**From:** Jarosik, Theresa (NIH/NIAID) [E]  
**Sent:** Thursday, June 28, 2007 9:49 AM  
**To:** NIAID State Dept Clearance  
**Cc:** England, Howard (NIH/NIAID) [E]; Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** 1820 for GRANT NUMBER: 1 K08 AI67549-01A2 ; FOREIGN COUNTRY:UNITED KIGDOM

An 1820 is ready for review for the following:

Grant Number: 1 K08 AI67549-01A2  
P.I. Jonathan Epstein  
Applicant organization:  
Foreign Country: UNITED KIGDOM  
GMS: Howard England  
PO: Christina Cassetti

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**From:** Cassetti, Cristina (NIH/NIAID) [E]  
**Sent:** Fri, 29 Jan 2010 12:57:15 -0500  
**To:** Schermerhorn, Jen (NIH/NIDA) [E]  
**Subject:** RE: ARRA award 3K08AI067549-03S1

Hi Jennifer,

Here are my answers:

Would you please review this request and let me know if it meets the following?

- is not a change of scope of the ARRA supplement or ARRA grant.  
NO, this request does NOT changes the scope of the ARRA supplement

- is not outside of the ARRA supplement or ARRA grant purpose.  
No, this request is NOT outside of the ARRA supplement purpose

- is not outside of the American Re-investment and Recovery Act (ARRA) purpose.  
No, this request is NOT outside of the American Re-investment and Recovery Act (ARRA) purpose

Thank you,

Cristina

Cristina Cassetti, Ph.D.

Program Officer

Acute Viral Diseases Program

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---

**From:** Schermerhorn, Jennifer (NIH/NIAID) [E]

**Sent:** Friday, January 29, 2010 11:48 AM

**To:** Cassetti, Cristina (NIH/NIAID) [E]

**Cc:** Schermerhorn, Jennifer (NIH/NIAID) [E]

**Subject:** FW: ARRA award 3K08AI067549-03S1

Good Morning, Dr. Cassetti,

Would you please review this request and let me know if it meets the following?

- is not a change of scope of the ARRA supplement or ARRA grant.
- is not outside of the ARRA supplement or ARRA grant purpose.
- is not outside of the American Re-investment and Recovery Act (ARRA) purpose.

Please respond to this inquiry by COB February 5.

Thank you,

**Jennifer L. Schermerhorn**

*Grants Management Specialist*

6700B Rockledge Drive, Room 2242

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---

**From:** Aleksei Chmura [mailto: (b) (6)]

**Sent:** Tuesday, January 19, 2010 9:59 PM

**To:** Schermerhorn, Jennifer (NIH/NIAID) [E]

**Subject:** Re: ARRA award 3K08AI067549-03S1

Dear Dr. Schermerhorn,

Please find a PDF (attached) of our request to modify the specifics of our ARRA award ( 3K08AI067549-03S1 ). This request is not to change the awarded budget, but to change the name of one of the named-researchers and the specifics of this named-person's duties. All details are in the attached, letter.

Call me anytime, if you have questions about our request. I look forward to your reply most,

Sincerely,

-aleksei

**Aleksei Chmura**

AOR and Program Coordinator

**From:** Jon Epstein  
**Sent:** Tue, 29 Sep 2009 13:57:00 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: ARRA supplemental funding question

Cristina,

Yes, fantastic news about the grant. Thank you very much!

The Discovery special is not available on line, but we're sending you down another copy which we'll test first. Sorry about that.

Cheers,

Jon

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Tuesday, September 29, 2009 1:49 PM  
**To:** Jon Epstein  
**Subject:** RE: ARRA supplemental funding question

Hi Jon,

Sorry if it took me a while to get back to you. Yes, your grant has been awarded an ARRA supplement of \$49,994. Congratulations!!!

Cristina

PS: I tried to watch the Discovery channel documentary on your work last night but unfortunately the disc I received does not work (it gets stuck after 5 minutes and cannot be read further).

Do you know if I can watch it online? Cheers

---

**From:** Jon Epstein [mailto: (b) (6)]  
**Sent:** Wednesday, September 23, 2009 3:55 PM  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** ARRA supplemental funding question

Cristina,

I meant to ask you, I had put in an application for supplemental funding off my K08, but I have not heard yet if it was awarded. Should I assume it was not, or are there some applications still being considered?

Thanks,

Jon

**Jonathan H. Epstein DVM, MPH**

*emerging zoonoses*

*Associate Vice President*

Wildlife Trust

*Executive Director*

The Consortium for Conservation Medicine

Member: IUCN Wildlife Health Specialist Group and

Bat Species Specialist Group

Wildlife Trust | 460 West 34th Street – 17th floor | New York, NY 10001

(b) (6) (direct) | (b) (6) (Wildlife Trust) | [www.wildlifetrust.org](http://www.wildlifetrust.org); [www.conservationmedicine.org](http://www.conservationmedicine.org)

*Wildlife Trust empowers local conservation scientists worldwide to protect nature and safeguard ecosystem and human health.*



**The Consortium for Conservation Medicine is a formal partnership among institutions dedicated to the goal of solving complex global health challenges using a multidisciplinary scientific approach. CCM partners include Johns Hopkins Bloomberg School of Public Health, Tufts Cummings School of Veterinary Medicine, The University of Pittsburgh Graduate School of Public Health, The University of Wisconsin-Madison Nelson Institute for Environmental Studies, The USGS National Wildlife Health Center, and Wildlife Trust.**

For more information about the Consortium for Conservation Medicine visit [www.conservationmedicine.org](http://www.conservationmedicine.org).



**From:** Jon Epstein  
**Sent:** Tue, 24 Mar 2009 18:46:14 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Cc:** 'Peter Daszak'  
**Subject:** RE: Eligibility for ARRA funding

Excellent, Thanks Cristina.

Cheers,

Jon

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Tuesday, March 24, 2009 6:27 PM  
**To:** (b) (6)  
**Cc:** 'Peter Daszak'  
**Subject:** RE: Eligibility for ARRA funding

Hi Jon,

From what I heard (not official yet) K08 awards should be eligible for ARRA administrative supplements (up to \$ 50,000/year in direct cost). Please check our webpage for updates on this.

Since all new research under a grant has to be peer reviewed by law, the administrative supplements (which are NOT peer reviewed) have to stay within the scope of the research specified in the grant. Here is how this is worded in our website, under SOP for admin supplements:

"Administrative supplements may **not** be awarded to pay for a PI to move in a new scientific direction or use a new technology. For example, beginning use of microarray technology or an animal model not specified in the application. If additional funds are needed for such purposes, investigators should apply for another [R01](#) or a small grant such as an R03 or R21."

If you can apply for a supplement, make sure that you explain clearly in your application how the supplement fits within the scope of your project, advances your project AND (very important!) provides an economic stimulus (like new FTEs and equipment). The supplement cannot exceed the length of your parent grant. For example if you have 1 year left on your grant you can only ask for a 1 year supplement.

Cheers,

Cristina

---

**From:** Jon Epstein [mailto: (b) (6)]  
**Sent:** Tuesday, March 24, 2009 5:41 PM  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Cc:** 'Peter Daszak'  
**Subject:** Eligibility for ARRA funding

Dear Cristina,

How are you? Do you happen to know whether my K08 award with NIAID is eligible for ARRA funding?

Cheers,

Jon

Jonathan Epstein DVM, MPH, cert. Internat'l. Vet. Med.

Senior Research Scientist  
*Emerging Zoonoses*  
The Consortium for Conservation Medicine  
&  
Associate Vice President  
Wildlife Trust

[The Consortium for Conservation Medicine,](#)

[Wildlife Trust](#)

460 W.34th st, 17th Floor  
New York, NY 10001

email: [REDACTED] (b) (6)

voice: [REDACTED] (b) (6)

fax: +1 (212) 380-4475

To learn more about the CCM and the field of conservation medicine, visit our website at

<http://www.conservationmedicine.org>

To join the International EcoHealth Association, and subscribe to the Springer journal EcoHealth", please visit <http://www.EcoHealth.net>

**From:** Schermerhorn, Jen (NIH/NIDA) [E]  
**Sent:** Tue, 2 Feb 2010 10:55:47 -0500  
**To:** 'Aleksei Chmura'  
**Cc:** Cassetti, Cristina (NIH/NIAID) [E]; (b) (6); Schermerhorn, Jen (NIH/NIDA) [E]  
**Subject:** RE: Grant #: 3K08AI067549-03S1- Prior Approval Request

Good Morning, Mr. Chmura.

This request does not require prior approval as long as the supplement's replacement:

- \*is not a change of scope of the ARRA supplement or ARRA grant
- \*is not outside of the ARRA supplement or ARRA grant purpose
- \*is not outside of the American Re-investment and Recovery Act purpose.

That being said, as long as the laboratory technician proposed meets the above requirements, you may replace Dr. Hosseini's employment with the laboratory tech.

Thank you,

**Jennifer L. Schermerhorn**  
*Grants Management Specialist*  
6700B Rockledge Drive, Room 2242  
Bethesda, MD 20892-7614  
(FedEx use zip 20817)  
Phone: (b) (6)  
Fax: 301-493-0597

(b) (6)v



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**From:** Aleksei Chmura [mailto:(b) (6)]  
**Sent:** Thursday, January 28, 2010 5:41 PM  
**To:** Schermerhorn, Jennifer (NIH/NIAID) [E]  
**Cc:** Cassetti, Cristina (NIH/NIAID) [E]; (b) (6)  
**Subject:** Re: Grant #: 3K08AI067549-03S1- Prior Approval Request

Dear Jennifer,

Many thanks for your reply! I will await the notification and other emails.

Have a splendid weekend!

-aleksei

**Aleksei Chmura**  
*Program Coordinator*



Wildlife Trust  
460 West 34th Street, 17th floor  
New York, NY 10001 USA  
(t) (b) (6)  
(m) (b) (6)  
(f) 1.212.380.4465  
[www.wildlifetrust.org](http://www.wildlifetrust.org)

**Wildlife Trust empowers local conservation scientists worldwide to protect nature and safeguard ecosystem and human health.**

On 28 Jan, 2010, at 15:22, Schermerhorn, Jennifer (NIH/NIAID) [E] wrote:

Dear Aleksei Chmura,

I have received your institution's prior approval request referenced in the subject line. The request is in the process of being reviewed and evaluated, or will soon be reviewed and evaluated by all NIAID responsible parties. Should additional information or clarifications be required, we will contact you. Because the review and evaluation process has not been completed, your institution must not infer or assume that your prior approval request will be approved. Any action you take inferring approval is not authorized by NIAID.

When a final decision is made, a revised Notice of Award, Letter of Response, or E-mail from the appropriate NIAID Grants Management Official will be issued to your institution.

If you have additional questions regarding your request you may contact me directly.

Sincerely,

**Jennifer L. Schermerhorn**

*Grants Management Specialist*

6700B Rockledge Drive, Room 2242

Bethesda, MD 20892-7614

(FedEx use zip 20817)

Phone: (b) (6)

Fax: 301-493-0597

(b) (6)



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---

**From:** Aleksei Chmura [mailto:(b) (6)]

**Sent:** Tuesday, January 19, 2010 9:59 PM

**To:** Schermerhorn, Jennifer (NIH/NIAID) [E]

**Subject:** Re: ARRA award 3K08AI067549-03S1

Dear Dr. Schermerhorn,

Please find a PDF (attached) of our request to modify the specifics of our ARRA award ( 3K08AI067549-03S1 ). This request is not to change the awarded budget, but to change the name of one of the named-researchers and the specifics of this named-person's duties. All details are in the attached, letter.

Call me anytime, if you have questions about our request. I look forward to your reply most,

Sincerely,

-aleksei

**Aleksei Chmura**

*AOR and Program Coordinator*

**From:** Challberg, Mark (NIH/NIAID) [E]  
**Sent:** Thu, 14 Jun 2007 18:26:36 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: Grant Number: 1K08AI067549 - 01A2 PI Name: EPSTEIN, JONATHAN H

I'll try to get to it tomorrow. How is the trip?

Mark

-----Original Message-----

From: Cassetti, Cristina (NIH/NIAID) [E]  
Sent: Thursday, June 14, 2007 5:43 PM  
To: Challberg, Mark (NIH/NIAID) [E]  
Subject: Fw: Grant Number: 1K08AI067549 - 01A2 PI Name: EPSTEIN, JONATHAN H

Fyi- I can take care of it when I get back Thanks Cristina

-----  
Sent from my BlackBerry Wireless Handheld

----- Original Message -----

From: England, Howard (NIH/NIAID) [E]  
To: Cassetti, Cristina (NIH/NIAID) [E]  
Cc: England, Howard (NIH/NIAID) [E]  
Sent: Thu Jun 14 16:39:08 2007  
Subject: Grant Number: 1K08AI067549 - 01A2 PI Name: EPSTEIN, JONATHAN H

Dear Dr. Cassetti,

A separate 1820 is required for each foreign site; Bangladesh, UK and Australia. The one that you've completed for the UK, you'll need to "Add Foreign Component Site" and complete the information in that section. Thank you.

Howard A. England

Grants Management Specialist

National Institute of Allergy & Infectious Diseases, NIH/DEA/GMB 6700B Rockledge Drive, Room 2229, MSC  
7614 Bethesda, Maryland 20892-7614 FEDERAL EXPRESS ONLY: Use zip 20817 Voice Mail/Phone - (b) (6)  
FAX - (301) 493-0597 E-Mail - c (b) (6)

NIH is in the process of converting from PHS 398 to SF424 (Research and Related [R&R]) forms and electronic submission through Grants.gov. Information on this plan and on registering for electronic submission is available at <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-05-067.html>. Updates regarding the transition process are at <http://era.nih.gov/ElectronicReceipt/>.

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**From:** Jon Epstein  
**Sent:** Tue, 5 Jun 2007 14:37:58 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]; 'Peter Daszak'  
**Subject:** RE: Ko8 grant

Hi Cristina,  
I just saw your e-mail today, sorry for the delayed response. I'll send you the information you requested asap.

Cheers,  
Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
USA

Tel: (b) (6)  
Fax: +1 212 380-4475

E-mail: (b) (6)  
web: [www.conservationmedicine.org](http://www.conservationmedicine.org)

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-----Original Message-----



From: Casseti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
Sent: Tuesday, June 05, 2007 2:09 PM  
To: Peter Daszak  
Cc: (b) (6)  
Subject: RE: Ko8 grant

Hi Peter,

I think Jon might be traveling. Do you think you can answer these questions related to his NIH application?

Thanks,

Cristina

Cristina Casseti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, Rm. 4044  
Bethesda, MD 20892-7630  
Tel: (b) (6)  
Fax: (301) 480-1594  
Email: (b) (6)

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-----Original Message-----

From: Casseti, Cristina (NIH/NIAID) [E]  
Sent: Monday, June 04, 2007 3:15 PM  
To: (b) (6)  
Subject: Ko8 grant

Hi Jon,

We are working to release your grant. Could you please send me the address, phone and FAX numbers and email addresses of all your foreign collaborators? If you have more than one collaborator for foreign site, please send me the information only of the main contact.

Also, can you please let me know if you are sub-contracting grant funds to any of the foreign sites? And if so, what are the total funds per year for each foreign site?

Many thanks,

Cristina

Cristina Cassetti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, Room 4044  
Bethesda, MD 20892-7630  
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Start preparing NOW for electronic submission. See:  
<http://era.nih.gov/ElectronicReceipt/>.

**From:** Jon Epstein  
**Sent:** Fri, 8 Jun 2007 14:59:44 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Cc:** 'Peter Daszak'  
**Subject:** RE: Ko8 grant

Hi Cristina,

I will be spending and estimated 8-10k per year in years 1-3 on technical field support in Bangladesh from the K08 grant. Year 4 will be an estimated 3-5k.

Our contact in Australia is Dr. Alex Hyatt  
CSIRO  
Australian Animal Health Laboratory  
Geelong, Victoria  
Australia

Ph: (b) (6)  
e-mail (b) (6)

Tim Coulson is the contact in the UK

Department of Biological Sciences  
Imperial College  
Silwood Park  
Ascot  
Berkshire  
SL5 7PY  
UK

Ph: (b) (6) 7  
e-mail: (b) (6)

Let me know if you need any more information.

Cheers,  
Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
USA

Tel: (b) (6)  
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-----Original Message-----

From: Cassetti, Cristina (NIH/NIAID) [E] [[mailto:\[REDACTED\]](mailto:[REDACTED])] (b) (6)  
Sent: Tuesday, June 05, 2007 4:04 PM  
To: [REDACTED] (b) (6)  
Cc: Peter Daszak  
Subject: RE: Ko8 grant

Hi Jon,

Thanks for the update, bat catching under monsoon rain in a forest in Bangladesh sounds very exotic and adventurous!

As for the request, if you are sending funds, even for a consultation, please send me an estimate, in total cost/year.

Also, when you have the chance please send me the contact info for the other sites as well (UK and Australia).

Good luck with your upcoming trip!

Cristina

-----Original Message-----

From: Jon Epstein [[mailto:\[REDACTED\]](mailto:[REDACTED])] (b) (6)  
Sent: Tuesday, June 05, 2007 3:54 PM  
To: Cassetti, Cristina (NIH/NIAID) [E]  
Cc: 'Peter Daszak'  
Subject: RE: Ko8 grant

Thanks Cristina - I'm getting ready to head over in July for two months of fun-filled (and wet) bat catching during monsoon season. I was glad to hear that you guys had a productive meeting when Peter and Steve Luby were down there a few weeks ago. Hopefully I can make it down there one of these days to meet you and others there in person.

A question about your request: We aren't planning on subcontracting funds to our foreign collaborators at ICDDR,B, but we are planning on using project funds to pay for Bangladeshi field assistants on a consulting, fee-for-service basis. Do you need this amount?

The contact information for our principal collaborator, Dr. Stephen Luby, is:

Stephen Luby  
Head, Programme on Infectious Diseases and Vaccine Sciences ICDDR,B  
Centre for Health and Population Research Mohakali, Dhaka  
1212  
GPO 128  
Bangladesh

Ph: (b) (6)  
Fax: +880 (2) 8823963

e-mail: (b) (6)

Please let me know if you need any additional information.

Cheers,  
Jon

Jonathan Epstein DVM, MPH  
Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
USA

Tel: (b) (6)  
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web: [www.conservationmedicine.org](http://www.conservationmedicine.org)

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-----Original Message-----

From: Cassetti, Cristina (NIH/NIAID) [E]  
[mailto: (b) (6)]  
Sent: Monday, June 04, 2007 3:15 PM  
To: (b) (6)  
Subject: Ko8 grant

Hi Jon,

We are working to release your grant. Could you please send me the address, phone and FAX numbers and email address of all your foreign collaborators ?  
If you have more than one collaborator per foreign site, please sent me the information only of the main contact.

Also, can you please let me know if you are sub-contracting grant funds to any of the foreign sites? And if so, what are the total funds per year for each foreign site?

Many thanks,

Cristina

Cristina Cassetti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, Room 4044  
Bethesda, MD 20892-7630  
Tel: (b) (6)  
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Start preparing NOW for electronic submission. See:  
<http://era.nih.gov/ElectronicReceipt/>.

**From:** Cassetti, Cristina (NIH/NIAID) [E]  
**Sent:** Mon, 27 Jul 2009 11:20:05 -0400  
**To:** 'Jon Epstein'  
**Subject:** RE: NIH Grant 5K08AI067549-03

Jon, that would be fine. I sent you a reminder so that there would be no delay in releasing the funds. I hope your stay in Malaysia is going well. I come back from Delhi yesterday and it was so hot!

Cheers  
Cristina

---

**From:** Jon Epstein [mailto: (b) (6)]  
**Sent:** Monday, July 27, 2009 11:02 AM  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: NIH Grant 5K08AI067549-03

Dear Cristina,

Please accept my apology for being late on this. I'm currently in Malaysia, but I will do my best to have this in to you by the end of next week.

I hope that is ok.

Cheers,

Jon

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Monday, July 27, 2009 8:38 PM  
**To:** (b) (6)  
**Cc:** (b) (6) NIAID GM I2 Notifications  
**Subject:** Re: NIH Grant 5K08AI067549-03

Dear Jonathan,

We have not yet received the Progress report for your grant (it was due on July 1, 2009). Please send it soon to avoid delays in the release of funding for next year.

Kind regards,

Cristina

Cristina Cassetti, Ph.D.

Program Officer

Acute Viral Diseases Program

DHHS/NIH/NIAID/DMID/Virology Branch

6610 Rockledge Drive, room 1202

Bethesda, MD 20892-7630

Tel: (b) (6)

Fax: (301) 480-1594

Email: (b) (6)



**From:** Jon Epstein  
**Sent:** Mon, 31 Aug 2009 10:22:48 -0400  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: NIH Grant 5K08AI067549-03

Thanks Cristina, I'm happy with the way the work is going. Lot's going on this year. I'll look into the copyright issues (grants office? ☺ ) and sort it out.

I will be at the NIAID meeting, and I look forward to seeing you and catching up.

Cheers,

Jon

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Monday, August 31, 2009 10:15 AM  
**To:** Jon Epstein  
**Subject:** RE: NIH Grant 5K08AI067549-03

Hi Jon,

Thanks for getting back to me promptly. I don't know if a co-author as copyright ownership but somebody from the journals (perhaps with help from your grants office) should be able to guide you. I hope you are doing well. I was glad to see from your progress report that your research has been very productive. Will I see you at the NIAID bat meeting is September?

Kind regards,

Cristina

---

**From:** Jon Epstein [mailto: (b) (6)]  
**Sent:** Monday, August 31, 2009 10:05 AM  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: NIH Grant 5K08AI067549-03

Dear Cristina,

Thank you for bringing this to my attention. I will contact the journal editors for the three papers you listed and arrange to have them registered with Pubmed central. I have final published versions of each of these papers. From reading the online instructions about submission, it looks as though I need to get permission from the editors to submit to PubMed central, , but that as a co-author I have copyright ownership to do so. Is that right? I will follow up with you once I have these permissions and have submitted the papers.

Cheers,

Jon

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Friday, August 28, 2009 12:39 PM  
**To:** (b) (6)  
**Cc:** (b) (6); NIAID GM I2 Notifications  
**Subject:** Re: NIH Grant 5K08AI067549-03

Dear Jon,

While working on your progress report I noticed that you didn't provide the Provide the PubMed Central reference numbers (PMCID) for the publications that you listed. I have attached a document with more information on the NIH public access policy. Please let me know how you are planning to comply with this NIH policy.

Thanks,

Cristina

Cristina Cassetti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, room 1202  
Bethesda, MD 20892-7630  
Tel: (b) (6)  
Fax: (301) 480-1594  
Email: (b) (6)

**From:** Jon Epstein  
**Sent:** Fri, 18 Jul 2008 09:45:23 -0400  
**To:** Casseti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: Request to reschedule our phone call

Hi Cristina,

I don't think there is a summary statement available yet. All I saw from ecommons was that the grant was un-scored, but I wasn't given any further info. I thought that you had sat in on the review or might know something more about it – but I also realize you hear hundreds of reviews and may not recall this one.

If we're both in the dark on this, then perhaps it makes sense to wait until you return from vacation and we can see if there is more information.

What do you suggest?

-Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
USA

Tel: (b) (6)  
Fax: +1 212 380-4475

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web: [www.conservationmedicine.org](http://www.conservationmedicine.org)

*The Consortium for Conservation Medicine is a unique collaborative institution linking Johns Hopkins Bloomberg School of Public Health, The University of Pittsburgh Graduate School of Public Health, The University of Wisconsin-Madison Nelson Institute for Environmental Studies, Tufts University School of Veterinary Medicine Center for Conservation Medicine, The USGS National Wildlife Health Center, and Wildlife Trust.*

*The CCM strives to understand the links among anthropogenic environmental change, health of all species including humans, and the conservation of biodiversity. We conduct collaborative scientific research in these fields and use the outcomes to inform policy, develop curricula and formulate*

*practical solutions to environmental threats that affect these links. Through these programs, we are fostering development of the field of conservation medicine.*

To learn more about the CCM and the field of conservation medicine, visit our website at <http://www.conservationmedicine.org>

---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Friday, July 18, 2008 9:30 AM  
**Subject:** RE: Request to reschedule our phone call

I have some time at 11,30.

For some reason I am not able to get your latest summary statement from my system. Could you email it to me?

cheers

Cristina

---

**From:** Jon Epstein [mailto: (b) (6)]  
**Sent:** Friday, July 18, 2008 9:29 AM  
**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** RE: Request to reschedule our phone call

Ah, I see. Are you by any chance free this morning?  
-Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
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---

**From:** Cassetti, Cristina (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Friday, July 18, 2008 9:04 AM  
**Subject:** RE: Request to reschedule our phone call

Hi Jon,

I will be on vacation from Monday of next week until August 1. If you can wait until after August 1, let's talk then.  
Otherwise I will be here today until 3 pm or so. Let me know.

Cheers

Cristina

Cristina Cassetti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, room 4097  
Bethesda, MD 20892-7630  
Tel: (b) (6)  
Fax: (301) 480-1594  
Email: (b) (6)

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Start preparing NOW for electronic submission. See: <http://era.nih.gov/ElectronicReceipt/>.

---

**From:** Jon Epstein [mailto:epstein@conservationmedicine.org]  
**Sent:** Friday, July 18, 2008 8:55 AM

**To:** Cassetti, Cristina (NIH/NIAID) [E]  
**Subject:** Request to reschedule our phone call  
**Importance:** High

Hi Cristina,

I was wondering if you would mind if we rescheduled our phone call about the R03 grant for one day next week. Would Monday or Tuesday work for you?

I just got back last night from Bangladesh and things are a bit crazy today.

I really appreciate it, and have a great weekend.

Cheers,  
Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
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**From:** NHLBI Automail (NIH/NHLBI)  
**Sent:** Thu, 5 Jul 2007 12:38:45 -0400  
**To:** NIAID FCTS;Cassetti, Cristina (NIH/NIAID) [E];Johnson, Jackie (NIH/NIAID) [E]  
**Subject:** Status Change for Foreign Clearance Number 11238

DO NOT REPLY TO THIS MESSAGE.

The status for Foreign Clearance Request Number 11238 for work in UNITED KINGDOM on Project AI067549-01A2 has changed to No Clearance Required.

For additional information, please login to <https://fts.nhlbi.nih.gov/nihfts> and read the comments from FIC by viewing the snapshot for this request.

**From:** [Jon Epstein](#)  
**To:** [Cassetti, Cristina \(NIH/NIAID\) \[E\]](#)  
**Cc:** ["Peter Daszak"](#)  
**Subject:** RE: Ko8 grant  
**Date:** Friday, April 18, 2008 4:46:09 PM  
**Attachments:** [NIAID supported research\\_Epstein K08.ppt](#)

---

Dear Cristina,

I've attached a few slides. Feel free to modify them as necessary. Please let me know if you have any questions or need more info for any of them. I've made some notes below the slides.

Enjoy Hawaii!

Cheers,  
Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
USA

Tel: (b) (6)  
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To learn more about the CCM and the field of conservation medicine, visit our website at <http://www.conservationmedicine.org>

-----Original Message-----

From: Cassetti, Cristina (NIH/NIAID) [E] [<mailto:> (b) (6)]  
Sent: Friday, April 18, 2008 12:56 PM  
To: (b) (6)  
Subject: RE: Ko8 grant

Thank you!  
Cristina

-----Original Message-----

From: Jon Epstein [<mailto:> (b) (6)]  
Sent: Friday, April 18, 2008 12:56 PM  
To: Cassetti, Cristina (NIH/NIAID) [E]  
Cc: 'Peter Daszak'  
Subject: RE: Ko8 grant

Hi Cristina,  
No problem. I'll send you a few summary slides by the end of today.

Cheers,  
Jon

Jonathan Epstein DVM, MPH

Senior Research Scientist  
Veterinary Epidemiology, Zoonotic Diseases

The Consortium for Conservation Medicine  
460 West 34th Street  
17th Floor  
New York, NY 10001  
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-----Original Message-----

From: Cassetti, Cristina (NIH/NIAID) [E]

[mailto: (b) (6)]

Sent: Friday, April 18, 2008 11:58 AM

To: (b) (6)

Cc: Peter Daszak

Subject: Ko8 grant

Hi Jon,

I hope you are well. I have to give a talk in a few days at the University of Hawaii on NIAID's efforts on emerging infectious diseases. I am planning to highlight some of the projects that we are supporting on Nipah and I would like to present one or two slides on your project.

Would you be able to send me some bullet points that describe the scope of your Ko8 Nipah study and perhaps a couple of pictures of bats in radio-collars?

Thanks,

Cristina

Cristina Cassetti, Ph.D.  
Program Officer  
Acute Viral Diseases Program  
DHHS/NIH/NIAID/DMID/Virology Branch  
6610 Rockledge Drive, room 4097  
Bethesda, MD 20892-7630  
Tel: (b) (6)  
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Start preparing NOW for electronic submission. See:  
<http://era.nih.gov/ElectronicReceipt/>.

**From:** [Mulach, Barbara \(NIH/NIAID\) \[E\]](#)  
**To:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#)  
**Cc:** [DMID GrantOps](#)  
**Subject:** Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Date:** Friday, July 17, 2020 1:05:39 PM  
**Attachments:** [Terms and Conditions of Award U01AI153415-01 .docx](#)  
[Terms of Cooperative agreement U01AI153420 Epstein.docx](#)

---

Hi Eunchung,

Dhana in Grants Management has a few comments on the terms of award documents associated with the Epstein R01 to U01 conversion. Could you take a look at the attached documents and let us know if you are ok with the proposed terms of award? Also, can you help in clarifying the role of Vince Munster in the project?

If it would help to discuss by phone, just let me know.

Thanks!

Barbara

**Terms and Conditions of Award U01 AI153415-01**

(b) (5)





Terms and Conditions of Award: U01 AI153420-01

(b) (5)







**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** (b) (6); (b) (6); (b) (6)  
**Cc:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Subject:** Cooperative Agreement Terms of Award for Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Date:** Wednesday, August 5, 2020 12:52:30 PM  
**Attachments:** [Terms of Cooperative agreement U01AI153420 Epstein FINAL CLEAN.pdf](#)

---

Hello Aleksei,

We are working on converting the R01 application for the grant referenced above in to a U01 Cooperative Agreement due to the substantial intramural involvement. Please review the attached terms and conditions of award and provide EcoHealth's acceptance.

Please respond by COB 8/6/2020

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

---

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## **Terms and Conditions of Award: U01 AI153420-01**

The following special terms of award are in addition to, and not in lieu of, otherwise applicable U.S. Office of Management and Budget (OMB) administrative guidelines, U.S. Department of Health and Human Services (DHHS) grant administration regulations at 45 CFR Part 75, and other HHS, PHS, and NIH grant administration policies.

The administrative and funding instrument used for this program will be the cooperative agreement an "assistance" mechanism (rather than an "acquisition" mechanism), in which substantial NIH intramural involvement with the awardees is anticipated during the performance of the activities supported by current award. Under the cooperative agreement, the NIH purpose is to support and stimulate the recipients' activities by involvement in and otherwise working jointly with the award recipient in a partnership role; it is not to assume direction, prime responsibility, or a dominant role in the activities. Consistent with this concept, the dominant role and prime responsibility resides with the awardee for the project as a whole, although specific tasks and activities may be shared among the awardee and the NIH as defined below.

### **The PD/PI(s) will have the primary responsibility for:**

- Administrative oversight for the grant includes defining the research objectives, approaches, and details of the program and primary responsibility for the planning, directing, and executing the proposed scientific activities.
- All aspects of the research design, data analysis and interpretation, preparation of publications, dissemination of data, tools, and technologies, and collaboration with other investigators.
- Making new information and materials known to the research community in a timely manner through publications, web announcements, and reports to the NIAID, or other mechanisms.
- Retaining custody of and primary rights to the data and software developed under these awards, subject to Government rights of access consistent with DHHS, PHS, and NIH policies
- Publications: The PD/PI will be responsible for the timely submission of all abstracts, manuscripts and reviews (co)authored by members of the grant and supported in part or in total under this Agreement. The PD/PI is requested to submit manuscripts to the Project Scientist right after acceptance for publication so that an up-to-date summary of program accomplishments can be maintained, and press conferences and press releases prepared.

### **NIH Staff Substantial Involvement**

Dr. Vincent Munster's lab at Rocky Mountain Laboratories, NIAID, will have responsibility for performing *in vivo* infection studies in bat and hamster models to understand Nipah virus transmissibility and pathogenesis of different Nipah virus strains.

- Experimental infection at NIH RML to determine whether seropositive Pteropus bats can be infected by NiV and sustain a productive viral infection.
- Comparison of pathogenicity of NiV strains from strains isolated different parts of Bangladesh, specifically inside and outside the Nipah belt, using hamsters.
- Comparison of transmissibility of NiV strains isolated different parts of Bangladesh,

specifically from inside and outside the Nipah belt, using hamsters.

Dr. Epstein will organize interactions between parties as needed.

The NIAID Project Scientist will monitor progress of the grant and be responsible for the normal scientific and programmatic stewardship of the award.

**Areas of Joint Responsibility:** Not applicable.

**Dispute Resolution:**

Any disagreements that may arise in scientific or programmatic matters (within the scope of the award) between award recipients and the NIH may be brought to Dispute Resolution. A Dispute Resolution Panel composed of three members will be convened. It will have three members: a designee of the Study Team chosen without NIH staff voting, one NIH designee, and a third designee with expertise in the relevant area who is chosen by the other two; in the case of individual disagreement, the first member may be chosen by the individual awardee. This special dispute resolution procedure does not alter the awardee's right to appeal an adverse action that is otherwise appealable in accordance with PHS regulation 42 CFR Part 50, Subpart D and DHHS regulation 45 CFR Part 16.

**From:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#)  
**To:** [Jon Epstein](#)  
**Subject:** RE: agreement to U01 structure  
**Date:** Friday, July 31, 2020 4:04:00 PM  
**Attachments:** [Terms of Cooperative agreement U01AI153420 Epstein FINAL CLEAN.docx](#)

---

Jon,

It is hard to believe but we are almost at the of fy2020. Which means is that your grant has to be awarded soon—finally. Here is the terms of award for U grant. I don't expect you find anything objectionable in this, but I thought to let you see it beforehand to make sure.

Do you have IACUC approval from Tufts?

Take care.

Sincerely,  
**Eunchung**

PH: (b) (6)  
(b) (6)

**From:** Jon Epstein (b) (6)  
**Sent:** Tuesday, May 12, 2020 10:26 AM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Subject:** agreement to U01 structure

Hi Eun-Chung,

As per our conversation, I agree to having my Nipah virus research grant structured as a U01 rather than an R01.

Cheers,

Jon

--

Jonathan H. Epstein DVM, MPH, PhD  
Vice President for Science and Outreach  
EcoHealth Alliance  
460 West 34th Street, Ste. 1701  
New York, NY 10001

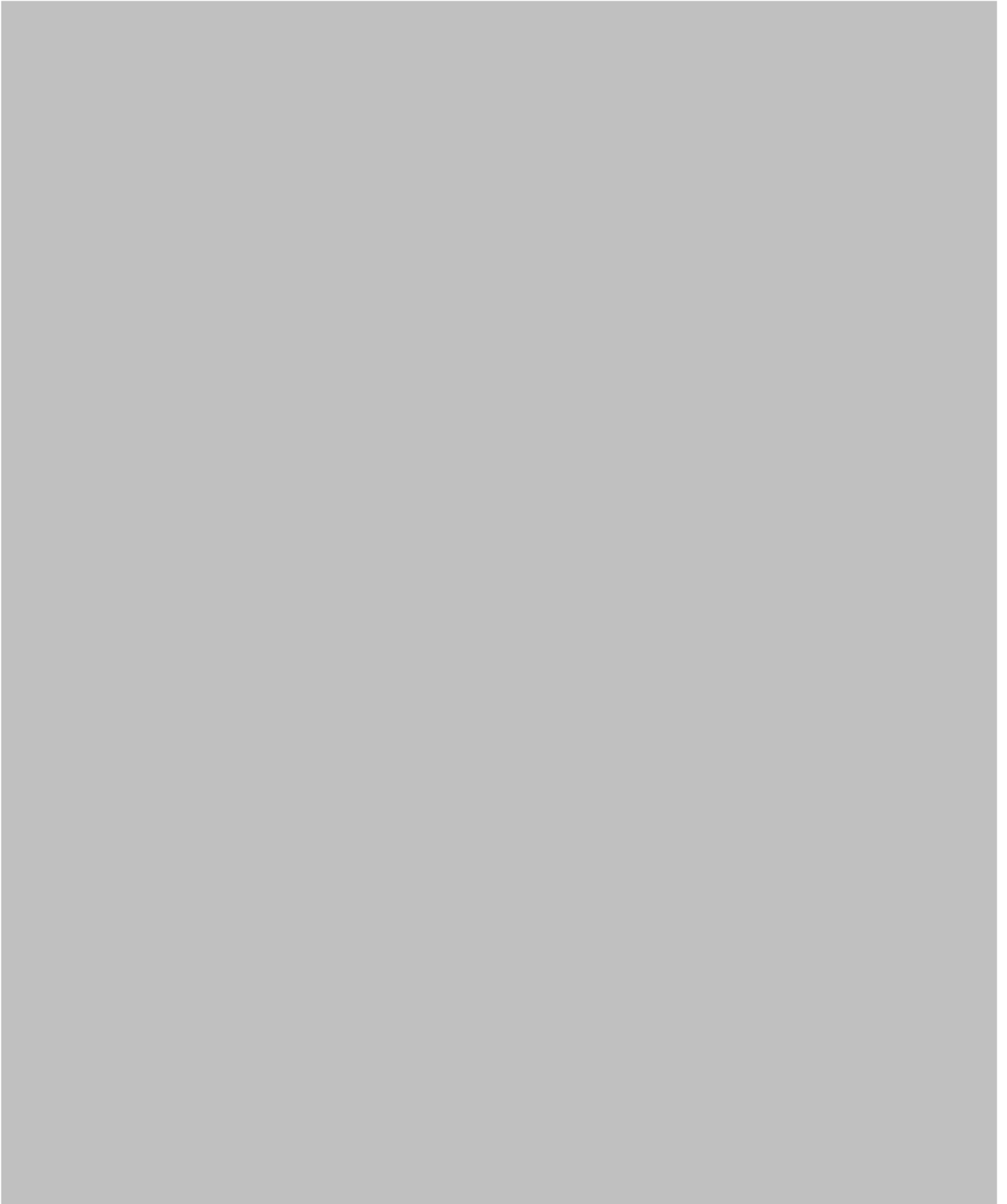
(b) (6) (direct)  
(b) (6) (mobile)

web: [ecohealthalliance.org](http://ecohealthalliance.org)

Twitter: [@epsteinjon](https://twitter.com/epsteinjon)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation*

**Terms and Conditions of Award: U01 AI153420-01**







**From:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#)  
**To:** [Mulach, Barbara \(NIH/NIAID\) \[E\]](#)  
**Cc:** [DMID GrantOps](#)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Date:** Friday, July 17, 2020 2:21:00 PM  
**Attachments:** [Terms of Cooperative agreement U01AI153420 Epstein \(003\) 7-17-2020 ecp.docx](#)

---

Added bullets.

Sincerely,  
*Eunchung*

PH: (b) (6)  
(b) (6)

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:59 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Eunchung,  
Thanks for the discussion. See attached for minor edits to the terms of award. Thanks for editing the information about Vince Munster's role. Once we have both pieces, I'll send it back to Dhana and hopefully we can finalize soon.

Barbara

---

**From:** Mulach, Barbara (NIH/NIAID) [E]  
**Sent:** Friday, July 17, 2020 1:28 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Yes, will do. I am on a call that should end around 2pm.

---

**From:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:25 PM  
**To:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Barbara,  
Thank you for sending this terms of award. When you have a chance, could you give me a call?  
Thank you.



Terms and Conditions of Award: U01 AI153420-01

(b) (5)





Sincerely,  
*Eunchung*

PH: (b) (6)  
(b) (6)

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:05 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Eunchung,  
Dhana in Grants Management has a few comments on the terms of award documents associated with the Epstein R01 to U01 conversion. Could you take a look at the attached documents and let us know if you are ok with the proposed terms of award? Also, can you help in clarifying the role of Vince Munster in the project?

If it would help to discuss by phone, just let me know.  
Thanks!  
Barbara

**From:** [Mulach, Barbara \(NIH/NIAID\) \[E\]](#)  
**To:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#)  
**Cc:** [DMID GrantOps](#)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Date:** Friday, July 31, 2020 3:00:56 PM  
**Attachments:** [FW Conversion to U01 Grant Number 1R01AI153420 - 01 PI Name EPSTEIN JONATHAN H.msg](#)

---

Hi Eunchung,

I sent the signed memo to GMP on July 22. See attached for the e-mail. What information do you need for the PI? Terms of award?

Thanks!

Barbara

---

**From:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Sent:** Thursday, July 30, 2020 7:45 PM  
**To:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Barbara,

Checking to see where this conversion is. If you have a document to share with the PI, could you share with me? Thank you.

Sincerely,  
*Eunchung*

PH: (b) (6)  
(b) (6)

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 2:30 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Thanks so much, Eunchung!

---

**From:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 2:21 PM  
**To:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Added bullets.

Sincerely,

**From:** Mulach, Barbara (NIH/NIAID) [E]  
**Sent:** Fri, 31 Jul 2020 18:59:08 +0000  
**To:** Mulach, Barbara (NIH/NIAID) [E]  
**Subject:** FW: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Attachments:** Epstein-Letter of Conversion R01 to U01AI153420 PDFee.pdf, Terms of Cooperative agreement U01AI153420 Epstein FINAL CLEAN.docx

---

**From:** Mulach, Barbara (NIH/NIAID) [E]  
**Sent:** Wednesday, July 22, 2020 12:30 AM  
**To:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6); Strickler-Dinglasan, Patricia (NIH/NIAID) [C] (b) (6)>  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Dhana,  
See attached for the signed memo and terms of award for the Epstein conversion. Dr. Erbeling signed at the top of the memo, I hope that's OK.

If you have questions or need anything else, just let us know.  
Thank you!  
Barbara

---

**From:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 3:25 PM  
**To:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6); Strickler-Dinglasan, Patricia (NIH/NIAID) [C] (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Barbara,

Thank you for the edits. Much appreciate if you can send me the signed memo with the terms and I will route it forward.

Yes, the second is ready for your review as well.

Thanks,  
Regards,  
Dhana

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 3:04 PM

**To:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6); Strickler-Dinglasan, Patricia (NIH/NIAID) [C]  
(b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Dhana,  
Since this is not a clinical trial, Eunchung and I made minor edits to the terms of award. Eunchung added bullets to expand on the role of Dr. Munster. Please let us know if this version will work for you or if you have any further edits.

I noticed that you also attached a document about a different conversion: **U01 AI153415-01**. Is this one ready for our review as well?

Thanks!  
Barbara

---

**From:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)  
**Sent:** Wednesday, July 15, 2020 9:51 AM  
**To:** Strickler-Dinglasan, Patricia (NIH/NIAID) [C] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Trish,

Appreciate if you can send the signed copy of the Conversion memo, there are no additional comments on that document. Attached are comments on the Terms and conditions for the two grants send forward.

Please let me know if you have any questions.

Thank you,  
Regards,  
Dhana

---

**From:** Strickler-Dinglasan, Patricia (NIH/NIAID) [C] (b) (6)  
**Sent:** Tuesday, June 23, 2020 9:59 AM  
**To:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Dhana,

Apologies for the additional delay. I have attached the drafts for the conversion memos and terms of award for conversion of 1R01AI153420-01 (Epstein) to the U01 mechanism. Please let us know if you have any edits.

Thank you,  
*Trish*

Patricia M. Strickler-Dinglasan, PhD [C]

Skype: (b) (6)

---

**From:** Strickler-Dinglasan, Patricia (NIH/NIAID) [C] (b) (6)

**Sent:** Wednesday, June 17, 2020 8:48 AM

**To:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)

**Cc:** DMID GrantOps (b) (6)

**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Dhana,

We are working on this one (and another one) and will get both to you in the next day or so.

Thank you,

Trish

---

**From:** Khurana, Dhana (NIH/NIAID) [E] (b) (6)

**Sent:** Wednesday, June 17, 2020 7:47 AM

**To:** DMID GrantOps (b) (6)

**Subject:** Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Karen,

Any update on the conversion documents? Appreciate if we can get these at the earliest.

Thank you,

Regards,

Dhana

Vandhana Khurana, MBA

Chief, Branch B

National Institute of Allergy and Infectious Diseases

5601 Fishers Lane, Room 4E31, MSC 9824

Bethesda, MD 20892-9824

P: (b) (6)

Fax: 301-493-0597

email: (b) (6)

NIAID, National Institutes of Health, DHHS

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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institutes of Health  
National Institute of Allergy  
and Infectious Diseases  
Bethesda, Maryland 20892

Date: July 17, 2020

To: Extramural Program Policy Officer, OEP, OER, OD, NIH

Through: Dr. Matthew Fenton, Director, Division of Extramural Activities (DEA), NIAID

Through: Ms. Emily Linde, Director, Grants Management Program (GMP), DEA, NIAID

Through: Dr. Andrea Wurster, Policy and Operations Officer, OERPO, DEA, NIAID

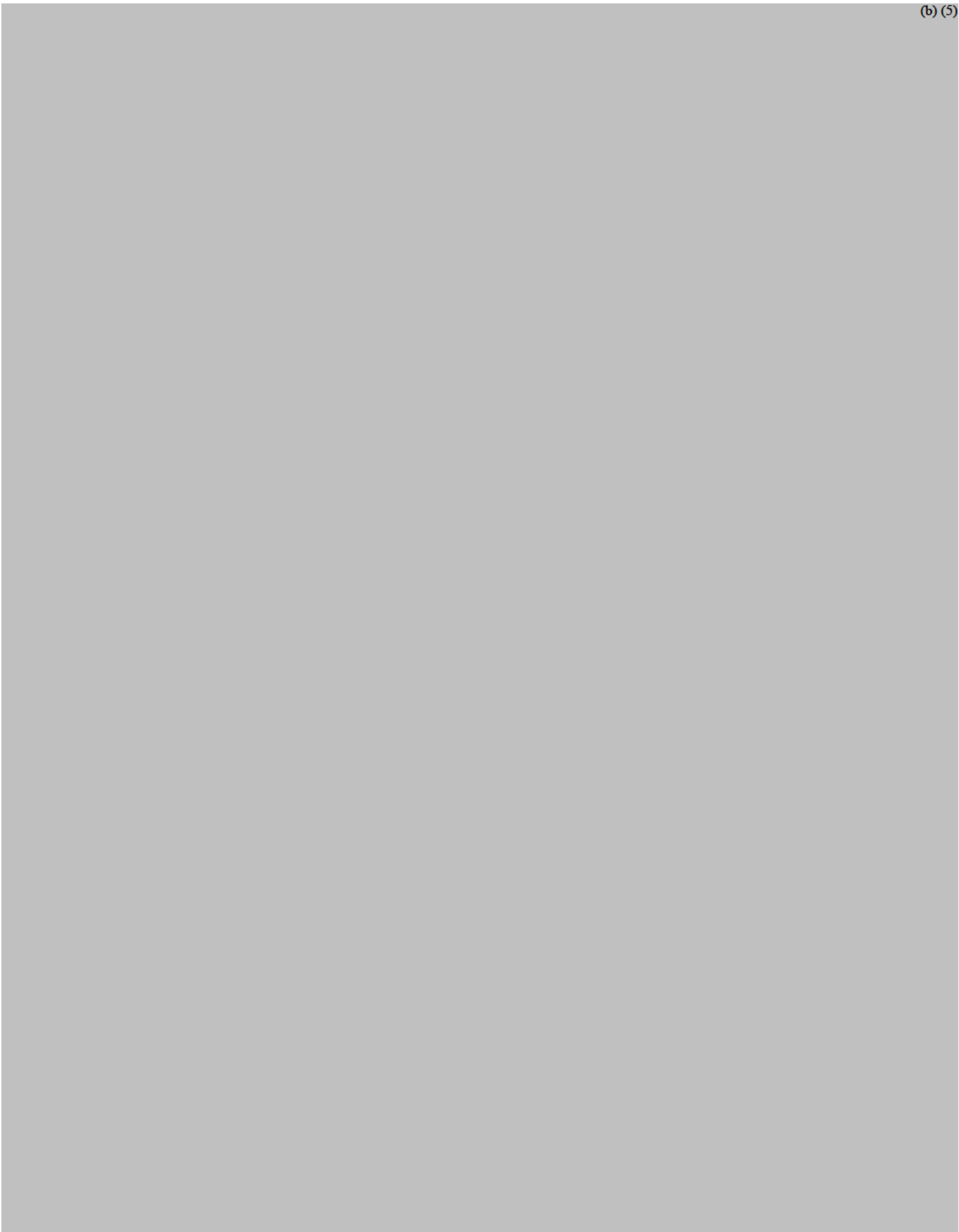
Through: Dr. Emily Erbelding, Director, Division of Microbiology and Infectious Diseases (DMID),  
NIAID  
Emily J. Erbelding -S  
Digitally signed by Emily J.  
Erbelding -S  
Date: 2020.07.21 13:42:07 -04'00'

From: Dr. Eun-Chung Park, Program Officer, DMID, NIAID

SUBJECT: Conversion of R01 to Cooperative Agreement U01 Mechanism: 1R01 AI153420-01

(b) (5)







**Terms and Conditions of Award: U01 AI153420-01**

(b) (5)





*Eunchung*

PH: (b) (6)  
(b) (6)

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:59 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6) >  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Eunchung,

Thanks for the discussion. See attached for minor edits to the terms of award. Thanks for editing the information about Vince Munster's role. Once we have both pieces, I'll send it back to Dhana and hopefully we can finalize soon.

Barbara

---

**From:** Mulach, Barbara (NIH/NIAID) [E]  
**Sent:** Friday, July 17, 2020 1:28 PM  
**To:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Yes, will do. I am on a call that should end around 2pm.

---

**From:** Park, Eun-Chung (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:25 PM  
**To:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Barbara,

Thank you for sending this terms of award. When you have a chance, could you give me a call?  
Thank you.

Sincerely,  
*Eunchung*

PH: (b) (6)  
(b) (6)

---

**From:** Mulach, Barbara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 17, 2020 1:05 PM

**To:** Park, Eun-Chung (NIH/NIAID) [E] [REDACTED] (b) (6)

**Cc:** DMID GrantOps [REDACTED] (b) (6)

**Subject:** Conversion to U01 Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Hi Eunchung,

Dhana in Grants Management has a few comments on the terms of award documents associated with the Epstein R01 to U01 conversion. Could you take a look at the attached documents and let us know if you are ok with the proposed terms of award? Also, can you help in clarifying the role of Vince Munster in the project?

If it would help to discuss by phone, just let me know.

Thanks!

Barbara

**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Aleksei Chmura](#)  
**Cc:** [Dr. Jon Epstein](#); [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#); [Emily Hagan](#)  
**Subject:** RE: Cooperative Agreement Terms of Award for Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H  
**Date:** Friday, August 7, 2020 8:15:25 AM

---

Thank you,

Please get me the JIT documents ASAP.

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

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**From:** Aleksei Chmura (b) (6)  
**Sent:** Friday, August 7, 2020 8:14 AM  
**To:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Dr. Jon Epstein (b) (6); Park, Eun-Chung (NIH/NIAID) [E] (b) (6); Emily Hagan (b) (6)  
**Subject:** Re: Cooperative Agreement Terms of Award for Grant Number: 1R01AI153420 - 01 PI Name: EPSTEIN, JONATHAN H

Dear Shaun,

Apologies for our delayed response. On behalf of the PI Dr. Epstein and EcoHealth Alliance, I confirm and accept the updated terms and conditions of our proposed award now converted into a U01 Cooperative Agreement.

Sincerely,

-Aleksei

**Aleksei Chmura, PhD**  
Chief of Staff

EcoHealth Alliance

520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(b) (6) (mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

On Aug 5, 2020, at 12:52, Gratton, Shaun (NIH/NIAID) [E] (b) (6) wrote:

Hello Aleksei,

We are working on converting the R01 application for the grant referenced above in to a U01 Cooperative Agreement due to the substantial intramural involvement. Please review the attached terms and conditions of award and provide EcoHealth's acceptance.

Please respond by COB 8/6/2020

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

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<Terms of Cooperative agreement U01AI153420 Epstein FINAL CLEAN.pdf>



**From:** [Hongying Li](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the University of North Carolina at Chapel Hill  
**Date:** Tuesday, January 26, 2021 7:41:12 PM  
**Attachments:** [UNC EID SEARCH CONTRACT FINAL SIGNED.pdf](#)

---

Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (14th January 2021) subaward agreement with the University of North Carolina at Chapel Hill under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



## CONTRACT AGREEMENT

NAME: The University of North Carolina at Chapel Hill

ADDRESS: 104 Airport Dr Suite 2200  
Campus Box 1350  
Chapel Hill, NC 27599-1350

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 608195277

AGREEMENT AMOUNT: \$194,375.00

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and the University of North Carolina at Chapel Hill.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between the University of North Carolina at Chapel Hill and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed according to the Disbursement of Funds section below and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, the University of North Carolina at Chapel Hill agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** The University of North Carolina at Chapel Hill agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

The University of North Carolina at Chapel Hill's directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and the University of North Carolina at Chapel Hill.

3. **Support for Acts of Terror:** The University of North Carolina at Chapel Hill certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that the University of North Carolina at Chapel Hill does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** The University of North Carolina at Chapel Hill certifies and represents that no Significant Financial Conflict of Interest exists regarding PI Ralph Baric participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all named personnel related to this project.
5. **Federal Funding Accountability and Transparency Act:** The University of North Carolina at Chapel Hill agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for

publication on applicable US government websites. The University of North Carolina at Chapel Hill shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.

6. **Non-Discrimination Policy:** The University of North Carolina at Chapel Hill will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

The University of North Carolina at Chapel Hill acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on reasonable request, the University of North Carolina at Chapel Hill will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a thirty (30) business day written notice if it determines that the University of North Carolina at Chapel Hill fails to comply with the conditions stated in section II of this contract and the University of North Carolina at Chapel Hill has not cured such breach within the thirty (30) day period. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay the University of North Carolina at Chapel Hill for all approved expenses and non-cancellable obligations made prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, the University of North Carolina at Chapel Hill agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, the University of North Carolina at Chapel Hill agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. The University of North Carolina at Chapel Hill also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for the University of North Carolina at Chapel Hill's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and the University of North Carolina at Chapel Hill or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, the University of North Carolina at Chapel Hill remains a distinct and separate legal entity from that of EcoHealth Alliance.

The University of North Carolina at Chapel Hill agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities.

#### V. REPORTING REQUIREMENTS

The University of North Carolina at Chapel Hill agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to the University of North Carolina at Chapel Hill herein. The University of North Carolina at Chapel Hill shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to the University of North Carolina at Chapel Hill an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. The University of North Carolina at Chapel Hill is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

The Parties may communicate to one another information of a proprietary nature that is directly related to the Scope of Work ("Confidential Information"). "Disclosing Party" means the Party providing Confidential Information to the other Party, and "Receiving Party" means the Party receiving Confidential Information. The Receiving Party shall neither use nor disclose Confidential Information except as permitted herein during the term of the agreement and for five (5) years thereafter. The Parties shall disclose only the portion of Confidential Information necessary to conduct the Study. Confidential Information shall be disclosed in writing and identified as such, or if disclosed orally, shall be reduced to writing within thirty (30) days thereafter. The definition of Confidential Information does not include information is (i) at the time of disclosure, is in the public domain, or later becomes part of the public domain; (ii) was received by the Receiving Party from a third Party; (iii) was independently developed by Receiving Party; (iv) is approved for release by the Disclosing Party; (v) was in Receiving Party's possession at the time of disclosure; or (vi) is required to be disclosed pursuant to law, regulation, or a court order.

## VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include scheduled visits to the University of North Carolina at Chapel Hill by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

## IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. The University of North Carolina at Chapel Hill shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. The University of North Carolina at Chapel Hill should attach a transaction report needed to substantiate any out-of-pocket expenses.
2. The University of North Carolina at Chapel Hill must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to the University of North Carolina at Chapel Hill in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by the University of North Carolina at Chapel Hill.
5. The University of North Carolina at Chapel Hill acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to the University of North Carolina at Chapel Hill.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to the University of North Carolina at Chapel Hill. The legal name of the University of North Carolina at Chapel Hill, who must be the sole owner of the account, must appear on the account. The University of North Carolina at Chapel Hill shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	University of North Carolina at Chapel Hill
<b>Bank Name:</b>	Bank of America
<b>Bank Address:</b>	104 E. Main Street, Carboro, NC 27510
<b>Account Number:</b>	(b) (6). (b) (4)
<b>ABA Code:</b>	(b) (6). (b) (4)
<b>Bank Telephone:</b>	1-888-715-1000, Ext 21598

When a transfer is initiated EcoHealth Alliance will include (b) (6). (b) (4) in the message and notify:

Dawn DiLello, Cash Manager  
Office of Sponsored Research

Phone: (b) (6) Fax: 919-962-5011  
Email: (b) (6)

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, the University of North Carolina at Chapel Hill agrees to adhere to all requirements contained in 2 CFR Part 200 – Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards during the term of the agreement. The University of North Carolina at Chapel Hill acknowledges responsibility for Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current single audit report as may be provided. The University of North Carolina at Chapel Hill agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. The University of North Carolina at Chapel Hill shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, the University of North Carolina at Chapel Hill will provide EcoHealth Alliance with a copy of a most current audit report. The University of North Carolina at Chapel Hill agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by the University of North Carolina at Chapel Hill for three (3) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of the University of North Carolina at Chapel Hill insofar as they relate to activities supported by this agreement. All audits, inspections, and examinations must be reasonably requested, scheduled at least seven (7) business days in advance to occur during normal business hours, and are conducted at the sole expense of EcoHealth Alliance.

The University of North Carolina at Chapel Hill budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate as applicable, date, and amount
2. Purchased services (e.g., field asst., boat hire) – detailed at the level of numbers 1 & 2, above. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both University of North Carolina at Chapel Hill and EHA or responsible party.
3. Vehicle associated costs – mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both University of North Carolina at Chapel Hill and EHA or responsible party.
4. Travel – trip cost indicating departure/arrival dates and air/car/train/boat costs along with all boarding passes and receipts.
5. Accommodation – location and amounts per person along with all lodging receipts.
6. Other – any other items that do not fall into the categories above with same level of detail.

The University of North Carolina at Chapel Hill shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of The University of North Carolina.

#### XII. UNUSED FUNDS

The University of North Carolina at Chapel Hill agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. The University of North Carolina at Chapel Hill may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both University of North Carolina at Chapel Hill and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With forty-five (45) days written notification either party may terminate the Agreement without cause and cancel all unpaid installments of the agreement. EcoHealth may require the University of North Carolina at Chapel Hill to repay all portions of the agreement that are unobligated and reasonably within the University of North Carolina at Chapel Hill's control. EcoHealth Alliance agrees to pay the University of North Carolina at Chapel Hill all reasonable and non-cancelable obligation incurred by the University of North Carolina at Chapel Hill up to the effective date of termination.

In addition, either party may terminate the Agreement for cause upon thirty (30) days written notice to the other party of an uncured breach, if the other party has breached the Agreement and has not cured such breach within the thirty (30) day period. EcoHealth may require the University of North Carolina at Chapel Hill to repay all portions of the agreement that are unobligated and reasonably within the University of North Carolina at Chapel Hill's control. EcoHealth Alliance agrees to pay the University of North Carolina at Chapel Hill all reasonable and non-cancelable obligation incurred by the University of North Carolina at Chapel Hill up to the effective date of termination.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, the University of North Carolina at Chapel Hill also accepts full responsibility for any and all applicable insurance needs to the extent permitted by the North Carolina Tort Claims Act for themselves and all other University of North Carolina at Chapel Hill, project related personnel, unless a separate arrangement has been made between EcoHealth Alliance and the University of North Carolina at Chapel Hill. By signing this agreement, both the University of North Carolina at Chapel Hill and EcoHealth Alliance relieve the other party from any and all liability due to accident or injury, or any other claims that may result from any activities conducted by the University of North Carolina at Chapel Hill in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to the University of North Carolina at Chapel Hill.



## XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)

(e) (b) (6)

## XVII. INDEMNIFICATION

The University of North Carolina at Chapel Hill and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional and/or negligent acts, errors or omissions of the University of North Carolina at Chapel Hill or EcoHealth Alliance to the extent permitted by the North Carolina Tort Claims Act.

## XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

## XIX. Biosafety

### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



\_\_\_\_\_  
Dr. Peter Daszak  
President  
EcoHealth Alliance



\_\_\_\_\_  
for Terry Magnuson, PH.D.  
Vice Chancellor for Research  
The University of North Carolina at Chapel Hill

01/14/2021

DATE

01/13/2021

DATE

**ATTACHMENT A: FFATA**

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In the University of North Carolina at Chapel Hill's business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in the University of North Carolina at Chapel Hill's business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## ATTACHMENT B: Scope of Work

Under the supervisor of Dr. Ralph Baric, Co-Investigator, coordinated by Dr. Timothy Sheahan, Research Scientist and Lab Coordinator, working close with a lab technician (TBN) the laboratory work will be implemented at the University of North Carolina at Chapel Hill to conduct systematic studies on the epidemiology, genetic evolution, interspecies infection mechanism and pathogenesis of a series of bat-borne CoVs, including:

- ***In vitro* Infection Experiment.** In vitro infection experiments using pseudoviruses carrying the spike proteins (wild type or mutants) or live viruses in cell lines of different origins, binding affinity assays between the spike proteins (wild type or mutants) and different cellular receptor molecules, and humanized mouse experiments.
- **Developing Luciferase Immunoprecipitation System (LIPS) Assay.** Develop LIPS assay for bat CoV antibody detection.
- **The Enzyme-Linked Immunosorbent Assay (ELISA) Testing.** Serological testing of bat serum samples with ELISA plates.
- **Meetings and travels.** Dr. Baric and lab team members will meet with other Co-PIs from EcoHealth Alliance and partners to refine study protocols, report results, and prepare publications

Coronaviruses (e.g. SARS-CoV, MERS-CoV), henipaviruses (HeV, NiV) and filoviruses (EBOV, MARV) are highly pathogenic viruses which emerged from zoonotic reservoirs to cause significant human morbidity and mortality. Like most emerging zoonoses, these pathogens originate in wildlife reservoirs, sometimes spilling over first into livestock 'amplifier' hosts, or directly into localized human populations with high levels of animal contact. Efforts to prevent emerging zoonoses have targeted these high-risk populations in regions prone to disease emergence, coupled with rapid surveillance systems designed to rapidly identify newly emerged virus pathogens in human outbreak settings. However, surveillance and control is hampered by inadequate information on the basic disease ecology, the availability of human cohorts at the interface between wildlife and human habitats, and cohorts of individuals in high-risk sites for secondary disease amplification and spread to sites around the world.

Dr. Baric will lead the studies at the University of North Carolina at Chapel Hill. He will design research strategies, interpret findings and review research outcomes with another investigator and Mr. Yount. At a regular basis, Dr. Baric will report the results of the team's research to Dr. Daszak, and together, they will use this information to identify additional research priorities and design downstream studies. Drs. Daszak and Baric have published together in the past and participated on research project applications. He will work closely with another investigator and Tse and Mr. Yount to prepare timely reports, share research and discuss future research directions with the group.

**ATTACHMENT C: PROJECT BUDGET**

YEAR 1		
SALARY		17 JUN 2020 - 31 MAY 2021 (b) (6), (b) (4)
Ralph Baric	Co-Investigator	
TBD	Co-Investigator	
Boyd Yount	Research Asst.	
Long Ping Victor Tse	Lab Tech	
TOTAL SALARY		\$ 70,189.00
FRINGE	30.95%	\$ 21,726.00
TOTAL SALARY + FRINGE		\$ 91,915.00
TRAVEL		
Domestic		\$ 1,000.00
International		\$ -
TOTAL TRAVEL		\$ 1,000.00
OTHER DIRECT COSTS		
Materials & Supplies		\$ 30,585.00
Publication Costs		\$ 500.00
Animal Housing		\$ 1,000.00
TOTAL OTHER DIRECT COSTS		\$ 32,085.00
TOTAL DIRECT		\$ 125,000.00
INDIRECT	55.50%	\$ 69,375.00
TOTAL		\$ 194,375.00

**From:** [Hongying Li](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)  
**Date:** Friday, December 18, 2020 8:54:21 AM  
**Attachments:** [CU EID-SEARCH CONTRACT Y1 Signed FINAL.PDF](#)

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Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (12th December 2020) subaward agreement with Chulalongkorn University (Thailand) under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



# EcoHealth Alliance

## CONTRACT AGREEMENT

NAME: WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University

ADDRESS: Rama IV Road, Bangkok, 10330 Thailand

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 659808836

AGREEMENT AMOUNT: \$215,944.56

This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Chulalongkorn University.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Chulalongkorn University and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Chulalongkorn University agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Chulalongkorn University agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Chulalongkorn University's directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Chulalongkorn University.

3. **Support for Acts of Terror:** Chulalongkorn University certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that Chulalongkorn University does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** Chulalongkorn University certifies and represents that no Significant Financial Conflict of Interest exists regarding PI Ralph Baric participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Chulalongkorn University agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US



government websites. Chulalongkorn University shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.

6. **Non-Discrimination Policy:** Chulalongkorn University will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Chulalongkorn University acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Chulalongkorn University will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Chulalongkorn University fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Chulalongkorn University for all approved expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Chulalongkorn University agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Chulalongkorn University agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Chulalongkorn University also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Chulalongkorn University's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Chulalongkorn University or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Chulalongkorn University remains a distinct and separate legal entity from that of EcoHealth Alliance.

Chulalongkorn University agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They

also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

Chulalongkorn University agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to Chulalongkorn University herein. Chulalongkorn University shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to Chulalongkorn University an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. Chulalongkorn University is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined by EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Chulalongkorn University by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Chulalongkorn University shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Chulalongkorn University should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Chulalongkorn University must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.



3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Chulalongkorn University in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Chulalongkorn University.
5. Chulalongkorn University acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Chulalongkorn University.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Chulalongkorn University. The legal name of Chulalongkorn University, who must be the sole owner of the account, must appear on the account. Chulalongkorn University shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	<b>Chula Unisearch, Chulalongkorn University</b>
<b>Bank Name:</b>	<b>Bangkok Bank Public Company Limited (BBL)</b>
	<b>394 Rama 1 Rd. Phatumwan Bangkok 10330 Thailand</b>
<b>Branch:</b>	<b>Siam Square</b>
<b>Account Number:</b>	(b) (6), (b) (4)
<b>Swift code:</b>	(b) (6), (b) (4)

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Chulalongkorn University agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Chulalongkorn University acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Chulalongkorn University agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. Chulalongkorn University shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, Chulalongkorn University will provide EcoHealth Alliance with a copy of a most current audit report. Chulalongkorn University agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Chulalongkorn University for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Chulalongkorn University insofar as they relate to activities supported by this agreement.

Chulalongkorn University budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.
8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Chulalongkorn University shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance’s principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. Chulalongkorn University agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

Chulalongkorn University agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. Chulalongkorn University may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both University of North Carolina at Chapel Hill and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION



With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Chulalongkorn University to repay all portions of the agreement that are within Chulalongkorn University's control. In addition, EcoHealth Alliance may require Chulalongkorn University to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Chulalongkorn University has failed to perform any of the terms of this agreement; and
4. Chulalongkorn University in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Chulalongkorn University also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel, unless a separate arrangement has been made between EcoHealth Alliance and Chulalongkorn University. By signing this agreement, Chulalongkorn University relieves EcoHealth Alliance from any and all liability due to accident or injury, or any other claims that may result from any activities conducted by Chulalongkorn University in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Chulalongkorn University.

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All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)  
(e) (b) (6)

#### XVII. INDEMNIFICATION

Chulalongkorn University and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action including



attorney's whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional and/or negligent acts, errors or omissions of Chulalongkorn University or EcoHealth Alliance to the extent permitted by applicable law.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18eh1/CDC%20Biosafety%20Guidelines.pdf?dl=0>

##### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.



Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Chulalongkorn University for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



\_\_\_\_\_  
Dr. Peter Daszak  
President, EcoHealth Alliance

\_\_\_\_\_  
10 December 2020  
DATE



\_\_\_\_\_  
(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University  
Grants Manager & Team Lead, Chulalongkorn University



\_\_\_\_\_  
12 December 2020  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

Please answer the following questions Yes or No.

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Chulalongkorn University's business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Chulalongkorn University's business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No





## ATTACHMENT B: Scope of Work Year 1 (17 June 2020 – 31 May 2021)

Under this contract, supervised and coordinated by the co-Investigators Dr. Supaporn Wacharapluesadee and Dr. Thiravat Hemachudha, the Thai Red Cross Emerging Infectious Diseases Health Science Centre (TRC-EID), Chulalongkorn Hospital, Faculty of Medicine, Chulalongkorn University will:

- 1. Work with the EID-SEARCH global team to develop work plan to:**
  - 1.1 Identify the surveillance sites for animal, human community, and hospital syndromic study
    - Work with the modelling team at EHA to identify the surveillance sites, targeted animal species, targeted sample sizes, for Coronaviruses, Paramyxoviruses, and Filoviruses.
  - 1.2 Develop protocol and questionnaires for community and hospital syndromic surveillance
  - 1.3 Pilot the questionnaire in country and provide feedbacks
- 2. Obtain local research approval document including:**
  - 2.1 Chulalongkorn University Animal Care and Use Protocol (CU-ACUP) approval for animal investigation
  - 2.2 Institutional Review Board (IRB) approval for human subject research
  - 2.3 Institutional Biosafety Committee (IBC) approval for lab work
  - 2.4 Permissions for animal capture
- 3. Laboratory testing**
  - 3.1 Full genome characterization of previously identified CoVs in animals. This could also include full Spike protein sequencing for CoVs (e.g. if full genome capture doesn't work) (n=10-20)
  - 3.2 Investigations of archived specimens from undiagnosed human infections available at Chula WHO-CC by performing available PCR and/or serological testing (n>100) for coronaviruses, influenza, filoviruses, and paramyxoviruses or NGS.
  - 3.3 For newly collected animal specimens, if applicable, complete viral family PCR testing of coronaviruses, influenza, filoviruses, paramyxoviruses and conduct DNA barcoding for confirmation of field species identification as necessary on a subset of the specimens.
  - 3.4 Collaborating with EID-SEARCH partner for the validation of newly developed serological assays.
- 4. Conduct scoping survey and initial wild animal surveillance at selected sites**
  - 4.1 Scoping survey on human-animal interfaces at selected site, and possibly pilot the questionnaire in Ratchaburi province (one site)
  - 4.2 Start initial specimen collection from bat, rodent, and macaque individuals (1 rectal swab + 1 swab/individual) in the province of Ratchaburi (one site; 300 animals including 100 each of bat, rodent and macaque).
- 5. Results and data sharing, analysis, reporting**
  - 5.1 Sharing of specimens will ONLY be possible for diagnostic purposes when capacity is not available in Thailand, or when it's part of the capacity building and training program.
  - 5.2 Participate in the CREID Working Group discussions and work with EID-SEARCH global team to develop data management and sharing policies.
  - 5.3 Maintain current contacts to whom results will be reported at in-country government ministries responsible for human health, livestock/agriculture, and wildlife.
  - 5.4 Collaborate with the EID-SEARCH global team for data cleaning, analysis, interpretation and contribute to scientific publications as agreed.

- 5.5 Complete the following programmatic and financial reporting by requested deadlines:
- Annual reports to NIAID
  - Quarterly invoices and financial reports
  - Other reports requested by NIAID
- 5.6 Reach out to communities and present appropriately available findings and public health information

**6. Communication**

- 6.1 Participate on calls with the EID-SEARCH global team at EHA as requested; hold regular team calls as agreed.
- 6.2 Represent EID-SEARCH on planning and other relevant meetings.

**7. Project Timeline**

ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.4.a. sampling targets																				
1.4.b. sample size justifications																				
1.4.c. sample collection & testing																				
1.4.d. NGS																				
1.4.e. sequencing Spike GP																				
1.5.a. human cell infection																				
1.5.b. receptor binding																				
1.5.c. host-pathogen dynamics																				
1.5.d. viral strain prioritization																				
1.5.e. animal models																				
2.4 target population & sample sizes																				
2.5 community data collection																				
2.6.a serological testing																				
2.6.b RT-PCR testing																				
2.6.c virus characterization																				
2.7 epidemiological analysis																				
3.4.a cohort selection																				
3.4.b clinic enrollment & follow-up																				
3.4.c clinical data collection																				
3.5 sample testing																				
3.6 risk characterization																				
annual meeting																				

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**ATTACHMENT C: PROJECT BUDGET**

<b>Items</b>	
<b>Personnel</b>	\$55,666.67
<b>Travel</b>	
1. Site scoping / pilot questionnaire for community study	\$10,780.00
2. Animal sampling	\$16,551.00
<b>Diagnosis</b>	
1. Full genome characterization of archived CoV positive animal specimens (NGS)	\$32,391.00
2. Investigation of undiagnosed archived human specimens (family PCR and NGS)	\$21,560.00
3. Animal study (300 animals x 1 site) 3 viral families	\$63,000.00
<b>Total direct cost</b>	199,948.67
<b>Indirect cost (8%)</b>	\$15,995.89
<b>Total</b>	\$215,944.56

**Financial arrangements**

	<b>Deliverable</b>	<b>Amount</b>
1	Countersigned Contract	\$25,000.00
2	Progress Report-1	\$110,000.00
3	Progress Report-2	\$55,944.56
4	Annual Report	\$25,000.00





POWER OF ATTORNEY

August 3, 2020

We, Chulalongkorn University represented by Professor Dr. Bundhit Eua-arporn, President of Chulalongkorn University, do hereby empower Dr. Supichai Tangjaitrong, Managing Director of Chula Unisearch, Chulalongkorn University, to be authorized lawful attorney to represent the organization for submission of "WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University" including any acts performed under this circumstance.

Signed  Principal

(Professor Bundhit Eua-arporn, Ph.D.)  
President  
Chulalongkorn University

Signed  Attorney

(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University

Signed  Witness

(Mr. Torsak Purksaritanont)  
Manager  
Department of Office Administration

Signed  Witness

(Mrs. Kitiya Jumpa)  
Legal Officer

(b) (6)



(b) (6)

ect

This IL

**From:** [Hongying Li](#)  
**To:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#); [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Aleksiej Chmura](#); [Peter Daszak](#); [Su Yadana](#)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the The Henry M. Jackson Foundation for the Advancement of Military Medicine  
**Date:** Tuesday, February 23, 2021 11:38:26 AM  
**Attachments:** [HJF EID-SEARCH Contract\\_Y1 Final - signed.pdf](#)

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Good Morning Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (23th February 2021) subaward agreement with The Henry M. Jackson Foundation for the Advancement of Military Medicine/Uniformed Services University under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



### CONTRACT AGREEMENT

NAME: The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

ADDRESS: 6720-A Rockledge Drive, Suite 100, Bethesda, Maryland, 20817

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 144676566

AGREEMENT AMOUNT: \$114,372.02

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

#### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.



## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

3. **Support for Acts of Terror:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represents that no Significant Financial Conflict of Interest exists regarding Dr. Christopher Broder participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.

5. **Federal Funding Accountability and Transparency Act:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.
6. **Non-Discrimination Policy:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a -thirty (30) business day written notice if it determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. fails to comply with the conditions stated in this contract and fails to cure such breach after an additional thirty (30) business day written notice to cure. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for all incurred and non-cancellable expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s use of EcoHealth Alliance contract funds.

Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. remains a distinct and separate legal entity from that of EcoHealth Alliance

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. herein. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. , during business hours and with advanced written notice and

approval by HJF, by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. 30 days net of invoice..
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.
5. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 60-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. The legal name of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., who must be the sole owner of the account, must appear on the account. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	The Henry M. Jackson Foundation Operating Account
<b>Bank Name:</b>	Bank of America
<b>Bank Address:</b>	730 15 <sup>th</sup> Street, NW, Washington, DC 20005
<b>Account Number:</b>	(b) (6), (b) (4)
<b>ABA Code:</b>	(b) (6), (b) (4)
<b>Bank Telephone:</b>	XXXXXXXXXX

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide EcoHealth Alliance with a copy of a most current audit report. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at a mutually agreeable time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. insofar as they relate to activities supported by this agreement.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount
2. Field Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with detailed and regular financial reports for all field equipment items.
3. Purchased services (e.g., field asst., boat hire) – detailed at the level of numbers 1 & 2, above. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
4. Vehicle associated costs – mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
5. Travel – trip cost indicating departure/arrival dates and air/car/train/boat costs along with all boarding passes and receipts.
6. Accommodation – location and amounts per person along with all lodging receipts.
7. Other – any other items that do not fall into the categories above with same level of detail.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order at EcoHealth Alliance's expense. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if, for cause, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. has materially failed to perform any of the terms of this agreement; and
4. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for, HJF employees unless a separate arrangement has been made between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)  
(e) (b) (6)

#### XVII. LIABILITY

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance hereby mutually agree to be liable for their own negligent acts, errors or omissions EcoHealth acknowledges that the Principal Investigator for this award is Dr. Christopher Broder, who is employed by the United States Government with his office located at the Uniformed Services University of Health Sciences. For the avoidance of doubt, it is understood and agreed that no third parties, including government personnel, are agents of HJF or authorized to legally bind HJF for any purpose. To the extent authorized under the provisions of the Federal Tort Claims Act, including 28 U.S.C. sections 2671-2680, the United States Government will be liable for any loss, claim, damage, or expense caused by the negligent or wrongful act or omission of any employee of the Department of Defense or any member of the United States Armed Forces while acting within the scope of his or her office or employment.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by

an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

#### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



---

Dr. Peter Daszak  
President, EcoHealth Alliance

**Yongkang Qiu**

Digitally signed by Yongkang Qiu  
DN: dc=org, dc=hjf, dc=ad, ou=HQ, ou=Users,  
ou=Research Administration, ou=OSP,  
cn=Yongkang Qiu, email=yqiu@hjff.org  
Date: 2021.02.22 13:33:47 -05'00'

---

Yongkang Qiu  
Grants Manager  
Research Administration  
The Henry M. Jackson Foundation for the  
Advancement of Military Medicine, Inc.



Feb 23, 2021  
DATE

2/22/2021  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor and coordination of Co-Investigators Dr. Christopher Broder and Dr. Eric Laing, working close with the post-doctoral associate, the work will be implemented at The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. on the epidemiology and characterization of a series of coronaviruses (CoVs), paramyxoviruses (PMVs – particularly Henipaviruses) and filoviruses (FVs), including:

- Develop molecular and serology platforms for lab diagnostics of collected human and animal samples, including the generation of reagents for novel assays;
- Provide training to Thailand and Malaysia laboratory staff for technology transfer and serological and molecular protocols;
- Collaborate with the EID-SEARCH global team for data analysis, interpretation and contribute to scientific publications as agreed;
- Participate calls with the CREID network, and communicate regularly with EID-SEARCH global team at EHA as agreed;
- Contribute to the annual report and other programmatic report requested by NIAID;
- Represent EID-SEARCH on planning and other relevant meetings;
- Complete quarterly invoices and/or financial reports

**ATTACHMENT C: PROJECT BUDGET**

SALARY		Y1
Christopher Broder	Co-Investigator	(b) (6), (b) (4)
Eric Laing	Co-Investigator	
TBD	Research Asst.	
<b>TOTAL SALARY</b>		\$ 5,400.00
FRINGE	30.76%	\$ 1,660.99
<b>TOTAL SALARY + FRINGE</b>		\$ 7,060.99
TRAVEL		
Domestic		\$ 3,500.00
International		\$ 18,500.00
<b>TOTAL TRAVEL</b>		\$ 22,000.00
OTHER DIRECT COSTS		
Materials & Supplies		\$ 41,439.00
AKTA Service Contract		\$ 4,500.00
<b>TOTAL OTHER DIRECT COSTS</b>		\$ 45,939.00
<b>TOTAL DIRECT</b>		\$ 74,999.99
INDIRECT	30.45%	\$ 22,837.50
G&A	16.90%	\$ 16,534.53
<b>TOTAL</b>		\$ 114,372.02

# HJF EID-SEARCH Contract\_v2 Clean version (008) final

Final Audit Report

2021-02-23

Created:	2021-02-23
By:	Hongying Li (b) (6)
Status:	Signed
Transaction ID:	(b) (6)

## "HJF EID-SEARCH Contract\_v2 Clean version (008) final" History

-  Document digitally presigned by Yongkang Qiu (b) (6)  
2021-02-22 - 6:33:47 PM GMT- IP address: 160.39.50.243
-  Document created by Hongying Li (b) (6)  
2021-02-23 - 4:02:24 AM GMT- IP address: 160.39.50.243
-  Document emailed to Peter Daszak (b) (6) for signature  
2021-02-23 - 4:04:15 AM GMT
-  Email viewed by Peter Daszak (b) (6)  
2021-02-23 - 4:04:17 AM GMT- IP address: 66.249.91.177
-  Document e-signed by Peter Daszak (b) (6)  
Signature Date: 2021-02-23 - 2:40:21 PM GMT - Time Source: server- IP address: 98.109.77.29
-  Agreement completed.  
2021-02-23 - 2:40:21 PM GMT

**From:** [Aleksi Chmura](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Hongying Li](#)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Sunday, December 13, 2020 8:49:35 PM  
**Attachments:** [Conservation Medicine Ltd EID-SEARCH CREID Subaward Signed.pdf](#)

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Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksi

**Aleksi Chmura, PhD**  
*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6)  
(office)  
(mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



## CONTRACT AGREEMENT

NAME: Conservation Medicine Ltd

ADDRESS: Lot No 20, Level 1, Lazenda Commercial Centre,  
Phase 3, Jalan OKK Abdullah, 87000 Labuan FT., MALAYSIA

PROJECT TITLE Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of  
Southeast Asia

PERIOD 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 534409256

AGREEMENT AMOUNT: \$224,998.15

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Conservation Medicine Ltd.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

## I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Conservation Medicine Ltd and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below, or subject to availability of funds a \$25,000 advance to be spent on agreed project expenses. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Conservation Medicine Ltd agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Conservation Medicine Ltd agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Conservation Medicine Ltd's director, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Conservation Medicine Ltd.

3. **Support for Acts of Terror:** Conservation Medicine Ltd certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror



and that Conservation Medicine Ltd does not engage in or support, directly or indirectly, acts of terror.

4. **Financial Conflict of Interest:** Conservation Medicine Ltd certifies and represents that no Significant Financial Conflict of Interest exists regarding participation in this project that would influence the research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Conservation Medicine Ltd agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites.
6. **Non-Discrimination Policy:** Conservation Medicine Ltd will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Conservation Medicine Ltd acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Conservation Medicine Ltd will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Conservation Medicine Ltd fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Conservation Medicine Ltd for all approved expenses prior to the effective date of termination.

EcoHealth Alliance and Conservation Medicine Ltd acknowledge that all funds under this agreement excluding the indirect costs will be paid to Conservation Medicine Ltd as trust monies for the sole purposes of this agreement, for which Conservation Medicine Ltd shall hold as trustee. Conservation Medicine Ltd indirect costs will accrue to Conservation Medicine Ltd and be used to cover operating expenses.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Conservation Medicine Ltd agrees to give prompt and detailed written notice to EcoHealth

Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Conservation Medicine Ltd agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Conservation Medicine Ltd also agrees to follow all requirements regarding scientific conduct.

#### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Conservation Medicine Ltd's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Conservation Medicine Ltd or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Conservation Medicine Ltd remains a distinct and separate legal entity from that of EcoHealth Alliance.

Conservation Medicine Ltd agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions utilizing the funds of this agreement.

#### V. REPORTING REQUIREMENTS

Conservation Medicine Ltd agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. CONFIDENTIALITY; PROPRIETARY INFORMATION AND DATA

The parties agree that all information and records exchanged in connection with this Agreement shall be treated as strictly confidential, and shall not be used or disclosed for any purpose other than the performance of the Agreement and implementation of the Project. Unless stated otherwise herein or agreed to in writing and signed by both parties, nothing contained in this Agreement shall, by express grant, implication, estoppel or otherwise, convey to either party any right, title, interest, or license in the inventions, patents, trademarks (including logos), technical data, computer software, or software documentation of the other party. EHA and the Subrecipient retain equal rights to and ownership of any and all media (photos, video, audio recorded by the Subrecipient as related to this Project) developed with respect to this Agreement and the implementation of the Project. Any publication of media must credit EcoHealth Alliance and Conservation Medicine Ltd. Intellectual property rights with regards to viral sequences and scientific publications will be co-owned by EHA and the subrecipient. The provisions of this paragraph shall survive the expiration or earlier termination of this Agreement. Further, the Subrecipient shall also adhere to EHA's other IP-sharing agreements insofar as they relate to data and products derived from work described in this agreement, e.g. sharing agreements with local in-country partners including but not limited to government agencies, NGOs and universities. EHA may provide details of data sharing agreements with other parties upon request from the Subrecipient.

## VII. PUBLICATION REVIEW AND APPROVAL

The parties agree that prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be shared for pre-publication review and recommendations for revision. The parties are under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. The parties will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance and Conservation Medicine Ltd, and as required by the parent award NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance or NIAID in the acknowledgements.

## VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Conservation Medicine Ltd by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

## IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Conservation Medicine Ltd shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Conservation Medicine Ltd should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Conservation Medicine Ltd must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Conservation Medicine Ltd in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Conservation Medicine Ltd.
5. Conservation Medicine Ltd acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Conservation Medicine Ltd.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Conservation Medicine Ltd. The legal name of Conservation Medicine Ltd, who must be the sole owner of the account, must appear on the account. Conservation Medicine Ltd shall provide the following banking information to EcoHealth Alliance:

**Organization Name:** Conservation Medicine Ltd  
**Bank Name:** CIMB BANK BERHAD  
**Bank Address:** Plaza Yeoh Tiong Lay, 55 Jalan Bukit Bintang, 55100, Kuala Lumpur, Malaysia  
**Account Number:** (b) (6), (b) (4)  
**ABA Code:** (b) (6), (b) (4)

X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Conservation Medicine Ltd agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Conservation Medicine Ltd acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Conservation Medicine Ltd agrees that all overhead charged to this grant shall not exceed the amount permitted by the applicable or de minimus federal indirect cost rate in effect during the performance period. Conservation Medicine Ltd shall provide EcoHealth Alliance if applicable with a copy of their most current federal indirect cost rate agreement. If requested, Conservation Medicine Ltd will provide EcoHealth Alliance with a copy of a most current audit report. Conservation Medicine Ltd agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Conservation Medicine Ltd for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Conservation Medicine Ltd insofar as they relate to activities supported by this agreement.

Conservation Medicine Ltd budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.  
**Please note that international travel requires EHA approval.**
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.

8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Conservation Medicine Ltd shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

For all capital equipment (items valued over US \$5,000 and with a useful life of one year or more) purchased under this agreement, a completed Capital Equipment Inventory must be submitted to EHA at the end of the Term (including any approved extensions). Conservation Medicine Ltd agrees to use this equipment for other projects or programs only with EHA approval and so long as such use does not interfere with the Project work for which it was originally acquired. Conservation Medicine Ltd also agrees to maintain it in proper working order.

All supply purchases over \$3,000 for a single item require the prior approval of EHA.

#### XII. UNUSED FUNDS

Conservation Medicine Ltd agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project, excluding the indirect funds. Conservation Medicine Ltd may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both Conservation Medicine Ltd and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Conservation Medicine Ltd to repay all portions of the agreement that are within Conservation Medicine Ltd's control. In addition, EcoHealth Alliance may require Conservation Medicine Ltd to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Conservation Medicine Ltd has failed to perform any of the terms of this agreement; and
4. Conservation Medicine Ltd in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Conservation Medicine Ltd also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel utilizing the funds of this subcontract, unless a separate arrangement has been made between EcoHealth Alliance and Conservation Medicine Ltd. By signing this agreement, Conservation Medicine Ltd relieves EcoHealth Alliance from any and all liability due to accident or injury to Conservation Medicine Ltd in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Conservation Medicine Ltd.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018  
(t) (b) (6)  
(e) (b) (6)

#### XVII. INDEMNIFICATION

Conservation Medicine Ltd and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action, including reasonable attorneys' fees and costs, whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional acts, errors or omissions of Conservation Medicine Ltd or EcoHealth Alliance.

For the avoidance of doubt, EcoHealth Alliance agrees to indemnify and hold the Subrecipient and his successors harmless from and against any claim by the Malaysian Inland Revenue Board arising from and relating to the funds flowing into Malaysia for the purposes of and in connection with this agreement, provided that the Subrecipient shall remain personally liable for his personal income tax obligations, if any.

## XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

## XIX. Biosafety

### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

## XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Conservation Medicine Ltd for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



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Dr. Peter Daszak  
President, EcoHealth Alliance

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30 November 2020  
DATE



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Thomas Hughes  
Director, Conservation Medicine Ltd.

---

30 November 2020  
DATE



## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Conservation Medicine Ltd.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Conservation Medicine Ltd.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor of Mr. Tom Hughes, Co-Investigator

1. Coordinate and conduct all field work and lab work released to this contract in Malaysia.
  - Bat and rodent sampling at cave sites in Malaysia
  - Sampling of Orang Asli and other high risk communities
  - Syndromic surveillance
  - Further characterisation of the 15 novel paramyxoviruses and 12 novel corona viruses found through PREDICT
2. Coordinate fieldwork for this project in conjunction with DTRA activities for the Serological Biosurveillance for Spillover of Henipaviruses and Filoviruses at Agricultural and Hunting Human-Animal Interfaces in Peninsular Malaysia project in Malaysia (where applicable)
3. Facilitate and coordinate training workshops and capacity building efforts at partner institutions.
4. Facilitate communication between PI and in-country collaborators.
5. Ensure all in-country permits and permissions are in place to conduct the work.
6. Work with in-country partners to identify archived samples to screen, as appropriate
7. Work with the PI to prepare reports to stakeholders and collaborators
8. Contribute to data analysis, manuscript preparation, and dissemination of results to stakeholders

### ATTACHMENT C: PROJECT BUDGET

Item.	US Dollars per month.	Month	June 17th 2020 - May 31st 2021
<b>PERSONNEL</b>			
<b>Salaries and wages</b>			
Tom Hughes (Program Coordinator)			(b) (6), (b) (4)
Mei Ho Lee (Lab Coordinator)			
Jimmy Lee (Field Coordinator)			
Fernandes Opook (WHGFL Manager)			
Velsri Sharminie A/P Sathianarayanan (Program Assistant)			
Emily Sion EHA Lab Tech			
Suraya binti Hamid (PM CM Ltd Lab Tech)			
Alexter Japrin (Ranger)			
Ronald Bin Herbert M Tinggu (Ranger)			
Mohammad Yuery Wazlan Abdul Wahad (Ranger)			
Amirah Sungif (Ranger & Lab Tech)			
Ranger			
Ranger			
Vet			
<b>TOTAL SALARIES AND WAGES</b>			<b>\$ 120,023.89</b>
<b>Fringe</b>			
Insurance cover for Tom Hughes (monthly rate)	\$ 493.33	6	\$ 2,960.01
<b>TOTAL FRINGE</b>			<b>\$ 2,960.01</b>
<b>TOTAL PERSONNEL</b>			<b>\$ 122,983.89</b>
	<i>US Dollars</i>	<i>Unit #/LOE %</i>	<b>TOTAL (12 months)</b>
<b>EQUIPMENT</b>			
<b>TOTAL EQUIPMENT</b>			<b>\$ -</b>
<b>TRAVEL</b>			
Domestic Travel	\$ 1,030.90	12	\$ 12,370.84
<b>TOTAL DOMESTIC TRAVEL</b>			<b>\$ 12,370.84</b>
International Travel			\$ 4,808.00
<b>TOTAL INTERNATIONAL TRAVEL</b>			<b>\$ 4,808.00</b>
<b>TOTAL TRAVEL</b>			<b>\$ 17,178.84</b>
<b>SERVICES</b>			
WHGFL Lab Certification	\$ 3,600.00	1	\$ 3,600.00
<b>TOTAL SERVICES</b>			<b>\$ 3,600.00</b>
<b>DIAGNOSTICS</b>			
TBC	\$2,690.37	12	\$32,284.44
<b>TOTAL DIAGNOSTICS</b>			<b>\$ 32,284.44</b>
<b>SUPPLIES</b>			
TBC	\$ 2,690.37	12	\$ 32,284.44
<b>TOTAL SUPPLIES</b>			<b>\$ 32,284.44</b>
<b>OTHER COSTS</b>			
Indirect Costs 8%	\$ 1,388.88		\$ 16,666.53
<b>TOTAL OTHER COSTS</b>			<b>\$ 16,666.53</b>
<b>Project Costs Total.</b>			<b>\$ 224,998.15</b>

**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements  
**Date:** Friday, February 26, 2021 8:58:16 AM  
**Attachments:** [HJF EID-SEARCH Contract Y1 Final - signed.pdf](#)  
[Subaward Agreement with Chulalongkorn University \(Thailand\).pdf](#)  
[Subaward Agreement with Conservation Medicine Ltd \(Malaysia\).pdf](#)  
[Subaward Agreement with UNC.pdf](#)

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Hi Jean and Sara,

I think we have your all's confirmation of acceptability on some of Echo Health's subaward agreements and bio plans. Just to sure up the file can I get you all to review all of the plans that we have received thus far and provide your concurrence on the plans?

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

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Disclaimer:

The information in this e-mail and any of its attachments is confidential and may contain sensitive information. It should not be used by anyone who is not the intended recipient. If you have received this e-mail in error please inform the sender and delete it from your mailbox or any other storage devices. The National Institutes of Allergy and Infectious Diseases (NIAID) shall not accept liability for any statement made that are the sender's own and not expressly made on behalf of the NIAID by one of its representatives.



## CONTRACT AGREEMENT

NAME: The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

ADDRESS: 6720-A Rockledge Drive, Suite 100, Bethesda, Maryland, 20817

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 144676566

AGREEMENT AMOUNT: \$114,372.02

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

3. **Support for Acts of Terror:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represents that no Significant Financial Conflict of Interest exists regarding Dr. Christopher Broder participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.

5. **Federal Funding Accountability and Transparency Act:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.
6. **Non-Discrimination Policy:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a -thirty (30) business day written notice if it determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. fails to comply with the conditions stated in this contract and fails to cure such breach after an additional thirty (30) business day written notice to cure. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for all incurred and non-cancellable expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s use of EcoHealth Alliance contract funds.

Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. remains a distinct and separate legal entity from that of EcoHealth Alliance

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. herein. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. , during business hours and with advanced written notice and



approval by HJF, by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. 30 days net of invoice..
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.
5. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 60-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. The legal name of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., who must be the sole owner of the account, must appear on the account. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	The Henry M. Jackson Foundation Operating Account
<b>Bank Name:</b>	Bank of America
<b>Bank Address:</b>	730 15 <sup>th</sup> Street, NW, Washington, DC 20005
<b>Account Number:</b>	(b) (6), (b) (4)
<b>ABA Code:</b>	(b) (6), (b) (4)
<b>Bank Telephone:</b>	XXXXXXXXXX

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide EcoHealth Alliance with a copy of a most current audit report. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at a mutually agreeable time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. insofar as they relate to activities supported by this agreement.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount
2. Field Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with detailed and regular financial reports for all field equipment items.
3. Purchased services (e.g., field asst., boat hire) – detailed at the level of numbers 1 & 2, above. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
4. Vehicle associated costs – mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
5. Travel – trip cost indicating departure/arrival dates and air/car/train/boat costs along with all boarding passes and receipts.
6. Accommodation – location and amounts per person along with all lodging receipts.
7. Other – any other items that do not fall into the categories above with same level of detail.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order at EcoHealth Alliance's expense. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if, for cause, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. has materially failed to perform any of the terms of this agreement; and
4. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for, HJF employees unless a separate arrangement has been made between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)  
(e) (b) (6)

#### XVII. LIABILITY

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance hereby mutually agree to be liable for their own negligent acts, errors or omissions EcoHealth acknowledges that the Principal Investigator for this award is Dr. Christopher Broder, who is employed by the United States Government with his office located at the Uniformed Services University of Health Sciences. For the avoidance of doubt, it is understood and agreed that no third parties, including government personnel, are agents of HJF or authorized to legally bind HJF for any purpose. To the extent authorized under the provisions of the Federal Tort Claims Act, including 28 U.S.C. sections 2671-2680, the United States Government will be liable for any loss, claim, damage, or expense caused by the negligent or wrongful act or omission of any employee of the Department of Defense or any member of the United States Armed Forces while acting within the scope of his or her office or employment.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by

an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrrl39t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrrl39t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

#### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



Dr. Peter Daszak  
President, EcoHealth Alliance

**Yongkang Qiu**

Digitally signed by Yongkang Qiu  
DN: dc=org, dc=hjf, dc=ad, ou=HQ, ou=Users,  
ou=Research Administration, ou=OSP,  
cn=Yongkang Qiu, email=yqiu@hjff.org  
Date: 2021.02.22 13:33:47 -05'00'

Yongkang Qiu  
Grants Manager  
Research Administration  
The Henry M. Jackson Foundation for the  
Advancement of Military Medicine, Inc.

Feb 23, 2021  
DATE

2/22/2021  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor and coordination of Co-Investigators Dr. Christopher Broder and Dr. Eric Laing, working close with the post-doctoral associate, the work will be implemented at The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. on the epidemiology and characterization of a series of coronaviruses (CoVs), paramyxoviruses (PMVs – particularly Henipaviruses) and filoviruses (FVs), including:

- Develop molecular and serology platforms for lab diagnostics of collected human and animal samples, including the generation of reagents for novel assays;
- Provide training to Thailand and Malaysia laboratory staff for technology transfer and serological and molecular protocols;
- Collaborate with the EID-SEARCH global team for data analysis, interpretation and contribute to scientific publications as agreed;
- Participate calls with the CREID network, and communicate regularly with EID-SEARCH global team at EHA as agreed;
- Contribute to the annual report and other programmatic report requested by NIAID;
- Represent EID-SEARCH on planning and other relevant meetings;
- Complete quarterly invoices and/or financial reports



**ATTACHMENT C: PROJECT BUDGET**

SALARY		Y1
Christopher Broder	Co-Investigator	(b) (6), (b) (4)
Eric Laing	Co-Investigator	
TBD	Research Asst.	
<b>TOTAL SALARY</b>		\$ 5,400.00
FRINGE	30.76%	\$ 1,660.99
<b>TOTAL SALARY + FRINGE</b>		\$ 7,060.99
TRAVEL		
Domestic		\$ 3,500.00
International		\$ 18,500.00
<b>TOTAL TRAVEL</b>		\$ 22,000.00
OTHER DIRECT COSTS		
Materials & Supplies		\$ 41,439.00
AKTA Service Contract		\$ 4,500.00
<b>TOTAL OTHER DIRECT COSTS</b>		\$ 45,939.00
<b>TOTAL DIRECT</b>		\$ 74,999.99
INDIRECT	30.45%	\$ 22,837.50
G&A	16.90%	\$ 16,534.53
<b>TOTAL</b>		\$ 114,372.02

# HJF EID-SEARCH Contract\_v2 Clean version (008) final

Final Audit Report

2021-02-23

Created:	2021-02-23
By:	Hongying Li (b) (6)
Status:	Signed
Transaction ID:	

## "HJF EID-SEARCH Contract\_v2 Clean version (008) final" History

-  Document digitally presigned by Yongkang Qiu (b) (6)  
2021-02-22 - 6:33:47 PM GMT- IP address: 160.39.50.243
-  Document created by Hongying Li (b) (6)  
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-  Document emailed to Peter Daszak (b) (6) for signature  
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-  Document e-signed by Peter Daszak (b) (6)  
Signature Date: 2021-02-23 - 2:40:21 PM GMT - Time Source: server- IP address: 98.109.77.29
-  Agreement completed.  
2021-02-23 - 2:40:21 PM GMT

**From:** [Hongying Li](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)  
**Date:** Friday, December 18, 2020 8:54:29 AM  
**Attachments:** [CU EID-SEARCH CONTRACT Y1 Signed FINAL.PDF](#)

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Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (12th December 2020) subaward agreement with Chulalongkorn University (Thailand) under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



# EcoHealth Alliance

## CONTRACT AGREEMENT

NAME: WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University

ADDRESS: Rama IV Road, Bangkok, 10330 Thailand

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 659808836

AGREEMENT AMOUNT: \$215,944.56

This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Chulalongkorn University.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Chulalongkorn University and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Chulalongkorn University agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Chulalongkorn University agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Chulalongkorn University's directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Chulalongkorn University.

3. **Support for Acts of Terror:** Chulalongkorn University certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that Chulalongkorn University does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** Chulalongkorn University certifies and represents that no Significant Financial Conflict of Interest exists regarding PI Ralph Baric participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Chulalongkorn University agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US

government websites. Chulalongkorn University shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.

6. **Non-Discrimination Policy:** Chulalongkorn University will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Chulalongkorn University acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Chulalongkorn University will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Chulalongkorn University fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Chulalongkorn University for all approved expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Chulalongkorn University agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Chulalongkorn University agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Chulalongkorn University also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Chulalongkorn University's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Chulalongkorn University or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Chulalongkorn University remains a distinct and separate legal entity from that of EcoHealth Alliance.

Chulalongkorn University agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They

also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

Chulalongkorn University agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to Chulalongkorn University herein. Chulalongkorn University shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to Chulalongkorn University an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. Chulalongkorn University is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Chulalongkorn University by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Chulalongkorn University shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Chulalongkorn University should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Chulalongkorn University must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.



3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Chulalongkorn University in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Chulalongkorn University.
5. Chulalongkorn University acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Chulalongkorn University.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Chulalongkorn University. The legal name of Chulalongkorn University, who must be the sole owner of the account, must appear on the account. Chulalongkorn University shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	<b>Chula Unisearch, Chulalongkorn University</b>
<b>Bank Name:</b>	<b>Bangkok Bank Public Company Limited (BBL)</b>
	<b>394 Rama 1 Rd. Phatumwan Bangkok 10330 Thailand</b>
<b>Branch:</b>	<b>Siam Square</b>
<b>Account Number:</b>	(b) (6), (b) (4)
<b>Swift code:</b>	(b) (6), (b) (4)

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Chulalongkorn University agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Chulalongkorn University acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Chulalongkorn University agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. Chulalongkorn University shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, Chulalongkorn University will provide EcoHealth Alliance with a copy of a most current audit report. Chulalongkorn University agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Chulalongkorn University for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Chulalongkorn University insofar as they relate to activities supported by this agreement.

Chulalongkorn University budget records must be itemized in the following categories, as applicable:



1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.
8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Chulalongkorn University shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance’s principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. Chulalongkorn University agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

Chulalongkorn University agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. Chulalongkorn University may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both University of North Carolina at Chapel Hill and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION



With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Chulalongkorn University to repay all portions of the agreement that are within Chulalongkorn University's control. In addition, EcoHealth Alliance may require Chulalongkorn University to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Chulalongkorn University has failed to perform any of the terms of this agreement; and
4. Chulalongkorn University in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Chulalongkorn University also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel, unless a separate arrangement has been made between EcoHealth Alliance and Chulalongkorn University. By signing this agreement, Chulalongkorn University relieves EcoHealth Alliance from any and all liability due to accident or injury, or any other claims that may result from any activities conducted by Chulalongkorn University in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Chulalongkorn University.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)  
(e) (b) (6)

#### XVII. INDEMNIFICATION

Chulalongkorn University and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action including



attorney's whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional and/or negligent acts, errors or omissions of Chulalongkorn University or EcoHealth Alliance to the extent permitted by applicable law.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18eh1/CDC%20Biosafety%20Guidelines.pdf?dl=0>

##### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.



Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Chulalongkorn University for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



\_\_\_\_\_  
Dr. Peter Daszak  
President, EcoHealth Alliance

\_\_\_\_\_  
10 December 2020  
DATE



\_\_\_\_\_  
(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University  
Grants Manager & Team Lead, Chulalongkorn University



\_\_\_\_\_  
12 December 2020  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

Please answer the following questions Yes or No.

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Chulalongkorn University's business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Chulalongkorn University's business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No



## ATTACHMENT B: Scope of Work Year 1 (17 June 2020 – 31 May 2021)

Under this contract, supervised and coordinated by the co-Investigators Dr. Supaporn Wacharapluesadee and Dr. Thiravat Hemachudha, the Thai Red Cross Emerging Infectious Diseases Health Science Centre (TRC-EID), Chulalongkorn Hospital, Faculty of Medicine, Chulalongkorn University will:

- 1. Work with the EID-SEARCH global team to develop work plan to:**
  - 1.1 Identify the surveillance sites for animal, human community, and hospital syndromic study
    - Work with the modelling team at EHA to identify the surveillance sites, targeted animal species, targeted sample sizes, for Coronaviruses, Paramyxoviruses, and Filoviruses.
  - 1.2 Develop protocol and questionnaires for community and hospital syndromic surveillance
  - 1.3 Pilot the questionnaire in country and provide feedbacks
- 2. Obtain local research approval document including:**
  - 2.1 Chulalongkorn University Animal Care and Use Protocol (CU-ACUP) approval for animal investigation
  - 2.2 Institutional Review Board (IRB) approval for human subject research
  - 2.3 Institutional Biosafety Committee (IBC) approval for lab work
  - 2.4 Permissions for animal capture
- 3. Laboratory testing**
  - 3.1 Full genome characterization of previously identified CoVs in animals. This could also include full Spike protein sequencing for CoVs (e.g. if full genome capture doesn't work) (n=10-20)
  - 3.2 Investigations of archived specimens from undiagnosed human infections available at Chula WHO-CC by performing available PCR and/or serological testing (n>100) for coronaviruses, influenza, filoviruses, and paramyxoviruses or NGS.
  - 3.3 For newly collected animal specimens, if applicable, complete viral family PCR testing of coronaviruses, influenza, filoviruses, paramyxoviruses and conduct DNA barcoding for confirmation of field species identification as necessary on a subset of the specimens.
  - 3.4 Collaborating with EID-SEARCH partner for the validation of newly developed serological assays.
- 4. Conduct scoping survey and initial wild animal surveillance at selected sites**
  - 4.1 Scoping survey on human-animal interfaces at selected site, and possibly pilot the questionnaire in Ratchaburi province (one site)
  - 4.2 Start initial specimen collection from bat, rodent, and macaque individuals (1 rectal swab + 1 swab/individual) in the province of Ratchaburi (one site; 300 animals including 100 each of bat, rodent and macaque).
- 5. Results and data sharing, analysis, reporting**
  - 5.1 Sharing of specimens will ONLY be possible for diagnostic purposes when capacity is not available in Thailand, or when it's part of the capacity building and training program.
  - 5.2 Participate in the CREID Working Group discussions and work with EID-SEARCH global team to develop data management and sharing policies.
  - 5.3 Maintain current contacts to whom results will be reported at in-country government ministries responsible for human health, livestock/agriculture, and wildlife.
  - 5.4 Collaborate with the EID-SEARCH global team for data cleaning, analysis, interpretation and contribute to scientific publications as agreed.

- 5.5 Complete the following programmatic and financial reporting by requested deadlines:
- Annual reports to NIAID
  - Quarterly invoices and financial reports
  - Other reports requested by NIAID
- 5.6 Reach out to communities and present appropriately available findings and public health information

**6. Communication**

- 6.1 Participate on calls with the EID-SEARCH global team at EHA as requested; hold regular team calls as agreed.
- 6.2 Represent EID-SEARCH on planning and other relevant meetings.

**7. Project Timeline**

ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.4.a. sampling targets																				
1.4.b. sample size justifications																				
1.4.c. sample collection & testing																				
1.4.d. NGS																				
1.4.e. sequencing Spike GP																				
1.5.a. human cell infection																				
1.5.b. receptor binding																				
1.5.c. host-pathogen dynamics																				
1.5.d. viral strain prioritization																				
1.5.e. animal models																				
2.4 target population & sample sizes																				
2.5 community data collection																				
2.6.a serological testing																				
2.6.b RT-PCR testing																				
2.6.c virus characterization																				
2.7 epidemiological analysis																				
3.4.a cohort selection																				
3.4.b clinic enrollment & follow-up																				
3.4.c clinical data collection																				
3.5 sample testing																				
3.6 risk characterization																				
annual meeting																				

*ritzy*

**ATTACHMENT C: PROJECT BUDGET**

<b>Items</b>	
<b>Personnel</b>	\$55,666.67
<b>Travel</b>	
1. Site scoping / pilot questionnaire for community study	\$10,780.00
2. Animal sampling	\$16,551.00
<b>Diagnosis</b>	
1. Full genome characterization of archived CoV positive animal specimens (NGS)	\$32,391.00
2. Investigation of undiagnosed archived human specimens (family PCR and NGS)	\$21,560.00
3. Animal study (300 animals x 1 site) 3 viral families	\$63,000.00
<b>Total direct cost</b>	199,948.67
<b>Indirect cost (8%)</b>	\$15,995.89
<b>Total</b>	\$215,944.56

**Financial arrangements**

	<b>Deliverable</b>	<b>Amount</b>
1	Countersigned Contract	\$25,000.00
2	Progress Report-1	\$110,000.00
3	Progress Report-2	\$55,944.56
4	Annual Report	\$25,000.00







POWER OF ATTORNEY

August 3, 2020

We, Chulalongkorn University represented by Professor Dr. Bundhit Eua-arporn, President of Chulalongkorn University, do hereby empower Dr. Supichai Tangjaitrong, Managing Director of Chula Unisearch, Chulalongkorn University, to be authorized lawful attorney to represent the organization for submission of "WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University" including any acts performed under this circumstance.

Signed  Principal

(Professor Bundhit Eua-arporn, Ph.D.)  
President  
Chulalongkorn University

Signed  Attorney

(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University

Signed  Witness

(Mr. Torsak Purksaritanont)  
Manager  
Department of Office Administration

Signed  Witness

(Mrs. Kitiya Jumpa)  
Legal Officer

(b) (6)

(b) (6)

ect

This IL

**From:** [Aleksiej Chmura](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Hongying Li](#)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Sunday, December 13, 2020 8:49:36 PM  
**Attachments:** [Conservation Medicine Ltd EID-SEARCH CREID Subaward Signed.pdf](#)

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Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksiej

**Aleksiej Chmura, PhD**

*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



## CONTRACT AGREEMENT

NAME: Conservation Medicine Ltd

ADDRESS: Lot No 20, Level 1, Lazenda Commercial Centre,  
Phase 3, Jalan OKK Abdullah, 87000 Labuan FT., MALAYSIA

PROJECT TITLE Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of  
Southeast Asia

PERIOD 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 534409256

AGREEMENT AMOUNT: \$224,998.15

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Conservation Medicine Ltd.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

## I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Conservation Medicine Ltd and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below, or subject to availability of funds a \$25,000 advance to be spent on agreed project expenses. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Conservation Medicine Ltd agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Conservation Medicine Ltd agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Conservation Medicine Ltd's director, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Conservation Medicine Ltd.

3. **Support for Acts of Terror:** Conservation Medicine Ltd certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror

and that Conservation Medicine Ltd does not engage in or support, directly or indirectly, acts of terror.

4. **Financial Conflict of Interest:** Conservation Medicine Ltd certifies and represents that no Significant Financial Conflict of Interest exists regarding participation in this project that would influence the research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Conservation Medicine Ltd agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites.
6. **Non-Discrimination Policy:** Conservation Medicine Ltd will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Conservation Medicine Ltd acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Conservation Medicine Ltd will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Conservation Medicine Ltd fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Conservation Medicine Ltd for all approved expenses prior to the effective date of termination.

EcoHealth Alliance and Conservation Medicine Ltd acknowledge that all funds under this agreement excluding the indirect costs will be paid to Conservation Medicine Ltd as trust monies for the sole purposes of this agreement, for which Conservation Medicine Ltd shall hold as trustee. Conservation Medicine Ltd indirect costs will accrue to Conservation Medicine Ltd and be used to cover operating expenses.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Conservation Medicine Ltd agrees to give prompt and detailed written notice to EcoHealth

Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Conservation Medicine Ltd agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Conservation Medicine Ltd also agrees to follow all requirements regarding scientific conduct.

#### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Conservation Medicine Ltd's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Conservation Medicine Ltd or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Conservation Medicine Ltd remains a distinct and separate legal entity from that of EcoHealth Alliance.

Conservation Medicine Ltd agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions utilizing the funds of this agreement.

#### V. REPORTING REQUIREMENTS

Conservation Medicine Ltd agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. CONFIDENTIALITY; PROPRIETARY INFORMATION AND DATA

The parties agree that all information and records exchanged in connection with this Agreement shall be treated as strictly confidential, and shall not be used or disclosed for any purpose other than the performance of the Agreement and implementation of the Project. Unless stated otherwise herein or agreed to in writing and signed by both parties, nothing contained in this Agreement shall, by express grant, implication, estoppel or otherwise, convey to either party any right, title, interest, or license in the inventions, patents, trademarks (including logos), technical data, computer software, or software documentation of the other party. EHA and the Subrecipient retain equal rights to and ownership of any and all media (photos, video, audio recorded by the Subrecipient as related to this Project) developed with respect to this Agreement and the implementation of the Project. Any publication of media must credit EcoHealth Alliance and Conservation Medicine Ltd. Intellectual property rights with regards to viral sequences and scientific publications will be co-owned by EHA and the subrecipient. The provisions of this paragraph shall survive the expiration or earlier termination of this Agreement. Further, the Subrecipient shall also adhere to EHA's other IP-sharing agreements insofar as they relate to data and products derived from work described in this agreement, e.g. sharing agreements with local in-country partners including but not limited to government agencies, NGOs and universities. EHA may provide details of data sharing agreements with other parties upon request from the Subrecipient.



## VII. PUBLICATION REVIEW AND APPROVAL

The parties agree that prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be shared for pre-publication review and recommendations for revision. The parties are under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. The parties will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance and Conservation Medicine Ltd, and as required by the parent award NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance or NIAID in the acknowledgements.

## VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Conservation Medicine Ltd by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

## IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Conservation Medicine Ltd shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Conservation Medicine Ltd should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Conservation Medicine Ltd must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Conservation Medicine Ltd in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Conservation Medicine Ltd.
5. Conservation Medicine Ltd acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Conservation Medicine Ltd.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Conservation Medicine Ltd. The legal name of Conservation Medicine Ltd, who must be the sole owner of the account, must appear on the account. Conservation Medicine Ltd shall provide the following banking information to EcoHealth Alliance:

**Organization Name:** Conservation Medicine Ltd  
**Bank Name:** CIMB BANK BERHAD  
**Bank Address:** Plaza Yeoh Tiong Lay, 55 Jalan Bukit Bintang, 55100, Kuala Lumpur, Malaysia  
**Account Number:** (b) (6), (b) (4)  
**ABA Code:** (b) (6), (b) (4)

X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Conservation Medicine Ltd agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Conservation Medicine Ltd acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Conservation Medicine Ltd agrees that all overhead charged to this grant shall not exceed the amount permitted by the applicable or de minimus federal indirect cost rate in effect during the performance period. Conservation Medicine Ltd shall provide EcoHealth Alliance if applicable with a copy of their most current federal indirect cost rate agreement. If requested, Conservation Medicine Ltd will provide EcoHealth Alliance with a copy of a most current audit report. Conservation Medicine Ltd agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Conservation Medicine Ltd for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Conservation Medicine Ltd insofar as they relate to activities supported by this agreement.

Conservation Medicine Ltd budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.  
**Please note that international travel requires EHA approval.**
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.

8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Conservation Medicine Ltd shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

For all capital equipment (items valued over US \$5,000 and with a useful life of one year or more) purchased under this agreement, a completed Capital Equipment Inventory must be submitted to EHA at the end of the Term (including any approved extensions). Conservation Medicine Ltd agrees to use this equipment for other projects or programs only with EHA approval and so long as such use does not interfere with the Project work for which it was originally acquired. Conservation Medicine Ltd also agrees to maintain it in proper working order.

All supply purchases over \$3,000 for a single item require the prior approval of EHA.

#### XII. UNUSED FUNDS

Conservation Medicine Ltd agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project, excluding the indirect funds. Conservation Medicine Ltd may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both Conservation Medicine Ltd and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Conservation Medicine Ltd to repay all portions of the agreement that are within Conservation Medicine Ltd's control. In addition, EcoHealth Alliance may require Conservation Medicine Ltd to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Conservation Medicine Ltd has failed to perform any of the terms of this agreement; and
4. Conservation Medicine Ltd in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Conservation Medicine Ltd also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel utilizing the funds of this subcontract, unless a separate arrangement has been made between EcoHealth Alliance and Conservation Medicine Ltd. By signing this agreement, Conservation Medicine Ltd relieves EcoHealth Alliance from any and all liability due to accident or injury to Conservation Medicine Ltd in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Conservation Medicine Ltd.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018  
(t) (b) (6)  
(e) (b) (6)

#### XVII. INDEMNIFICATION

Conservation Medicine Ltd and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action, including reasonable attorneys' fees and costs, whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional acts, errors or omissions of Conservation Medicine Ltd or EcoHealth Alliance.

For the avoidance of doubt, EcoHealth Alliance agrees to indemnify and hold the Subrecipient and his successors harmless from and against any claim by the Malaysian Inland Revenue Board arising from and relating to the funds flowing into Malaysia for the purposes of and in connection with this agreement, provided that the Subrecipient shall remain personally liable for his personal income tax obligations, if any.

## XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

## XIX. Biosafety

### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

## XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Conservation Medicine Ltd for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



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Dr. Peter Daszak  
President, EcoHealth Alliance

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30 November 2020  
DATE



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Thomas Hughes  
Director, Conservation Medicine Ltd.

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30 November 2020  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Conservation Medicine Ltd.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Conservation Medicine Ltd.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor of Mr. Tom Hughes, Co-Investigator

1. Coordinate and conduct all field work and lab work released to this contract in Malaysia.
  - Bat and rodent sampling at cave sites in Malaysia
  - Sampling of Orang Asli and other high risk communities
  - Syndromic surveillance
  - Further characterisation of the 15 novel paramyxoviruses and 12 novel corona viruses found through PREDICT
2. Coordinate fieldwork for this project in conjunction with DTRA activities for the Serological Biosurveillance for Spillover of Henipaviruses and Filoviruses at Agricultural and Hunting Human-Animal Interfaces in Peninsular Malaysia project in Malaysia (where applicable)
3. Facilitate and coordinate training workshops and capacity building efforts at partner institutions.
4. Facilitate communication between PI and in-country collaborators.
5. Ensure all in-country permits and permissions are in place to conduct the work.
6. Work with in-country partners to identify archived samples to screen, as appropriate
7. Work with the PI to prepare reports to stakeholders and collaborators
8. Contribute to data analysis, manuscript preparation, and dissemination of results to stakeholders



### ATTACHMENT C: PROJECT BUDGET

Item.	US Dollars per month.	Month	June 17th 2020 - May 31st 2021
<b>PERSONNEL</b>			
<b>Salaries and wages</b>			
Tom Hughes (Program Coordinator)			(b) (6), (b) (4)
Mei Ho Lee (Lab Coordinator)			
Jimmy Lee (Field Coordinator)			
Fernandes Opook (WHGFL Manager)			
Velsri Sharminie A/P Sathianarayanan (Program Assistant)			
Emily Sion EHA Lab Tech			
Suraya binti Hamid (PM CM Ltd Lab Tech)			
Alexter Japrin (Ranger)			
Ronald Bin Herbert M Tinggu (Ranger)			
Mohammad Yuery Wazlan Abdul Wahad (Ranger)			
Amirah Sungif (Ranger & Lab Tech)			
Ranger			
Ranger			
Vet			
<b>TOTAL SALARIES AND WAGES</b>			<b>\$ 120,023.89</b>
<b>Fringe</b>			
Insurance cover for Tom Hughes (monthly rate)	\$ 493.33	6	\$ 2,960.01
<b>TOTAL FRINGE</b>			<b>\$ 2,960.01</b>
<b>TOTAL PERSONNEL</b>			<b>\$ 122,983.89</b>
	<i>US Dollars</i>	<i>Unit #/LOE %</i>	<b>TOTAL (12 months)</b>
<b>EQUIPMENT</b>			
<b>TOTAL EQUIPMENT</b>			<b>\$ -</b>
<b>TRAVEL</b>			
Domestic Travel	\$ 1,030.90	12	\$ 12,370.84
<b>TOTAL DOMESTIC TRAVEL</b>			<b>\$ 12,370.84</b>
International Travel			\$ 4,808.00
<b>TOTAL INTERNATIONAL TRAVEL</b>			<b>\$ 4,808.00</b>
<b>TOTAL TRAVEL</b>			<b>\$ 17,178.84</b>
<b>SERVICES</b>			
WHGFL Lab Certification	\$ 3,600.00	1	\$ 3,600.00
<b>TOTAL SERVICES</b>			<b>\$ 3,600.00</b>
<b>DIAGNOSTICS</b>			
TBC	\$2,690.37	12	\$32,284.44
<b>TOTAL DIAGNOSTICS</b>			<b>\$ 32,284.44</b>
<b>SUPPLIES</b>			
TBC	\$ 2,690.37	12	\$ 32,284.44
<b>TOTAL SUPPLIES</b>			<b>\$ 32,284.44</b>
<b>OTHER COSTS</b>			
Indirect Costs 8%	\$ 1,388.88		\$ 16,666.53
<b>TOTAL OTHER COSTS</b>			<b>\$ 16,666.53</b>
<b>Project Costs Total.</b>			<b>\$ 224,998.15</b>

**From:** [Hongying Li](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the University of North Carolina at Chapel Hill  
**Date:** Tuesday, January 26, 2021 7:41:00 PM  
**Attachments:** [UNC EID SEARCH CONTRACT FINAL SIGNED.pdf](#)

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Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (14th January 2021) subaward agreement with the University of North Carolina at Chapel Hill under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



## CONTRACT AGREEMENT

NAME: The University of North Carolina at Chapel Hill

ADDRESS: 104 Airport Dr Suite 2200  
Campus Box 1350  
Chapel Hill, NC 27599-1350

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 608195277

AGREEMENT AMOUNT: \$194,375.00

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and the University of North Carolina at Chapel Hill.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

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The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed according to the Disbursement of Funds section below and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, the University of North Carolina at Chapel Hill agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** The University of North Carolina at Chapel Hill agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

The University of North Carolina at Chapel Hill's directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and the University of North Carolina at Chapel Hill.

3. **Support for Acts of Terror:** The University of North Carolina at Chapel Hill certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that the University of North Carolina at Chapel Hill does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** The University of North Carolina at Chapel Hill certifies and represents that no Significant Financial Conflict of Interest exists regarding PI Ralph Baric participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all named personnel related to this project.
5. **Federal Funding Accountability and Transparency Act:** The University of North Carolina at Chapel Hill agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for

publication on applicable US government websites. The University of North Carolina at Chapel Hill shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.

6. **Non-Discrimination Policy:** The University of North Carolina at Chapel Hill will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

The University of North Carolina at Chapel Hill acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on reasonable request, the University of North Carolina at Chapel Hill will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a thirty (30) business day written notice if it determines that the University of North Carolina at Chapel Hill fails to comply with the conditions stated in section II of this contract and the University of North Carolina at Chapel Hill has not cured such breach within the thirty (30) day period. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay the University of North Carolina at Chapel Hill for all approved expenses and non-cancellable obligations made prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, the University of North Carolina at Chapel Hill agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, the University of North Carolina at Chapel Hill agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. The University of North Carolina at Chapel Hill also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for the University of North Carolina at Chapel Hill's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and the University of North Carolina at Chapel Hill or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, the University of North Carolina at Chapel Hill remains a distinct and separate legal entity from that of EcoHealth Alliance.

The University of North Carolina at Chapel Hill agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities.

#### V. REPORTING REQUIREMENTS

The University of North Carolina at Chapel Hill agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to the University of North Carolina at Chapel Hill herein. The University of North Carolina at Chapel Hill shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to the University of North Carolina at Chapel Hill an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. The University of North Carolina at Chapel Hill is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

The Parties may communicate to one another information of a proprietary nature that is directly related to the Scope of Work ("Confidential Information"). "Disclosing Party" means the Party providing Confidential Information to the other Party, and "Receiving Party" means the Party receiving Confidential Information. The Receiving Party shall neither use nor disclose Confidential Information except as permitted herein during the term of the agreement and for five (5) years thereafter. The Parties shall disclose only the portion of Confidential Information necessary to conduct the Study. Confidential Information shall be disclosed in writing and identified as such, or if disclosed orally, shall be reduced to writing within thirty (30) days thereafter. The definition of Confidential Information does not include information is (i) at the time of disclosure, is in the public domain, or later becomes part of the public domain; (ii) was received by the Receiving Party from a third Party; (iii) was independently developed by Receiving Party; (iv) is approved for release by the Disclosing Party; (v) was in Receiving Party's possession at the time of disclosure; or (vi) is required to be disclosed pursuant to law, regulation, or a court order.

## VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include scheduled visits to the University of North Carolina at Chapel Hill by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

## IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. The University of North Carolina at Chapel Hill shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. The University of North Carolina at Chapel Hill should attach a transaction report needed to substantiate any out-of-pocket expenses.
2. The University of North Carolina at Chapel Hill must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to the University of North Carolina at Chapel Hill in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by the University of North Carolina at Chapel Hill.
5. The University of North Carolina at Chapel Hill acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to the University of North Carolina at Chapel Hill.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to the University of North Carolina at Chapel Hill. The legal name of the University of North Carolina at Chapel Hill, who must be the sole owner of the account, must appear on the account. The University of North Carolina at Chapel Hill shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	University of North Carolina at Chapel Hill
<b>Bank Name:</b>	Bank of America
<b>Bank Address:</b>	104 E. Main Street, Carborro, NC 27510
<b>Account Number:</b>	(b) (6). (b) (4)
<b>ABA Code:</b>	(b) (6). (b) (4)
<b>Bank Telephone:</b>	1-888-715-1000, Ext 21598

When a transfer is initiated EcoHealth Alliance will include [REDACTED] in the message and notify:

Dawn DiLello, Cash Manager  
Office of Sponsored Research

Phone: (b) (6) Fax: 919-962-5011  
Email: (b) (6)

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, the University of North Carolina at Chapel Hill agrees to adhere to all requirements contained in 2 CFR Part 200 – Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards during the term of the agreement. The University of North Carolina at Chapel Hill acknowledges responsibility for Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current single audit report as may be provided. The University of North Carolina at Chapel Hill agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. The University of North Carolina at Chapel Hill shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, the University of North Carolina at Chapel Hill will provide EcoHealth Alliance with a copy of a most current audit report. The University of North Carolina at Chapel Hill agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by the University of North Carolina at Chapel Hill for three (3) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of the University of North Carolina at Chapel Hill insofar as they relate to activities supported by this agreement. All audits, inspections, and examinations must be reasonably requested, scheduled at least seven (7) business days in advance to occur during normal business hours, and are conducted at the sole expense of EcoHealth Alliance.

The University of North Carolina at Chapel Hill budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate as applicable, date, and amount
2. Purchased services (e.g., field asst., boat hire) – detailed at the level of numbers 1 & 2, above. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both University of North Carolina at Chapel Hill and EHA or responsible party.
3. Vehicle associated costs – mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both University of North Carolina at Chapel Hill and EHA or responsible party.
4. Travel – trip cost indicating departure/arrival dates and air/car/train/boat costs along with all boarding passes and receipts.
5. Accommodation – location and amounts per person along with all lodging receipts.
6. Other – any other items that do not fall into the categories above with same level of detail.

The University of North Carolina at Chapel Hill shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.



#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of The University of North Carolina.

#### XII. UNUSED FUNDS

The University of North Carolina at Chapel Hill agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. The University of North Carolina at Chapel Hill may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both University of North Carolina at Chapel Hill and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With forty-five (45) days written notification either party may terminate the Agreement without cause and cancel all unpaid installments of the agreement. EcoHealth may require the University of North Carolina at Chapel Hill to repay all portions of the agreement that are unobligated and reasonably within the University of North Carolina at Chapel Hill's control. EcoHealth Alliance agrees to pay the University of North Carolina at Chapel Hill all reasonable and non-cancelable obligation incurred by the University of North Carolina at Chapel Hill up to the effective date of termination.

In addition, either party may terminate the Agreement for cause upon thirty (30) days written notice to the other party of an uncured breach, if the other party has breached the Agreement and has not cured such breach within the thirty (30) day period. EcoHealth may require the University of North Carolina at Chapel Hill to repay all portions of the agreement that are unobligated and reasonably within the University of North Carolina at Chapel Hill's control. EcoHealth Alliance agrees to pay the University of North Carolina at Chapel Hill all reasonable and non-cancelable obligation incurred by the University of North Carolina at Chapel Hill up to the effective date of termination.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, the University of North Carolina at Chapel Hill also accepts full responsibility for any and all applicable insurance needs to the extent permitted by the North Carolina Tort Claims Act for themselves and all other University of North Carolina at Chapel Hill, project related personnel, unless a separate arrangement has been made between EcoHealth Alliance and the University of North Carolina at Chapel Hill. By signing this agreement, both the University of North Carolina at Chapel Hill and EcoHealth Alliance relieve the other party from any and all liability due to accident or injury, or any other claims that may result from any activities conducted by the University of North Carolina at Chapel Hill in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to the University of North Carolina at Chapel Hill.

## XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)

(e) (b) (6)

## XVII. INDEMNIFICATION

The University of North Carolina at Chapel Hill and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional and/or negligent acts, errors or omissions of the University of North Carolina at Chapel Hill or EcoHealth Alliance to the extent permitted by the North Carolina Tort Claims Act.

## XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

## XIX. Biosafety

### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



\_\_\_\_\_  
Dr. Peter Daszak  
President  
EcoHealth Alliance



\_\_\_\_\_  
for Terry Magnuson, PH.D.  
Vice Chancellor for Research  
The University of North Carolina at Chapel Hill

01/14/2021

DATE

01/13/2021

DATE

**ATTACHMENT A: FFATA**

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In the University of North Carolina at Chapel Hill's business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in the University of North Carolina at Chapel Hill's business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## ATTACHMENT B: Scope of Work

Under the supervisor of Dr. Ralph Baric, Co-Investigator, coordinated by Dr. Timothy Sheahan, Research Scientist and Lab Coordinator, working close with a lab technician (TBN) the laboratory work will be implemented at the University of North Carolina at Chapel Hill to conduct systematic studies on the epidemiology, genetic evolution, interspecies infection mechanism and pathogenesis of a series of bat-borne CoVs, including:

- ***In vitro* Infection Experiment.** In vitro infection experiments using pseudoviruses carrying the spike proteins (wild type or mutants) or live viruses in cell lines of different origins, binding affinity assays between the spike proteins (wild type or mutants) and different cellular receptor molecules, and humanized mouse experiments.
- **Developing Luciferase Immunoprecipitation System (LIPS) Assay.** Develop LIPS assay for bat CoV antibody detection.
- **The Enzyme-Linked Immunosorbent Assay (ELISA) Testing.** Serological testing of bat serum samples with ELISA plates.
- **Meetings and travels.** Dr. Baric and lab team members will meet with other Co-PIs from EcoHealth Alliance and partners to refine study protocols, report results, and prepare publications

Coronaviruses (e.g. SARS-CoV, MERS-CoV), henipaviruses (HeV, NiV) and filoviruses (EBOV, MARV) are highly pathogenic viruses which emerged from zoonotic reservoirs to cause significant human morbidity and mortality. Like most emerging zoonoses, these pathogens originate in wildlife reservoirs, sometimes spilling over first into livestock 'amplifier' hosts, or directly into localized human populations with high levels of animal contact. Efforts to prevent emerging zoonoses have targeted these high-risk populations in regions prone to disease emergence, coupled with rapid surveillance systems designed to rapidly identify newly emerged virus pathogens in human outbreak settings. However, surveillance and control is hampered by inadequate information on the basic disease ecology, the availability of human cohorts at the interface between wildlife and human habitats, and cohorts of individuals in high-risk sites for secondary disease amplification and spread to sites around the world.

Dr. Baric will lead the studies at the University of North Carolina at Chapel Hill. He will design research strategies, interpret findings and review research outcomes with another investigator and Mr. Yount. At a regular basis, Dr. Baric will report the results of the team's research to Dr. Daszak, and together, they will use this information to identify additional research priorities and design downstream studies. Drs. Daszak and Baric have published together in the past and participated on research project applications. He will work closely with another investigator and Tse and Mr. Yount to prepare timely reports, share research and discuss future research directions with the group.

**ATTACHMENT C: PROJECT BUDGET**

YEAR 1		
SALARY		17 JUN 2020 - 31 MAY 2021
Ralph Baric	Co-Investigator	(b) (6), (b) (4)
TBD	Co-Investigator	
Boyd Yount	Research Asst.	
Long Ping Victor Tse	Lab Tech	
TOTAL SALARY		\$ 70,189.00
FRINGE	30.95%	\$ 21,726.00
TOTAL SALARY + FRINGE		\$ 91,915.00
TRAVEL		
Domestic		\$ 1,000.00
International		\$ -
TOTAL TRAVEL		\$ 1,000.00
OTHER DIRECT COSTS		
Materials & Supplies		\$ 30,585.00
Publication Costs		\$ 500.00
Animal Housing		\$ 1,000.00
TOTAL OTHER DIRECT COSTS		\$ 32,085.00
TOTAL DIRECT		\$ 125,000.00
INDIRECT	55.50%	\$ 69,375.00
TOTAL		\$ 194,375.00

**From:** [Peter Daszak](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Aleksiej Chmura](#)  
**Subject:** Quick question re our revised NoA  
**Date:** Friday, September 11, 2020 1:35:17 AM  
**Attachments:** [NIH\\_NOA\\_1U01AI151797-01 revised.PDF](#)  
**Importance:** High

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Dear Jean and Shaun,

I wondered if it's possible to set up a short call either Friday (tomorrow) afternoon, Monday or Tuesday, just to check with you on the details of one of the changes in our revised NoA (attached). We'll make sure we comply, of course, but just want to check on whether the 'biosafety monitoring plan' is a standardized format we can get the details of, and how much detail you'll need, and how often we'll need to file or audit our partner's labs.

Look forward to talking with you.

Cheers,

Peter

**Peter Daszak**

*President*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-6507  
USA

Tel.: (b) (6)

Website: [www.ecohealthalliance.org](http://www.ecohealthalliance.org)

Twitter: [@PeterDaszak](https://twitter.com/PeterDaszak)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation*



NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

**Grant Number:** 1U01AI151797-01 REVISED  
**FAIN:** U01AI151797

**Principal Investigator(s):**  
PETER DASZAK, PHD

**Project Title:** Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

Aleksei Chmura  
Authorized Organizational Representative  
460 West 34th Street, Suite 1701  
New York, NY 100012317

**Award e-mailed to:** [REDACTED] (b) (6)

**Period Of Performance:**

**Budget Period:** 06/17/2020 – 05/31/2021

**Project Period:** 06/17/2020 – 05/31/2025

Dear Business Official:

The National Institutes of Health hereby revises this award (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to ECOHEALTH ALLIANCE, INC. in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 31 USC 6305 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release, or other document about research supported by an NIH award must include an acknowledgment of NIH award support and a disclaimer such as "Research reported in this publication was supported by the National Institute Of Allergy And Infectious Diseases of the National Institutes of Health under Award Number U01AI151797. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health." Prior to issuing a press release concerning the outcome of this research, please notify the NIH awarding IC in advance to allow for coordination.

Award recipients must promote objectivity in research by establishing standards that provide a reasonable expectation that the design, conduct and reporting of research funded under NIH awards will be free from bias resulting from an Investigator's Financial Conflict of Interest (FCOI), in accordance with the 2011 revised regulation at 42 CFR Part 50 Subpart F. The Institution shall submit all FCOI reports to the NIH through the eRA Commons FCOI Module. The regulation does not apply to Phase I Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) awards. Consult the NIH website <http://grants.nih.gov/grants/policy/coi/> for a link to the regulation and additional important information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,



Regina E. Kitsoulis  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

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**SECTION I – AWARD DATA – 1U01AI151797-01 REVISED****Award Calculation (U.S. Dollars)**

Salaries and Wages	\$272,938
Fringe Benefits	\$96,627
Personnel Costs (Subtotal)	\$369,565
Consultant Services	\$15,000
Materials & Supplies	\$7,918
Travel	\$72,225
Other	\$27,000
Subawards/Consortium/Contractual Costs	\$857,689

Federal Direct Costs	\$1,349,397
Federal F&A Costs	\$197,347
Approved Budget	\$1,546,744
Total Amount of Federal Funds Obligated (Federal Share)	\$1,546,744
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$1,546,744</b>

**AMOUNT OF THIS ACTION (FEDERAL SHARE)** \$0

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
1	\$1,546,744	\$1,546,744
2	\$1,505,568	\$1,505,568
3	\$1,504,400	\$1,504,400
4	\$1,503,220	\$1,503,220
5	\$1,502,037	\$1,502,037

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

**CFDA Name:** Allergy and Infectious Diseases Research  
**CFDA Number:** 93.855  
**EIN:** 1311726494A1  
**Document Number:** UAI151797A  
**PMS Account Type:** P (Subaccount)  
**Fiscal Year:** 2020

IC	CAN	2020	2021	2022	2023	2024
AI	8472315	\$1,546,744	\$1,505,568	\$1,504,400	\$1,503,220	\$1,502,037

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

**PCC:** M32F B / **OC:** 41026 / **Released:** (b) (6) 08/28/2020  
**Award Processed:** 08/29/2020 12:01:42 AM

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**SECTION II – PAYMENT/HOTLINE INFORMATION – 1U01AI151797-01 REVISED**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

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**SECTION III – TERMS AND CONDITIONS – 1U01AI151797-01 REVISED**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as

- those included in appropriations acts.
- c. 45 CFR Part 75.
- d. National Policy Requirements and all other requirements described in the NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- e. Federal Award Performance Goals: As required by the periodic report in the RPPR or in the final progress report when applicable.
- f. This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm> for certain references cited above.)

**Research and Development (R&D):** All awards issued by the National Institutes of Health (NIH) meet the definition of "Research and Development" at 45 CFR Part§ 75.2. As such, auditees should identify NIH awards as part of the R&D cluster on the Schedule of Expenditures of Federal Awards (SEFA). The auditor should test NIH awards for compliance as instructed in Part V, Clusters of Programs. NIH recognizes that some awards may have another classification for purposes of indirect costs. The auditor is not required to report the disconnect (i.e., the award is classified as R&D for Federal Audit Requirement purposes but non-research for indirect cost rate purposes), unless the auditee is charging indirect costs at a rate other than the rate(s) specified in the award document(s).

Carry over of an unobligated balance into the next budget period requires Grants Management Officer prior approval.

This award is subject to the requirements of 2 CFR Part 25 for institutions to receive a Dun & Bradstreet Universal Numbering System (DUNS) number and maintain an active registration in the System for Award Management (SAM). Should a consortium/subaward be issued under this award, a DUNS requirement must be included. See <http://grants.nih.gov/grants/policy/awardconditions.htm> for the full NIH award term implementing this requirement and other additional information.

This award has been assigned the Federal Award Identification Number (FAIN) U01AI151797. Recipients must document the assigned FAIN on each consortium/subaward issued under this award.

Based on the project period start date of this project, this award is likely subject to the Transparency Act subaward and executive compensation reporting requirement of 2 CFR Part 170. There are conditions that may exclude this award; see <http://grants.nih.gov/grants/policy/awardconditions.htm> for additional award applicability information.

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

In accordance with the regulatory requirements provided at 45 CFR 75.113 and Appendix XII to 45 CFR Part 75, recipients that have currently active Federal grants, cooperative agreements, and procurement contracts with cumulative total value greater than \$10,000,000 must report and maintain information in the System for Award Management (SAM) about civil, criminal, and administrative proceedings in connection with the award or performance of a Federal award that reached final disposition within the most recent five-year period. The recipient must also make semiannual disclosures regarding such proceedings. Proceedings information will be made publicly available in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System (FAPIIS)). Full reporting requirements and procedures are found in Appendix XII to 45 CFR Part 75. This term does not apply to NIH fellowships.

**Treatment of Program Income:**

---

**SECTION IV – AI Special Terms and Conditions – 1U01AI151797-01 REVISED**

Clinical Trial Indicator: No

This award does not support any NIH-defined Clinical Trials. See the NIH Grants Policy Statement Section 1.2 for NIH definition of Clinical Trial.

REVISED AWARD:

Subaward Agreement Requirements: The ECOHEALTH ALLIANCE, INC. must provide NIAID with copies of all (existing and newly established) subaward agreements established under this award, including descriptions of the biosafety monitoring plans, within 30 days of establishment.

Federal Funding Accountability and Transparency Subaward Reporting System (FSRS) Requirements: This award is subject to the Transparency Act subaward reporting requirement of 2 CFR Part 170, which must be reported through the Federal Funding Accountability and Transparency Subaward Reporting System (FSRS). The ECOHEALTH ALLIANCE, INC. must provide NIAID with proof of documentation of timely entries of subaward information into the FSRS within 30 days of submitting to FSRS.

Supersedes previous Notice of Award dated **06/17/2020**. All other terms and conditions still apply to this award.

+++++++

This award does not include funds to support research subject to the [Department of Health and Human Services Framework for Guiding Funding Decisions about Proposed Research Involving Enhanced Potential Pandemic Pathogens](#) (DHHS P3CO Framework) Therefore:

- For Aim 1: Identify, characterize and rank spillover risk of high zoonotic potential viruses from wildlife, the building of chimeric SARS-like bat coronaviruses will be based on the SHC014 or the pangolin coronavirus molecular clones and the building of chimeric MERS-CoV will be based on the HKU5 strain. Prior to further altering the mutant viruses you must provide NIAID with a detailed description of the proposed alterations and supporting evidence for the anticipated phenotypic characteristics of each virus.
- Alternative approaches to those referenced above, including building chimeras based on SARS-CoV-1, SARS-CoV-2, and MERS-CoV, may be subject to the DHHS P3CO Framework and must be submitted to NIAID for review and approval prior to the work commencing.

If any of the experiments proposed for Aim 1 result in a virus with a phenotype of enhanced pathogenicity and/or transmissibility, enhanced growth by more than 10 fold when compared to wild type strains, or if the mice display significant increases in weight loss, viral titer, or mortality when compared to wild-type strains, the recipient must immediately stop the work and notify the NIAID Program Officer, Grants Management Specialist, and appropriate institutional biosafety committee. Policy changes regarding the classification of these experiments or components used in these experiments may be subject to immediate halting of experimentation. No NIH funding can be used to perform such experiments until these experiments have been approved by NIAID with a revised NOA.

\*\*\*\*\*

Dissemination of study data will be in accord with the Recipient's accepted genomic data sharing plan as stated on page(s) **373** of the application. Failure to adhere to the sharing plan as mutually agreed upon by the Recipient and the NIAID may result in Enforcement Actions as described in the NIH Grants Policy Statement.

\*\*\*\*\*

This award includes human subject research studies and must conform to the DHHS policies for the [Protection of Human Subjects](#) research, which are a term and condition of award. Human subjects research is covered by the 2018 Common Rule, and may not be initiated until the associated protocols have received IRB approval as specified in [45 CFR 46](#). Failure to comply

with the terms and conditions of award may result in the disallowance of costs and/or additional enforcement actions as outlined in Section 8.5 of the NIH Grants Policy Statement.

\*\*\*\*\*

The Research Performance Progress Report (RPPR), Section G.9 (Foreign component), includes reporting requirements for all research performed outside of the United States. Research conducted at the following site(s) must be reported in your RPPR:

**Jeppesen Field Consulting Australia - AUSTRALIA**  
**Conservation Medicine Ltd. - MALAYSIA**  
**Duke-NUS Medical School - SINGAPORE**  
**Chulalongkorn University - THAILAND**

\*\*\*\*\*

This award may include collaborations with and/or between foreign organizations. Please be advised that short term travel visa expenses are an allowable expense on this grant, if justified as critical and necessary for the conduct of the project.

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Conservation Medicine Ltd. - MALAYSIA** in the amount of **\$224,997** (**\$208,331** direct costs + **\$16,666** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Duke-NUS Medical School - SINGAPORE** in the amount of **\$108,000** (**\$100,000** direct costs + **\$8,000** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Chulalongkorn University - THAILAND** in the amount of **\$215,944** (**\$199,948** direct costs + **\$15,996** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **The University of North Carolina at Chapel Hill** in the amount of **\$194,375** (**\$125,000** direct costs + **\$69,375** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity **The Henry M. Jackson Fdn. for the Adv'mt. of Mil. Med., Inc.** in the amount of **\$114,373** (**\$75,000** direct costs + **\$39,373** F&A costs).

\*\*\*\*\*

In accordance with the NIAID Financial Management Plan, NIAID does not provide funds for inflationary increases. Committed future year (s) funding was adjusted accordingly. See: <https://www.niaid.nih.gov/grants-contracts/financial-management-plan>.

\*\*\*\*\*

This award is issued as a Cooperative Agreement, a financial assistance mechanism in which substantial NIH scientific and/or programmatic involvement is anticipated in the performance of the activity. This award is subject to the Terms and Conditions of Award as set forth in Section VI: Award Administrative Information of **RFA AI-19-028, "Emerging Infectious Diseases Research Centers,"** posted date **3/5/2019**, which are hereby incorporated by reference as special terms and conditions of this award.

This RFA may be accessed at: <http://grants.nih.gov/grants/guide/index.html>

\*\*\*\*\*

This award is subject to the Clinical Terms of Award referenced in the NIH Guide for Grants and Contracts, July 8, 2002, NOT AI-02-032. These terms and conditions are hereby incorporated by reference, and can be accessed via the following World Wide Web address:

<https://www.niaid.nih.gov/grants-contracts/niaid-clinical-terms-award> All submissions required by the NIAID Clinical Terms of Award must be forwarded electronically or by mail to the responsible NIAID Program Official identified on this Notice of Award.

\*\*\*\*\*

Select Agents:

Awardee of a project that at any time involves a restricted experiment with a select agent, is responsible for notifying and receiving prior approval from the NIAID. Please be advised that changes in the use of a Select Agent will be considered a change in scope and require NIH awarding office prior approval. The approval is necessary for new select agent experiments as well as changes in on-going experiments that would require change in the biosafety plan and/or biosafety containment level. An approval to conduct a restricted experiment granted to an individual cannot be assumed an approval to other individuals who conduct the same restricted experiment as defined in the Select Agents Regulation 42 CFR Part 73, Section 13.b (<http://www.selectagents.gov/Regulations.html>).

#### Highly Pathogenic Agent:

NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmbl5/bmbl5toc.htm>). Research funded under this grant must adhere to the BMBL, including using the BMBL-recommended biocontainment level at a minimum. If your Institutional Biosafety Committee (or equivalent body) or designated institutional biosafety official recommend a higher biocontainment level, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If your IBC or equivalent body or official has determined, for example, by conducting a risk assessment, that the work being planned or performed under this grant may be conducted at a biocontainment safety level that is lower than BSL3.

If the work involves Select Agents and/or Highly Pathogenic Agents, also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) including its restricted experiments that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s), and whether or not the work is a restricted experiment;
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

## STAFF CONTACTS

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Shaun W Gratton

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Jean Lois Patterson

**Email:** (b) (6) **Phone:** (b) (6)

**SPREADSHEET SUMMARY****GRANT NUMBER:** 1U01AI151797-01 REVISED**INSTITUTION:** ECOHEALTH ALLIANCE, INC.

Budget	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries and Wages	\$272,938	\$272,938	\$272,938	\$272,938	\$272,938
Fringe Benefits	\$96,627	\$96,628	\$96,628	\$96,628	\$96,628
Personnel Costs (Subtotal)	\$369,565	\$369,566	\$369,566	\$369,566	\$369,566
Consultant Services	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Materials & Supplies	\$7,918	\$7,918	\$7,918	\$7,918	\$7,918
Travel	\$72,225	\$72,225	\$72,225	\$72,225	\$72,225
Other	\$27,000	\$27,000	\$27,000	\$27,000	\$27,000
Subawards/Consortium/Contractual Costs	\$857,689	\$856,512	\$855,344	\$854,164	\$852,981
TOTAL FEDERAL DC	\$1,349,397	\$1,348,221	\$1,347,053	\$1,345,873	\$1,344,690
TOTAL FEDERAL F&A	\$197,347	\$157,347	\$157,347	\$157,347	\$157,347
TOTAL COST	\$1,546,744	\$1,505,568	\$1,504,400	\$1,503,220	\$1,502,037

Facilities and Administrative Costs	Year 1	Year 2	Year 3	Year 4	Year 5
F&A Cost Rate 1	32%	32%	32%	32%	32%
F&A Cost Base 1	\$616,708	\$491,709	\$491,709	\$491,709	\$491,709
F&A Costs 1	\$197,347	\$157,347	\$157,347	\$157,347	\$157,347

**From:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**To:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#); [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements  
**Date:** Friday, February 26, 2021 1:08:19 PM

---

Hi Shaun,  
Yes, I've been reviewing these as they've been coming in. They all appear to be acceptable to me.  
Sincerely, Sara

---

**From:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, February 26, 2021 8:57 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Cc:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Subject:** FW: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements

Hi Jean and Sara,

I think we have your all's confirmation of acceptability on some of Echo Health's subaward agreements and bio plans. Just to sure up the file can I get you all to review all of the plans that we have received thus far and provide your concurrence on the plans?

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

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*statement made that are the sender's own and not expressly made on behalf of the NIAID by one of its representatives.*

**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Hongying Li](#); [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Aleksei Chmura](#); [Peter Daszak](#); [Su Yadana](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the The Henry M. Jackson Foundation for the Advancement of Military Medicine  
**Date:** Thursday, February 25, 2021 8:46:20 AM

---

Hi Hongying,

This email is to confirm receipt of the newly established subaward agreement.

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

*Note:*

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---

**From:** Hongying Li (b) (6)  
**Sent:** Tuesday, February 23, 2021 11:37 AM  
**To:** Gratton, Shaun (NIH/NIAID) [E] (b) (6); Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Cc:** Aleksei Chmura (b) (6); Peter Daszak (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the The Henry M. Jackson Foundation for the Advancement of Military Medicine

Good Morning Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (23th February 2021) subaward agreement with The Henry M. Jackson Foundation for the Advancement of Military Medicine/Uniformed Services University under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Hongying Li](#); [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the University of North Carolina at Chapel Hill  
**Date:** Wednesday, January 27, 2021 8:04:44 AM

---

Good Morning Hongying,

This email confirms NIAID's receipt of the newly established subaward agreement on grant 1U01AI152797-01.

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

*Note:*

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**From:** Hongying Li (b) (6)  
**Sent:** Tuesday, January 26, 2021 7:40 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the University of North Carolina at Chapel Hill

Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (14th January 2021) subaward agreement with the University of North Carolina at Chapel Hill under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)  
**Date:** Wednesday, January 6, 2021 8:51:41 AM

---

Hi Jean,

I can't seem to find an email with the attachment that Hongying probably included in her email below. Would you be able to dig that out and forward it to me?

Sincerely, Sara

---

**From:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, December 18, 2020 9:01 AM  
**To:** Hongying Li (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6); Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Thank you, Hongying. We have received it!  
Jean

**From:** Hongying Li (b) (6)  
**Sent:** Friday, December 18, 2020 8:53 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Dear Jean and Shaun,


As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (12th December 2020) subaward agreement with Chulalongkorn University (Thailand) under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

 (b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#); [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements  
**Date:** Monday, March 1, 2021 7:51:41 AM

---

Thank you both!

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

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---

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---

**From:** Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, February 26, 2021 1:08 PM  
**To:** Gratton, Shaun (NIH/NIAID) [E] (b) (6); Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements

Hi Shaun,  
Yes, I've been reviewing these as they've been coming in. They all appear to be acceptable to me.  
Sincerely, Sara

---

**From:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, February 26, 2021 8:57 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Cc:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)



**Subject:** FW: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreements

Hi Jean and Sara,

I think we have your all's confirmation of acceptability on some of Echo Health's subaward agreements and bio plans. Just to sure up the file can I get you all to review all of the plans that we have received thus far and provide your concurrence on the plans?

Thank you,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

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---

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**From:** [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**To:** [Aleksei Chmura; Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak; Hongying Li](#)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Monday, December 14, 2020 7:23:48 AM

---

Good Morning Aleksei,

I am writing to confirm receipt of the subaward agreement. We will review the agreement and get back to EchoHealth should we have any questions.

Sincerely,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

---

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---

**From:** Aleksei Chmura (b) (6)  
**Sent:** Sunday, December 13, 2020 8:49 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6) Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6) Hongying Li (b) (6)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksi

**Aleksei Chmura, PhD**  
*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6)  
(office)  
(mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**To:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Monday, December 14, 2020 8:31:35 AM

---

Hi Jean,  
Can you forward me the attachment (if there was one)? It didn't come through.....  
Sincerely, Sara

---

**From:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 8:30 AM  
**To:** Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Subject:** FW: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

---

**From:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 7:24 AM  
**To:** Aleksei Chmura (b) (6) Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6) Hongying Li (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Good Morning Aleksei,

I am writing to confirm receipt of the subaward agreement. We will review the agreement and get back to EchoHealth should we have any questions.

Sincerely,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

---

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---

**From:** Aleksei Chmura (b) (6)  
**Sent:** Sunday, December 13, 2020 8:49 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6) Gratton, Shaun (NIH/NIAID) [E]  
(b) (6)  
**Cc:** Peter Daszak (b) (6) Hongying Li (b) (6)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksei

**Aleksei Chmura, PhD**  
*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(b) (6) (mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Aleksei Chmura](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#); [Peter Daszak](#); [Hongying Li](#)  
**Subject:** Re: REMINDER: URGENT: SARS-CoV-2 Variant Supplements  
**Date:** Thursday, June 10, 2021 11:26:44 PM  
**Attachments:** [AI151797 EID-SEARCH Y2 Supplement as submitted.pdf](#)  
**Importance:** High

---

Dear Sara,

Please find a copy of our proposed supplemental funding for Thailand under our CREID EID-SEARCH award (AI151797).

If you have any questions or require additional details, let us know anytime.

Cheers!

-Aleksei

**Aleksei Chmura, PhD**  
*Chief of Staff &  
Authorized Organizational Representative*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

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APPLICATION FOR FEDERAL ASSISTANCE  
**SF 424 (R&R)**

<b>3. DATE RECEIVED BY STATE</b>		<b>State Application Identifier</b>
<b>1. TYPE OF SUBMISSION*</b>		<b>4.a. Federal Identifier</b> AI151797
<input type="radio"/> Pre-application <input checked="" type="radio"/> Application <input type="radio"/> Changed/Corrected Application		<b>b. Agency Routing Number</b>
<b>2. DATE SUBMITTED</b>	<b>Application Identifier</b>	<b>c. Previous Grants.gov Tracking Number</b>
<b>5. APPLICANT INFORMATION</b>		<b>Organizational DUNS*: 077090066</b>
Legal Name*:	ECOHEALTH ALLIANCE, INC.	
Department:		
Division:		
Street1*:	460 West 34th Street, Suite 1701	
Street2:		
City*:	New York	
County:		
State*:	NY: New York	
Province:		
Country*:	USA: UNITED STATES	
ZIP / Postal Code*:	100012317	
Person to be contacted on matters involving this application		
Prefix: Dr.	First Name*: Aleksei	Middle Name: Last Name*: Chmura Suffix:
Position/Title:		
Street1*:	460 West 34th Street, Suite 1701	
Street2:		
City*:	New York	
County:		
State*:	NY: New York	
Province:		
Country*:	USA: UNITED STATES	
ZIP / Postal Code*:	100184183	
Phone Number*:	(b) (6)	Fax Number: 2123804465 Email: (b) (6)
<b>6. EMPLOYER IDENTIFICATION NUMBER (EIN) or (TIN)*</b>		311726494
<b>7. TYPE OF APPLICANT*</b>		M: Nonprofit with 501C3 IRS Status (Other than Institution of Higher Education)
Other (Specify):		
<input checked="" type="radio"/> <b>Small Business Organization Type</b> <input type="radio"/> Women Owned <input type="radio"/> Socially and Economically Disadvantaged		
<b>8. TYPE OF APPLICATION*</b>		If Revision, mark appropriate box(es).
<input type="radio"/> New <input type="radio"/> Resubmission <input type="radio"/> A. Increase Award <input type="radio"/> B. Decrease Award <input type="radio"/> C. Increase Duration		
<input type="radio"/> Renewal <input type="radio"/> Continuation <input checked="" type="radio"/> Revision <input type="radio"/> D. Decrease Duration <input type="radio"/> E. Other (specify) :		
<b>Is this application being submitted to other agencies?*</b> <input type="radio"/> Yes <input checked="" type="radio"/> No     What other Agencies?		
<b>9. NAME OF FEDERAL AGENCY*</b>		<b>10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER</b>
National Institutes of Health		855
		TITLE:
<b>11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT*</b>		
Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia		
<b>12. PROPOSED PROJECT</b>		<b>13. CONGRESSIONAL DISTRICTS OF APPLICANT</b>
Start Date*	Ending Date*	NY-010
07/01/2021	06/30/2022	

**14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION**

Prefix: Dr. First Name\*: PETER Middle Name: Last Name\*: DASZAK Suffix:  
 Position/Title: Executive Director  
 Organization Name\*: ECOHEALTH ALLIANCE, INC.  
 Department:  
 Division:  
 Street1\*: 520 Eighth Avenue  
 Street2: Suite 1200  
 City\*: New York  
 County:  
 State\*: NY: New York  
 Province:  
 Country\*: USA: UNITED STATES  
 ZIP / Postal Code\*: 100186507  
 Phone Number\*: (b) (6) Fax Number: 212-380-4465 Email\*: (b) (6)

**15. ESTIMATED PROJECT FUNDING**

a. Total Federal Funds Requested\* \$271,743.00  
 b. Total Non-Federal Funds\* \$0.00  
 c. Total Federal & Non-Federal Funds\* \$271,743.00  
 d. Estimated Program Income\* \$0.00

**16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?\***

- a. YES  THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:  
 DATE:  
 b. NO  PROGRAM IS NOT COVERED BY E.O. 12372; OR  
 PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

**17. By signing this application, I certify (1) to the statements contained in the list of certifications\* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances \* and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)**

I agree\*

\* The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

**18. SFLL or OTHER EXPLANATORY DOCUMENTATION**

File Name:

**19. AUTHORIZED REPRESENTATIVE**

Prefix: Dr. First Name\*: Aleksei Middle Name: Last Name\*: Chmura Suffix:  
 Position/Title\*: Authorized Organizational Repr  
 Organization Name\*: EcoHealth Alliance, Inc.  
 Department:  
 Division:  
 Street1\*: 520 Eighth Avenue  
 Street2: Suite 1200  
 City\*: New York  
 County:  
 State\*: NY: New York  
 Province:  
 Country\*: USA: UNITED STATES  
 ZIP / Postal Code\*: 100184183  
 Phone Number\*: (b) (6) Fax Number: 2123804465 Email\*: (b) (6)

**Signature of Authorized Representative\***

Completed on submission to Grants.gov

**Date Signed\***

06/08/2021

**20. PRE-APPLICATION** File Name:**21. COVER LETTER ATTACHMENT** File Name:



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### Project/Performance Site Location(s)

#### Project/Performance Site Primary Location

I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name: ECOHEALTH ALLIANCE, INC.  
Duns Number: 077090066  
Street1\*: 460 W 34TH ST.  
Street2: SUITE 1701  
City\*: NEW YORK  
County: NEW YORK  
State\*: NY: New York  
Province:  
Country\*: USA: UNITED STATES  
Zip / Postal Code\*: 100012320  
Project/Performance Site Congressional District\*: NY-010

#### Project/Performance Site Location 1

I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name: Chulalongkorn University  
DUNS Number: 659808836  
Street1\*: 254 Phayathai Road  
Street2:  
City\*: Pathumwan, Bangkok  
County:  
State\*:  
Province:  
Country\*: THA: THAILAND  
Zip / Postal Code\*: 103300000  
Project/Performance Site Congressional District\*:

#### Additional Location(s)

File Name:



## PROJECT SUMMARY/ABSTRACT

The continuing evolution and spread of SARS-CoV-2 is a global concern. Some SARS-CoV-2 variants detected in multiple countries have showed increased transmissibility and virulence, posing challenges for public health measures and available diagnostics, vaccines, and therapeutics. Enhanced genomic monitoring and surveillance is essential to control the spread of SARS-CoV-2. Thailand has experienced a resurgence of COVID-19 cases in recent months caused by SARS-CoV-2 variants, but a genomic surveillance system is not yet in place. The proposed work will be led by collaborators at King Chulalongkorn Memorial Hospital, the central clinical and diagnostic facility in the capital city Bangkok. We will establish a national genomic surveillance system for SARS-CoV-2 for Thailand that **1)** Identifies known and novel SARS-CoV-2 variants circulating in local communities by conducting genomic surveillance among COVID-19 patients; **2)** Characterizes SARS-CoV-2 variants we identify and analyze clinical data to understand viral shedding, immune response and other clinical impacts of different SARS-CoV-2 variants; **3)** Strengthens in-country research capacity and promote international collaboration and global data sharing on SARS-CoV-2 and other emerging viruses. This work is well supported by CREID EID-SEARCH partners and stakeholders in Thailand, to address a key scientific and capacity gap in Southeast Asia. This work will inform clinical practices, public health and social measures for COVID-19 control, and significantly contribute to international genomic surveillance and data sharing on SARS-CoV-2 variants.

## **PROJECT NARRATIVE**

The proposed work will help establish a national genomic surveillance system for SARS-CoV-2 in Thailand to monitor and characterize SARS-CoV-2 variants circulating among local communities. The team will conduct genomic surveillance among COVID-19 patients in Thailand to identify known and novel SARS-CoV-2 variants and characterize important strains to understand their potential clinical impacts. This work will fill a critical knowledge and capacity gap in understanding the risk of SARS-CoV-2 variants in Thailand, and significantly contribute to global genomic surveillance and data sharing for SARS-CoV-2 variants.

## RESEARCH &amp; RELATED Senior/Key Person Profile (Expanded)

PROFILE - Project Director/Principal Investigator				
Prefix: Dr.	First Name*: PETER	Middle Name	Last Name*: DASZAK	Suffix:
Position/Title*:	Executive Director			
Organization Name*:	ECOHEALTH ALLIANCE, INC.			
Department:				
Division:				
Street1*:	520 Eighth Avenue			
Street2:	Suite 1200			
City*:	New York			
County:				
State*:	NY: New York			
Province:				
Country*:	USA: UNITED STATES			
Zip / Postal Code*:	100186507			
Phone Number*:	(b) (6)	Fax Number:	212-380-4465	
E-Mail*:	(b) (6)			
Credential, e.g., agency login:	(b) (6)			
Project Role*:	PD/PI	Other Project Role Category:		
Degree Type:	PhD	Degree Year:	1993	
Attach Biographical Sketch*:	File Name:			
Attach Current & Pending Support:	File Name:			

PROFILE - Senior/Key Person				
Prefix:	First Name*: Hongying	Middle Name	Last Name*: Li	Suffix:
Position/Title*:				
Organization Name*:	EcoHealth Alliance			
Department:				
Division:				
Street1*:	520 Eighth Avenue			
Street2:				
City*:	New York			
County:	New York			
State*:	NY: New York			
Province:				
Country*:	USA: UNITED STATES			
Zip / Postal Code*:	100184183			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Other (Specify)			Other Project Role Category: Epidemiologist	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		

PROFILE - Senior/Key Person				
Prefix: Dr.	First Name*: Supaporn	Middle Name	Last Name*: Wacharapluesadee	Suffix:
Position/Title*:				
Organization Name*:				
Department:				
Division:				
Street1*:	1873 Rama IV Road			
Street2:				
City*:	Bangkok			
County:				
State*:				
Province:				
Country*:	THA: THAILAND			
Zip / Postal Code*:	103300000			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Co-Investigator			Other Project Role Category:	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		

PROFILE - Senior/Key Person				
Prefix: Dr.	First Name*: Cadhla	Middle Name	Last Name*: Firth	Suffix:
Position/Title*:				
Organization Name*:	EcoHealth Alliance			
Department:				
Division:				
Street1*:	520 Eighth Avenue			
Street2:				
City*:	New York			
County:				
State*:	NY: New York			
Province:				
Country*:	USA: UNITED STATES			
Zip / Postal Code*:	100184183			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Other (Specify)			Other Project Role Category: Bioinformatician	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		

PROFILE - Senior/Key Person				
Prefix:	First Name*: Su	Middle Name	Last Name*: Yadana	Suffix:
Position/Title*:				
Organization Name*:	EcoHealth Alliance			
Department:				
Division:				
Street1*:	520 Eighth Avenue			
Street2:				
City*:	New York			
County:				
State*:	NY: New York			
Province:				
Country*:	USA: UNITED STATES			
Zip / Postal Code*:	100184183			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Other (Specify)			Other Project Role Category: Epidemiologist	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		



PROFILE - Senior/Key Person				
Prefix: Dr.	First Name*: Pattama	Middle Name	Last Name*: Torvorapanit	Suffix:
Position/Title*:	Infectious Disease Specialist			
Organization Name*:	Thai Red Cross Emerging Infectious Diseases Clinical Center			
Department:				
Division:				
Street1*:	Rama IV			
Street2:				
City*:	Pathumwan			
County:				
State*:				
Province:				
Country*:	THA: THAILAND			
Zip / Postal Code*:	10330			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Other (Specify)			Other Project Role Category: Clinician	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		

PROFILE - Senior/Key Person				
Prefix: Dr.	First Name*: Opass	Middle Name	Last Name*: Putcharoen	Suffix:
Position/Title*:	Chief Director of the TRC-EID Clinical Center			
Organization Name*:	Thai Red Cross Emerging Infectious Diseases Clinical Center			
Department:				
Division:				
Street1*:	Rama IV			
Street2:				
City*:	Pathumwan			
County:				
State*:				
Province:				
Country*:	THA: THAILAND			
Zip / Postal Code*:	10330			
Phone Number*:	(b) (6)	Fax Number:		
E-Mail*:	(b) (6)			
Credential, e.g., agency login:				
Project Role*: Other (Specify)			Other Project Role Category: Clinician	
Degree Type:			Degree Year:	
Attach Biographical Sketch*:		File Name:		
Attach Current & Pending Support:		File Name:		

## RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 1

ORGANIZATIONAL DUNS\*: 077090066

**Budget Type\*:**     Project     Subaward/Consortium

**Enter name of Organization:** ECOHEALTH ALLIANCE, INC.

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

A. Senior/Key Person												
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*
1 . Dr.	Cadhla		Firth		Bioinformatician							(b) (6), (b) (4)
<b>Total Funds Requested for all Senior Key Persons in the attached file</b>											(b) (6), (b) (4)	
<b>Additional Senior Key Persons:</b> File Name:											<b>Total Senior/Key Person</b> (b) (6), (b) (4)	

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
1	Epidemiologist	2.0					(b) (6), (b) (4)
1	Research Coordinator	4.0					(b) (6), (b) (4)
<b>2</b>	<b>Total Number Other Personnel</b>					<b>Total Other Personnel</b>	<b>(b) (6), (b) (4)</b>
<b>Total Salary, Wages and Fringe Benefits (A+B)</b>							<b>59,850.00</b>

RESEARCH & RELATED Budget {A-B} (Funds Requested)

## RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 1

**ORGANIZATIONAL DUNS\*:** 077090066

**Budget Type\*:**     Project     Subaward/Consortium

**Organization:** ECOHEALTH ALLIANCE, INC.

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

<b>C. Equipment Description</b>		<b>Funds Requested (\$)*</b>
List items and dollar amount for each item exceeding \$5,000		
<b>Equipment Item</b>		
<b>Total funds requested for all equipment listed in the attached file</b>		
<b>Total Equipment</b>		<b>0.00</b>
<b>Additional Equipment:</b> File Name:		

<b>D. Travel</b>		<b>Funds Requested (\$)*</b>
1. Domestic Travel Costs ( Incl. Canada, Mexico, and U.S. Possessions)		
2. Foreign Travel Costs		
<b>Total Travel Cost</b>		<b>0.00</b>

<b>E. Participant/Trainee Support Costs</b>		<b>Funds Requested (\$)*</b>
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
<b>Number of Participants/Trainees</b>		
<b>Total Participant Trainee Support Costs</b>		<b>0.00</b>

RESEARCH & RELATED Budget (C-E) (Funds Requested)

## RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 1

**ORGANIZATIONAL DUNS\*:** 077090066

**Budget Type\*:**   ● Project   ○ Subaward/Consortium

**Organization:** ECOHEALTH ALLIANCE, INC.

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

F. Other Direct Costs	Funds Requested (\$)*
1. Materials and Supplies	
2. Publication Costs	3,500.00
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	171,933.00
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
<b>Total Other Direct Costs</b>	<b>175,433.00</b>

G. Direct Costs	Funds Requested (\$)*
<b>Total Direct Costs (A thru F)</b>	<b>235,283.00</b>

H. Indirect Costs			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. Federally approved indirect cost rate	35.84	63,350.00	22,705.00
2. Chulalongkorn de minimus Indirect Cost	8.0	171,933.00	13,755.00
		<b>Total Indirect Costs</b>	<b>36,460.00</b>
<b>Cognizant Federal Agency</b>		Department of Defense, Department of the Navy, Sharon Gales,	
(Agency Name, POC Name, and POC Phone Number)		+1.703.696.8559	

I. Total Direct and Indirect Costs	Funds Requested (\$)*
<b>Total Direct and Indirect Institutional Costs (G + H)</b>	<b>271,743.00</b>

J. Fee	Funds Requested (\$)*

K. Total Costs and Fee	Funds Requested (\$)*
	<b>271,743.00</b>

L. Budget Justification*
File Name: EHA_Budget_Justification_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget {F-K} (Funds Requested)

## **ECOHEALTH ALLIANCE BUDGET JUSTIFICATION**

### **A. Senior/Key Personnel**

Dr. Cadhla Firth (Bioinformatician), will commit (b) (6), (b) (4) per year to this study. Dr. Firth will assist in with meta-genomic data and phylogenetic analyses and manuscript writing.

Epidemiologist, Hongying Li, will commit (b) (6), (b) (4) per year to this study. Li will assist with the development of human data collection instruments, testing, and implementation; advise on data storage, data analyses, and manuscript writing. She will also provide training for teams conducting human subjects research.

Su Yadana (Research Coordinator), will commit (b) (6), (b) (4) per year to this study. Yadana will coordinate the study implementation with EcoHealth Alliance and Thai partners, support the management of IRBs and trainings for human subject research.

### **B. Other Personnel**

#### **Fringe Benefits**

Fringe benefits for all personnel are calculated with EcoHealth Alliance's federally approved rate of 36.80% of base salary.

#### **C. Equipment**

No equipment will be purchased in this budget.

#### **D. Travel**

No travel cost is requested in this budget.

#### **E. Participant/Trainee Support Costs**

No participant/trainee support cost is requested in this budget.

#### **F. Other Direct Costs**

##### *Publication Costs*

We request \$3,500 per year for open access fees required to publish research findings in peer-reviewed journals such as *Nature*, *Public Library of Science*, and other journals. We estimate one publication per year from this work at \$3,500 in open access fee.

#### **H. Indirect Costs**

We are requesting the EcoHealth Alliance federally approved indirect cost rate of 35.84% on all applicable direct costs. No indirect is applied on the subaward for this study.

**RESEARCH & RELATED BUDGET - Cumulative Budget**

	Totals (\$)	(b) (6), (b) (4)
Section A, Senior/Key Person		
Section B, Other Personnel		
Total Number Other Personnel	2	
Total Salary, Wages and Fringe Benefits (A+B)		59,850.00
Section C, Equipment		0.00
Section D, Travel		0.00
1. Domestic	0.00	
2. Foreign	0.00	
Section E, Participant/Trainee Support Costs		0.00
1. Tuition/Fees/Health Insurance	0.00	
2. Stipends	0.00	
3. Travel	0.00	
4. Subsistence	0.00	
5. Other	0.00	
6. Number of Participants/Trainees	0	
Section F, Other Direct Costs		175,433.00
1. Materials and Supplies	0.00	
2. Publication Costs	3,500.00	
3. Consultant Services	0.00	
4. ADP/Computer Services	0.00	
5. Subawards/Consortium/Contractual Costs	171,933.00	
6. Equipment or Facility Rental/User Fees	0.00	
7. Alterations and Renovations	0.00	
8. Other 1	0.00	
9. Other 2	0.00	
10. Other 3	0.00	
Section G, Direct Costs (A thru F)		235,283.00
Section H, Indirect Costs		36,460.00
Section I, Total Direct and Indirect Costs (G + H)		271,743.00
Section J, Fee		0.00
Section K, Total Costs and Fee (I + J)		271,743.00

## RESEARCH & RELATED BUDGET - SECTION A & B, Budget Period 1

ORGANIZATIONAL DUNS\*: 6598088360000

**Budget Type\*:**     Project     Subaward/Consortium

**Enter name of Organization:** Chulalongkorn University

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

A. Senior/Key Person												
Prefix	First Name*	Middle Name	Last Name*	Suffix	Project Role*	Base Salary (\$)	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits (\$)*	Funds Requested (\$)*
1 .	Dr.	Supaporn	Wacharapulsadee		Co-Investigator							(b) (6), (b) (4)
2 .	Dr.	Pattama	Torvorapanit		Co-Investigator							
3 .	Dr.	Opass	Putchareon		Co-Investigator							
<b>Total Funds Requested for all Senior Key Persons in the attached file</b>												
<b>Additional Senior Key Persons:</b>		File Name:								<b>Total Senior/Key Person</b>	<b>25,000.00</b>	

B. Other Personnel							
Number of Personnel*	Project Role*	Calendar Months	Academic Months	Summer Months	Requested Salary (\$)*	Fringe Benefits*	Funds Requested (\$)*
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
	Secretarial/Clerical						
2	Site coordinating nurse						(b) (6), (b) (4)
1	Lab technician						
1	Program manager						
<b>4</b>	<b>Total Number Other Personnel</b>					<b>Total Other Personnel</b>	<b>39,333.33</b>
						<b>Total Salary, Wages and Fringe Benefits (A+B)</b>	<b>64,333.33</b>

RESEARCH & RELATED Budget {A-B} (Funds Requested)

## RESEARCH & RELATED BUDGET - SECTION C, D, & E, Budget Period 1

**ORGANIZATIONAL DUNS\*:** 6598088360000

**Budget Type\*:**     Project     Subaward/Consortium

**Organization:** Chulalongkorn University

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

<b>C. Equipment Description</b>		<b>Funds Requested (\$)*</b>
List items and dollar amount for each item exceeding \$5,000		
<b>Equipment Item</b>		
<b>Total funds requested for all equipment listed in the attached file</b>		
<b>Total Equipment</b>		<b>0.00</b>
<b>Additional Equipment:</b> File Name:		

<b>D. Travel</b>		<b>Funds Requested (\$)*</b>
1. Domestic Travel Costs ( Incl. Canada, Mexico, and U.S. Possessions)		
2. Foreign Travel Costs		
<b>Total Travel Cost</b>		<b>1,000.00</b>

<b>E. Participant/Trainee Support Costs</b>		<b>Funds Requested (\$)*</b>
1. Tuition/Fees/Health Insurance		
2. Stipends		
3. Travel		
4. Subsistence		
5. Other:		
<b>Number of Participants/Trainees</b>		<b>0.00</b>
<b>Total Participant Trainee Support Costs</b>		<b>0.00</b>

RESEARCH & RELATED Budget (C-E) (Funds Requested)



## RESEARCH & RELATED BUDGET - SECTIONS F-K, Budget Period 1

**ORGANIZATIONAL DUNS\*:** 6598088360000

**Budget Type\*:**     Project     Subaward/Consortium

**Organization:** Chulalongkorn University

**Start Date\*:** 07-01-2021

**End Date\*:** 06-30-2022

**Budget Period:** 1

<b>F. Other Direct Costs</b>	<b>Funds Requested (\$)*</b>
1. Materials and Supplies	98,600.00
2. Publication Costs	3,000.00
3. Consultant Services	
4. ADP/Computer Services	
5. Subawards/Consortium/Contractual Costs	
6. Equipment or Facility Rental/User Fees	
7. Alterations and Renovations	
8. Maintenance cost	3,000.00
9. Meetings (facilities)	2,000.00
<b>Total Other Direct Costs</b>	<b>106,600.00</b>

<b>G. Direct Costs</b>	<b>Funds Requested (\$)*</b>
<b>Total Direct Costs (A thru F)</b>	<b>171,933.33</b>

<b>H. Indirect Costs</b>			
Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base (\$)	Funds Requested (\$)*
1. de minimus	8.0	171,933.33	13,754.67
<b>Total Indirect Costs</b>			<b>13,754.67</b>
<b>Cognizant Federal Agency</b>			
(Agency Name, POC Name, and POC Phone Number)			

<b>I. Total Direct and Indirect Costs</b>	<b>Funds Requested (\$)*</b>
<b>Total Direct and Indirect Institutional Costs (G + H)</b>	<b>185,688.00</b>

<b>J. Fee</b>	<b>Funds Requested (\$)*</b>

<b>K. Total Costs and Fee</b>	<b>Funds Requested (\$)*</b>
	<b>185,688.00</b>

<b>L. Budget Justification*</b>
File Name: Chulalongkorn_Budget_Justification_FINAL.pdf (Only attach one file.)

RESEARCH & RELATED Budget (F-K) (Funds Requested)

## CHULALONGKORN HOSPITAL BUDGET JUSTIFICATION, SUBAWARD

### **A. Senior/Key Personnel**

Supaporn Wacharapluesadee (Co-Investigator), will commit (b) (6), (b) (4) to this study. Dr. Wacharapluesadee will oversee all aspects of this study in Thailand and direct the activities of the Other Personnel. At a regular basis, Dr. Wacharapluesadee will meet with the PI and other Co-PIs to refine study protocols, report back results, and prepare publications.

Pattama Torvorapanit (Clinician), will commit (b) (6), (b) (4) to this study. Dr. Torvorapanit will assist with study design, implementing human data collection at clinics, genomic analysis and coordinate with local research team members and international collaborators.

Opass Putchareon (Clinician), will commit (b) (6), (b) (4) to this study. Dr. Putchareon will oversee the study implementation at the hospital site and contribute to the study design and manuscript writing.

### **B. Other Personnel**

TBD (2) (Site Coordinating Nurse), will commit (b) (6), (b) (4) per year to assist the recruitment, sample collection and sample transportation to the lab.

TBD (Laboratory Technician), will commit (b) (6), (b) (4) per year to run diagnostic assays, genomics, and virus isolation work as well as assisting with sample shipments, storage, and maintenance of cold chain

TBD (Program Manager), will commit (b) (6), (b) (4) per year to assist all personnel and maintaining all administrative aspects of this proposal including equipment purchase and inventory, reporting, minutes, setting up meetings, and coordinating in-country meetings.

### **Fringe Benefits**

No fringe benefits are requested.

### **C. Equipment**

No equipment over \$5,000 will be purchased.

### **D. Travel**

#### *Domestic Travel.*

Domestic travel costs are estimated at \$1,000 per year to support the study Co-investigator and team members to visit hospital site(s), in-county research collaborators, health authorities, and other government stakeholders for data collection, study communication and coordination. The costs are estimated as \$100 x 10 trips, including costs of drivers, vehicle rental, and fuels.

#### *Foreign Travel.*

No International travel is anticipated.

### **E. Participant/Trainee Support Costs**

No participant/trainee support costs are requested.

### **F. Other Direct Costs**

#### *Materials and Supplies.*

Chulalongkorn University requests reimbursement of estimated laboratory costs. These are calculated based upon current annual costs, including RNA extraction (\$10,000), PCR reagents and sequencing (\$35,000), gloves, chemicals, plasticware, and other miscellaneous supplies (\$8,600). In addition, NGS sequencing costs are estimated at \$45,000.

#### *Meetings*

Chulalongkorn University will host meetings with hospital staff, health authorities, and research collaborators to

implement the study, report the progress, and disseminate the study results. Costs are estimated at \$2,000, including \$1,000 for venue rentals, \$1,000 for projector, video, meeting material printing supported by the University.

*Maintenance Costs.*

Reimbursement is requested in the amount of \$3,000 for annual maintenance costs for laboratory PCR-sequencers and other equipment.

*Publication Costs*

Chulalongkorn University requests \$3,000 per year for open access fees required to publish research findings in peer-reviewed journals. It is estimated for one publication per year from this work at \$3,000 in open access fee.

**H. Indirect Costs (8%)**

Chulalongkorn University requests reimbursement of the *de minimus* indirect cost recovery rate of 8% of modified or allowable direct costs.

**RESEARCH & RELATED BUDGET - Cumulative Budget**

	Totals (\$)	
Section A, Senior/Key Person		25,000.00
Section B, Other Personnel		39,333.33
Total Number Other Personnel	4	
Total Salary, Wages and Fringe Benefits (A+B)		64,333.33
Section C, Equipment		0.00
Section D, Travel		1,000.00
1. Domestic	0.00	
2. Foreign	1,000.00	
Section E, Participant/Trainee Support Costs		0.00
1. Tuition/Fees/Health Insurance	0.00	
2. Stipends	0.00	
3. Travel	0.00	
4. Subsistence	0.00	
5. Other	0.00	
6. Number of Participants/Trainees	0	
Section F, Other Direct Costs		106,600.00
1. Materials and Supplies	98,600.00	
2. Publication Costs	3,000.00	
3. Consultant Services	0.00	
4. ADP/Computer Services	0.00	
5. Subawards/Consortium/Contractual Costs	0.00	
6. Equipment or Facility Rental/User Fees	0.00	
7. Alterations and Renovations	0.00	
8. Other 1	3,000.00	
9. Other 2	2,000.00	
10. Other 3	0.00	
Section G, Direct Costs (A thru F)		171,933.33
Section H, Indirect Costs		13,754.67
Section I, Total Direct and Indirect Costs (G + H)		185,688.00
Section J, Fee		0.00
Section K, Total Costs and Fee (I + J)		185,688.00

**Total Direct Costs less Consortium F&A**

NIH policy (NOT-OD-05-004) allows applicants to exclude consortium/contractual F&A costs when determining if an application falls at or beneath any applicable direct cost limit. When a direct cost limit is specified in an FOA, the following table can be used to determine if your application falls within that limit.

<b>Categories</b>	<b>Budget Period 1</b>	<b>Budget Period 2</b>	<b>Budget Period 3</b>	<b>Budget Period 4</b>	<b>Budget Period 5</b>	<b>TOTALS</b>
Total Direct Costs less Consortium F&A	221,528	0	0	0	0	<b>221,528</b>

## PHS 398 Cover Page Supplement

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### 1. Vertebrate Animals Section

Are vertebrate animals euthanized?  Yes  No

If "Yes" to euthanasia

Is the method consistent with American Veterinary Medical Association (AVMA) guidelines?

Yes  No

If "No" to AVMA guidelines, describe method and provide scientific justification

.....

### 2. \*Program Income Section

\*Is program income anticipated during the periods for which the grant support is requested?

Yes  No

If you checked "yes" above (indicating that program income is anticipated), then use the format below to reflect the amount and source(s). Otherwise, leave this section blank.

\*Budget Period   \*Anticipated Amount (\$)   \*Source(s)

## PHS 398 Cover Page Supplement

## 3. Human Embryonic Stem Cells Section

\*Does the proposed project involve human embryonic stem cells?  Yes  No

If the proposed project involves human embryonic stem cells, list below the registration number of the specific cell line(s) from the following list: [http://grants.nih.gov/stem\\_cells/registry/current.htm](http://grants.nih.gov/stem_cells/registry/current.htm). Or, if a specific stem cell line cannot be referenced at this time, check the box indicating that one from the registry will be used:

Specific stem cell line cannot be referenced at this time. One from the registry will be used.

Cell Line(s) (Example: 0004):

## 4. Human Fetal Tissue Section

\*Does the proposed project involve human fetal tissue obtained from elective abortions?  Yes  No

If "yes" then provide the HFT Compliance Assurance

If "yes" then provide the HFT Sample IRB Consent Form

## 5. Inventions and Patents Section (Renewal applications)

\*Inventions and Patents:  Yes  No

If the answer is "Yes" then please answer the following:

\*Previously Reported:  Yes  No

## 6. Change of Investigator/Change of Institution Section

Change of Project Director/Principal Investigator

Name of former Project Director/Principal Investigator

Prefix:

\*First Name:

Middle Name:

\*Last Name:

Suffix:

Change of Grantee Institution

\*Name of former institution:

# PHS 398 Research Plan

OMB Number: 0925-0001  
Expiration Date: 02/28/2023

## Introduction

- 1. Introduction to Application  
(for Resubmission and Revision applications)

## Research Plan Section

- 2. Specific Aims
- 3. Research Strategy\* Research\_Strategy\_Final.pdf
- 4. Progress Report Publication List

## Other Research Plan Section

- 5. Vertebrate Animals
- 6. Select Agent Research
- 7. Multiple PD/PI Leadership Plan
- 8. Consortium/Contractual Arrangements
- 9. Letters of Support
- 10. Resource Sharing Plan(s)
- 11. Authentication of Key Biological and/or Chemical Resources

## Appendix

- 12. Appendix



## RESEARCH STRATEGY

### 1. Significance

Thailand has not yet established an official national genomic surveillance system for SARS-CoV-2. This is critically needed because there is a current resurgence of COVID-19 in the country, thought to be caused by emergence of novel variants. In March 2020, A/Thai-1 was the largest lineage locally transmitted in Thailand (1), but genomic surveillance was not implemented at scale due to a severe lock-down policy and the seemingly successful control of local COVID-19 transmission.

However, recent reports of the emergence of B.1.1.7, B.1.351 and B1.617 lineages has prompted the Thai government to conduct genomic analysis in clusters of returning travelers and immigrant communities. The first identification of B.1.1.7, B.1.351, P.1, B.617.2, B.1 cases in Thailand was led by EID-SEARCH collaborator Dr. Wacharapluesadee at Chulalongkorn Hospital using whole-genome sequencing.

A recent surge in cases, coupled with a ~2% fully vaccinated population has led to concerns about the role of variants in the continued public health threat of COVID-19. A new 24-day isolation policy has now been implemented for patients diagnosed or suspected to be infected with SARS-CoV-2. However, the prevalence of variants of concern of SARS-CoV-2 infection is not fully known due to inadequate budget for widespread whole genome sequencing (WGS). These budget constraints have also meant that the Thai Ministry of Public Health has focused the supply of diagnostic RT-PCR tests, quarantine and vaccine for Thai citizens, but many immigrant communities have been less intensively surveyed.

In Bangkok, Thailand, the high prevalence of SARS-CoV-2 infection means clinics are unable to differentiate patients SARS-CoV-2 reinfections and other acute viral infection with persistent previous positive for RT-PCR for SARS-CoV-2, due to the lack of WGS comparison data. Furthermore, our unpublished data show that viral mutations are likely not only due to importation, but also by natural genetic drift and shift. Genomic surveillance in Thailand is urgently needed to fill this critical knowledge gap to control SARS-CoV-2 transmission.

This research is well supported by all partners and stakeholders within the country. The outcomes will significantly contribute to public health in Thailand by building a systematic approach to monitor new SARS-CoV-2 variants in Thailand. They will also help inform policy measures to limit the spread. Moreover, the network and team developed among partners in this project will be key leaders to carry on the new system or new research conduction, not only for COVID-19 but also other merging infectious diseases in the future.

### 2. Rationale and Impact

COVID-19 has led to substantial impacts on public health, national and global economies, travel and trade, employment stability, education and many other aspects of society. Despite increased rollout of vaccines, in many countries the ongoing emergence of SARS-CoV-2 variants is driving substantial spikes in cases, and provides opportunity for the emergence of vaccine escape mutants that could threaten global health.

Many studies have demonstrated that genomic evolution from the reference genome (Wuhan-Hu-1/2019) has occurred continuously over time (2). This is largely caused by multiple point mutations of on the spike gene driving viral infectivity, host immune escape and viral transmission might be adapted (3). For example, D614G mutation of spike gene is the dominant mutation early reported in Europe emphasizing the SARS-CoV-2 antigenic drift importance to the world by rapid transmission during

March 2020 (4,5). The mink-associated or 'Cluster 5' variant of SARS-CoV-2, that shows Y453F mutation encoding amino acid change in the spike protein, was first reported in Denmark and alerted scientists globally. Fortunately, mink-associated variant demonstrated to be confined in some people groups and subsided at last (6). The B.1.1.7 lineage; VOC202012/01 (Variant of Concern, year 2020, month 12, variant 01), defined by 23 mutations on spike gene, was discovered in UK with the key N501Y mutation that making virus more contagious (7). The E484K mutation, primarily found in B1.351 lineage in South Africa, B1.1.28 lineage in Brazil and also additionally mutated in B1.1.7 lineage; as B.1.1.7 with E484K in UK, may now be able to reduce vaccine efficacy by escape neutralizing antibodies (5,8).

Global monitoring of SARS-CoV-2 mutations is hampered by lack of understanding of their distribution, incidence/prevalence, and their impact on clinical outcomes. The development of effective control and prevention measures, including the vaccine development and distribution to prevent the resurgence in local communities caused by SARS-CoV-2 variants, global participation in SARS-CoV-2 variants monitoring, genomic analysis, and in-time data sharing is essential. However, the limited resources in some countries remain a critical barrier to participate in this global action, including Thailand.

Thailand recently experienced new waves of COVID-19 outbreaks, mainly in Bangkok after December 2020, and largely caused by the B.1.1.7 lineage. Recently the B.1.617 lineage, primarily discovered in India and with indication of capacity for vaccine or immune escape also developed among immigrants located in many construction camps in Bangkok. The mortality rate is significantly higher than prior cases and healthcare facilities and resources are now stretched in their response.

This proposed work will focus on the genomic monitoring and surveillance of SARS-CoV-2 variants in Thailand to provide essential genomic data and information to fill the knowledge gap on SARS-CoV-2 mutation and transmission in Thailand, and contribute to the regional and global emerging infectious disease monitoring and research collaboration with timely data and information sharing. The research outcomes will also help us to inform the national policies to guide the public health measures and clinical practices on COVID-19 control. In addition, it will support the development of immigrant health care systems to prevent silent emerging disease outbreaks in the future.

### 3. Research Aims & Objectives

The overarching goal of this project is to establish a national genomic surveillance system for SARS-CoV-2 to monitor and characterize the dynamic SARS-CoV-2 variants circulating among the communities in Thailand, with the following specific aims and objectives:

#### Aim 1: Conduct genomic surveillance of SARS-CoV-2 variants to identify known and novel variants among COVID-19 patients in Thailand

- **Objective 1:** Collect respiratory samples from both Thai and immigrant COVID-19 patients admitted in operating hospital.
- **Objective 2:** Conduct whole genome sequencing of those samples to understand the dynamics of SARS-CoV-2 variants circulating in Thailand.
- **Objective 3:** Develop guidance for government in case of new variants of SARS-CoV-2 detection; for examples: quarantine duration extension longer than for known variants, setting stricter bundle to prevent further wide transmission and other optimal control measures.

#### Aim 2: Characterize different SARS-CoV-2 variants and understand their clinical impacts

- **Objective 1:** Collect respiratory and blood samples from enrolled patients with different SARS-CoV-2 variants infection serially at Day 7 and Day 14.

- **Objective 2:** Conduct viral isolation of those respiratory samples to study the duration of viable viral shredding among different SARS-CoV-2 variants.
- **Objective 3:** Perform SARS-CoV-2 neutralizing antibodies of those blood samples to study the immunologic response to infection with different SARS-CoV-2 variants.

**Aim 3: Strengthen the capacity for emerging virus research and international collaboration in Thailand**

- **Objective 1:** Establish the genomic research and surveillance network of SARS-CoV-2 among research institutions, hospitals, and health authorities in Thailand, to improve the responses to SARS-CoV-2 variants.
- **Objective 2:** Contribute to the enhanced global genomic surveillance of SARS-CoV-2.

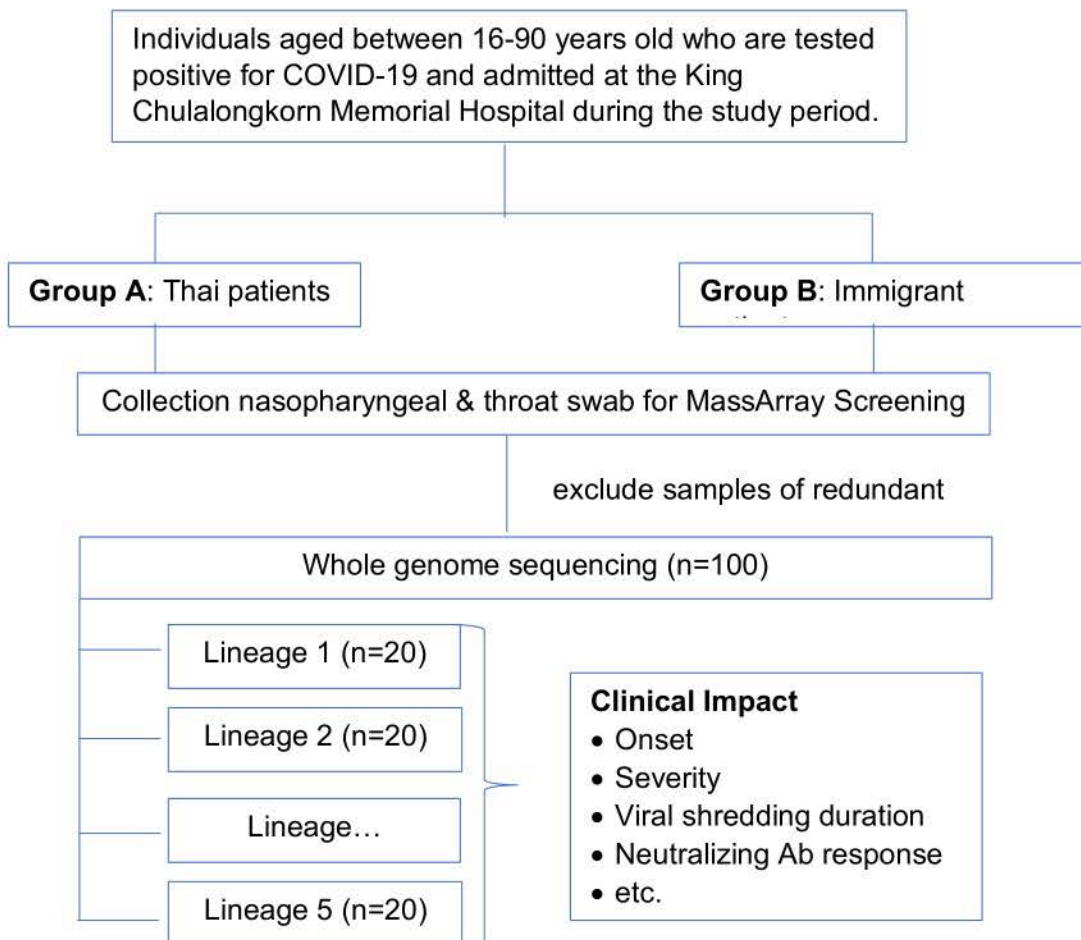
#### **4. Research Methods**

A cross-sectional observational study will be implemented among different clinical cohorts in Thailand.

##### **4.1. Target populations**

Participants to be enrolled in this study will be individuals aged between 16-90 years old, who are tested positive for COVID-19 and admitted to the King Chulalongkorn Memorial Hospital during the study period. Based on the current trends of the SARS-CoV-2 variants detection among populations in Thailand, we will stratify the participants into two groups (A and B) based on different demographics to cover the overall interested population containing circulating variants of SARS-CoV-2 and potential novel variant in Thailand over one-year period.

A total of 200 participants who meet the eligibility criteria will be enrolled at this study hospital into two groups based on the immigration status for initial screening of SARS-CoV-2 variants, from which 100 participants will be selected representing the five lineages in groups, with 20 participants per group. All 100 participants will also be followed up at Day 7 and Day 14 through the study. The process of enrollment and stratification of cohort is showed in Figure 1.



**Figure 1 Enrollment and stratification of cohorts in study.**

#### 4.2. Cohort study sample size

100 participants from whom different SARS-CoV-2 variants are identified will be included for the cohort study. The sample size is calculated by Kelsey et al method for cohort study (10). Owing to the assumption that new variants of SARS-CoV-2 transmission occurred by horizontal importation among immigrant easier than natural mutation. Like B.1.17 lineage, Oliver Pybus et al demonstrated that estimated 80% of B.1.17 lineage SARS-CoV-2 had been transmitted in UK by imported source during international travel. However, the shifting source locations of SARS-CoV-2 importation was very too dynamic to be captured in their analysis (7). Thus, we designate the parameter of % exposed with outcome = 80 and ratio of unexposed to exposed sample size = 2 and two-sided significance level 95%. Total sample size of 24 can demonstrate the power at 80%; as below described formula:

$$n_1 = \frac{(Z_{\alpha/2} + Z_{1-\beta})^2 pq (r+1)}{r(p_1-p_2)^2}$$

and  $n_2 = rn_1$

where  $n_1$  = no. of exposed,  $n_2$  = no. of unexposed,  $Z_{\alpha/2}$  = standard normal deviate for 2-tailed test,  $Z_{\beta}$  = standard normal deviate for 1-tailed test,  $r$  = ratio of unexposed to exposed,  $p_1$  = proportion of exposed with disease and  $p_2$  = proportion of unexposed with disease

We decided to upscale total sample size to 100, which is comprised of 20 of each SARS-CoV-2 variant in 5 viral lineages, that can demonstrate the significant power for further analysis and is reasonable for our budget costs.

#### **4.3. Recruitment approach**

The eligibility of potential participants will be reviewed by the research staff at the study hospital, the research coordinator (or PI) will be notified if there are eligible participants to double check all required eligible criteria and implement the informed consent process with the patients. All eligible patients will be primarily recruited and then we will randomly select the target subjects stratified between group A and B in distribution of 2-3 cases per week to be the best representatives of the circulating variants of SARS-CoV-2 though whole timeline of sample collection.

#### **4.4. Data collection**

Biological samples: Nasopharyngeal and throat swab (NT) will be collected by well-trained health-care providers following the US-CDC interim guidance for obtaining upper respiratory tract sample (11, 12). Collected samples will be screened for variant identification using MassArray assay and further characterization for whole genome sequencing (WGS). Additional NT will be collected serially on day 7<sup>th</sup> and 14<sup>th</sup> after first detection of SARS-CoV-2 infection to perform viral isolation. We will also collect blood sample on day 7<sup>th</sup> and 14<sup>th</sup> to test the SARS-CoV-2 neutralizing antibodies.

Nasopharyngeal and throat swab will be stored in viral transport media (VTM) and kept cold at 4-8 °C during transportation. All samples have to be 3-layer packed in leak-proof containers and then transferred to LAB within 48-72 hours. According to sample cannot be processed immediately, they will be stored in an ultralow (-80 °C) freezer at LAB until analysis<sup>11</sup>.

Demographic and clinical data: We will retrieve demographic data, socioeconomic and travel profile, clinical data, laboratory results and radiographic findings from all recruited participants by electronic chart review.

#### **4.5. Laboratory analysis**

RT-PCR technique: In case of other reagent used at the diagnostic time before enrollment, RT-PCR for SARS-CoV-2 detection might be repeated by standard FDA-approved kit; Allplex™ 2019-nCoV Assay, to standardize semiquantitative viral RNA determination before sequencing procedure.

MassArray technique: Using reverse transcriptase, cDNA was synthesized from RNA extracted from NT specimen. Enabling highly multiplexed reactions under universal cycling conditions and up to 40-point mutation will be used for screening SARS-CoV-2 variant using MassArray technology.

Sequencing technique: The specimens which presumed to have high level of SARS-CoV-2 RNA copies (PCR Ct < 25) will be proceeded with whole genome sequencing using MiSeq Illumina platform (Next Generation Sequencing). The enrichment library preparation protocol (Respiratory Virus Oligo Panel; RVOP) will be conducted to increase the sensitivity. The full spike gene sequencing might be primarily performed in the specimens that have low viral copies (PCR Ct between 25-30) because the limited yield of WGS demonstrated if samples contain too low viral RNA level.

Viral isolation technique: The virus will be isolated from nasopharyngeal and throat swabs in VTM from PCR positive COVID-19 patients. Inoculated Vero cells were cultured at 37°C, 5% CO<sub>2</sub> in 1× Dulbecco's modified Eagle's medium (DMEM) supplemented with 2% fetal bovine serum and penicillin-streptomycin. Virus replication and isolation were confirmed through cytopathic effects and PCR detection. Viral culture of SARS-CoV-2 was conducted in a biosafety Level-3 facility according to laboratory biosafety guidelines of Chulalongkorn University.

Neutralizing antibodies ELISA technique: SARS-CoV-2 neutralizing antibodies using will be tested sVNT assay (cPass™, GenScript USA), according to the manufacturer's instructions. Briefly, horseradish peroxidase (HRP)–RBD was pre-incubated with test serum (1:10 diluted) for 30 mins at 37°C after which it was added onto the ELISA plate pre-coated with hACE2 (GenScript). The unbound HRP-RBD was washed off, and bound RBD-ACE2 was detected colorimetrically. Circulating NABs against SARS-CoV-2 competitively inhibited the RBD-ACE2 interaction. The percentage of inhibition was calculated by measuring the difference in the amount of labelled RBD between test versus control samples. The cutoff ratio for percentage of inhibition was at 30%.

#### **4.6. Data management**

Study data will be handled with REDCap management system protected with password, biological samples are stored in double locked room at the project lab. Only authorized project persons can access to both data and samples. We will also collaborate with the EID-SEARCH to develop data management mechanism between this research project and the Research Center, and to ensure the in-time data sharing following the NIH guideline.

#### **4.7. Data analysis and sharing**

Phylogenetic analysis and haplotype network analysis will be performed to describe the dynamic SARS-CoV-2 variants circulating in Thailand through 2021 – 2022. Report and data will be registered and globally shared if novel SARS-CoV-2 variant could be identified.

The research findings will also help understand whether different SARS-CoV-2 variants lead to different clinical outcomes in human populations in Thailand, including the onset, severity, time to clinical response, viable viral shedding duration, effective neutralizing antibodies response, length of stay and mortality. The statistical method will be tested using chi-square for categorical data and unpaired T-test for numerical data at significant level of 95% confidence interval and p-value < 0.05.

### **5. Potential problems & alternative strategies**

For newly discovered SARS-CoV-2 variants, the sample size in this study might not be enough summarize the clinical characteristics. If new variants are identified, we will expand the sample size with further active surveillance within the same area of the index patient.

### **6. Benchmarks for success**

#### Genomic databases and sharing

- The work will generate a geography-specific genomic database for Thailand and also get participated to global data sharing; GISAID, GenBank, etc., that leading people to understand more about SARS-CoV-2.
- The research will allow us to support the national government to set up genomic surveillance system that is the important basis for public health system development in the future.

#### Clinical and policy application

- The work will provide important clinical data from different variants of SARS-CoV-2 infections in Thailand.
- Research results will guide the public health measure and clinical practices.
- The surveillance work will facilitate clinicians to differentiate SARS-CoV-2 reinfection and acute other viral infection with persistent previous positive for RT-PCR for SARS-CoV-2, in situations that conventional RT-PCR and neutralizing antibodies cannot demonstrate the causal relation.

#### Research extension

- Novel variant of SARS-CoV-2 we might discover from this project will be shared for further study of the immune response and vaccine efficacy of novel variants.

## 7. Research Performance Site

This proposed study will be implemented at the King Chulalongkorn Memorial Hospital (KCMH) collaborating with the Thai Red Cross Emerging Infectious Diseases (TRC-EID) Clinical Center. KCMH is a 1,000-bed sized university hospital, in close coordination with the Faculty of Medicine, Chulalongkorn University. It's one of the center hospitals for COVID-19 patients in Thailand, especially for travelers from outside of the country. More than 2,000 COVID-19 patients were admitted at KCMH since December 2020. TRC-EID clinical center is official operated under KCMH. TRC-EID clinical center has the facilities to run the large scale of WGS and coordinate with the Department of Disease Control of Thailand (Thai-DDC) to support the Thai government and the national policy making through molecular diagnosis, including the identification of the first case of SARS-CoV-2 infection in Thailand. TRC-EID scientists have high performance in research laboratory services and are part of the national reference laboratory for COVID-19 and other emerging infectious diseases confirmation in Thailand. All clinician and scientist staff in this study have extensive experience on viral and molecular research.

### Cited References

1. Joonlasak K, Batty EM, Kochakarn T, et al. Genomic surveillance of SARS-CoV-2 in Thailand reveals mixed imported populations, a local lineage expansion and a virus with truncated ORF7a. *Virus Res* 2021;292:198233.
2. Sekizuka T, Itokawa K, Hashino M, et al. A Genome Epidemiological Study of SARS-CoV-2 Introduction into Japan. *mSphere* 2020;5:e00786-20.
3. Laamarti M, Alouane T, Kartti S, et al. Large scale genomic analysis of 3067 SARS-CoV-2 genomes reveals a clonal geo-distribution and a rich genetic variations of hotspots mutations. *PLOS ONE* 2020;15:e0240345.
4. Nguyen TT, Pathirana PN, Nguyen T, et al. Genomic mutations and changes in protein secondary structure and solvent accessibility of SARS-CoV-2 (COVID-19 virus). *Scientific Reports* 2021;11:3487.
5. Weisblum Y SF, Zhang F, et al. Escape from neutralizing antibodies by SARS-CoV-2 spike protein variants. *eLife* 2020:e61312.
6. Mallapaty S. COVID Mink Analysis Shows Mutations Are Not Dangerous — yet. *Nature* 2020;587:340-1.
7. du Plessis L, McCrone JT, Zarebski AE, et al. Establishment & lineage dynamics of the SARS-CoV-2 epidemic in the UK. *medRxiv* 2020:2020.10.23.20218446.
8. Resende PC BJ, de Vasconcelos RHT, at al. Spike E484K mutation in the first SARS-CoV-2 reinfection case confirmed in Brazil, 2020. January 10, 2021 ed2021.
9. Kelsey JL, Whittemore AS, Evans AS, Thompson WD. *Methods in observational epidemiology: Monographs in Epidemiology and*; 1996.
10. Interim Guidelines for Collecting and Handling of Clinical Specimens for COVID-19 Testing. 2021 at [https://www.cdc.gov/coronavirus/2019-ncov/lab/guidelines-clinicalspecimens.html?ACSTrackingID=USCDC\\_2146DM50827&ACSTrackingLabel=Laboratory%20Update%3A%20CDC%20Updates%20Interim%20Guidelines%20for%20Collecting%20and%20Handling%20Clinical%20Specimens%20for%20COVID-19%20Testing&deliveryName=USCDC\\_2146-DM50827.](https://www.cdc.gov/coronavirus/2019-ncov/lab/guidelines-clinicalspecimens.html?ACSTrackingID=USCDC_2146DM50827&ACSTrackingLabel=Laboratory%20Update%3A%20CDC%20Updates%20Interim%20Guidelines%20for%20Collecting%20and%20Handling%20Clinical%20Specimens%20for%20COVID-19%20Testing&deliveryName=USCDC_2146-DM50827.))
11. Marty FM, Chen K, Verrill KA. How to Obtain a Nasopharyngeal Swab Specimen. *New England Journal of Medicine* 2020;382:e76.

## PHS Human Subjects and Clinical Trials Information

OMB Number: 0925-0001

Expiration Date: 02/28/2023

### Use of Human Specimens and/or Data

Does any of the proposed research in the application involve human specimens and/or data \*

Yes  No

Provide an explanation for any use of human specimens and/or data not considered to be human subjects research.

Are Human Subjects Involved

Yes  No

Is the Project Exempt from Federal regulations?

Yes  No

Exemption Number

1  2  3  4  5  6  7  8

Other Requested Information



**Human Subject Studies**

Study#	Study Title	Clinical Trial?
<u>1</u>	Monitoring and characterizing SARS-CoV-2 variants in Thailand	No

### Section 1 - Basic Information (Study 1)

1.1. Study Title \*

Monitoring and characterizing SARS-CoV-2 variants in Thailand

1.2. Is this study exempt from Federal Regulations \*

Yes  No

1.3. Exemption Number

1  2  3  4  5  6  7  8

1.4. Clinical Trial Questionnaire \*

1.4.a. Does the study involve human participants?

Yes  No

1.4.b. Are the participants prospectively assigned to an intervention?

Yes  No

1.4.c. Is the study designed to evaluate the effect of the intervention on the participants?

Yes  No

1.4.d. Is the effect that will be evaluated a health-related biomedical or behavioral outcome?

Yes  No

1.5. Provide the ClinicalTrials.gov Identifier (e.g. NCT87654321) for this trial, if applicable

## Section 2 - Study Population Characteristics (Study 1)

### 2.1. Conditions or Focus of Study

- Patients admitted at study hospital sites

### 2.2. Eligibility Criteria

Participants to be enrolled in this study will be individuals aged between 16-90 years old, who are tested positive for COVID-19 and admitted to the King Chulalongkorn Memorial Hospital during the study period. Biological samples will be collected from the participants at enrollment and during the follow-up on Day 7 and Day 14 for whole genome analysis, antibodies assessment, and further viral isolation and characterization. Medical records will be reviewed to obtain data on the demographic background, life history, and clinical characteristics.

Additional inclusion criteria:

- Adults between 18-90 years of age who provide informed consent
- Children between 16-17 years of age who provide assent along with an accompanying parent or guardian who is able to provide informed consent
- Pregnant women will be considered eligible for inclusion

Exclusion criteria:

- Individuals between 16-90 years of age who refuse to provide informed consent
- Adults unable to provide informed consent, including individuals with physiologically or medically induced cognitive impairments
- Children, aged 16-17 years old, without an accompanying parent or guardian who is able to provide informed consent, or a child aged 16-17 who is unable or unwilling to provide assent
- Children < 16 years of age or children who are wards of the state
- Prisoners

2.3. Age Limits	Min Age: 16 Years	Max Age: 90 Years
2.3.a. Inclusion of Individuals Across the Lifespan	2.3a_Inclusion_Across_Lifespan.pdf	
2.4. Inclusion of Women and Minorities	2.4_Inclusion_of_Women_Minorities.pdf	
2.5. Recruitment and Retention Plan	2.5_Recruitment_and_Retention_Plan.pdf	
2.6. Recruitment Status	Not yet recruiting	
2.7. Study Timeline	2.7_Study_Timeline.pdf	
2.8. Enrollment of First Participant	07/01/2021	Anticipated

## **INCLUSION OF INDIVIDUALS ACROSS THE LIFESPAN**

This study plans to enroll 1) adults between 18-90 years of age and 2) children aged 16-17 years old who meet the eligibility criteria.

- Literature and clinical data have showed that individuals at different age groups, including children, are at risk of SARS-CoV-2 infection and hospitalization.
- Children aged 16 years or older are in upper secondary school in Thailand, who are able to comprehend and respond to questions which increase the reliability of information provided in the medical records. We will not enroll children aged 16-17 years without an accompanying parent or guardian who is able to provide informed consent, or a child aged 16-17 who is unable to or unwilling to provide assent.
- Children under age 16 are excluded from the study because the research involves follow-up for additional sample collection at two time points, which is difficult to implement among children under age 16 who may not follow the instruction well.
- Adults over 90 years old are excluded from the study because the research involves follow-up for additional swabs and blood sample collection at two time points, which requires the participants to move to a designated pre-filters room at the study hospital for sample collection performance, the movement may be practically difficult for individuals over 90 years.
- We will not enroll children who are wars of the state.

Every effort will be made to protect the privacy, dignity, and well-being of all individuals who participate in this study. Our in-country human research team are well-trained medical doctors and researchers who have extensive experience working with individuals of all ages, including older adults and children, and their accompanying parents or guardians, at both community and clinical settings. Prior to the start of human subject research activities, all research staff will be CITI-trained and further trained on conducting ethical human subject research training including a module on the special considerations for working with children regarding risk and coercion.

Enrollment of children will be monitored reported to the IRB. De-identified participant-level age-related information will be collected at enrollment and submitted within the Inclusion Enrollment Report to NIAID to improve the understanding of the study outcomes across age groups.

## **INCLUSION OF WOMEN AND MINORITIES**

This study will enroll men and women as study participants. Subjects will be enrolled in this study without regard to ethnicity. We will make every effort to have men and women equally represented in this study and no individuals will be excluded based on ethnicity. Every effort will be made to protect the privacy, dignity, and well-being of all study participants who participate in this study.

## RECRUITMENT AND RETENTION PLAN

In order to build rapport and improve recruitment within target sites, introductory meeting will be hold at the King Chulalongkorn Memorial Hospital by study staff prior to research commencement. The meeting will provide a detailed description of this study to the leaders and hospital or clinic administration and staff. A project description letter with project information will be also shared among the hospital staff, which will be written in the local languages with a Flesch–Kincaid readability score equivalent to a 7th grade reading level to assure potential participants understand the study purpose, eligibility, and inclusion guidelines.

For the purposes of this study, anyone 16-17 years of age will be considered a child and is eligible to participate in the research if they meet the inclusion criteria and have consent from a parent or legal guardian with the child's assent. Pregnant women will also be eligible to participate if they meet the inclusion criteria.

After meeting with hospital administration staff, notification of the study with a project description letter will be shared among relevant healthcare staff and, when appropriate, posted at healthcare facilities on update boards. Patients eligible for enrollment will be identified by collaborating clinic staff during standard intake procedures, from overnight intake logs, the emergency room/ward, or the intensive care unit of each participating clinic or hospital. Patients will be screened for eligibility according to the study inclusion/exclusion criteria and based on available clinical information and clinical presentation at the hospital or clinic.

We have set a target enrollment sample size to detect SARS-COV-2 variants in patients at the hospital site. We will work with the local institution review board to determine the maximum enrollment of patients without undue burden on the population. However, in larger tertiary healthcare facilities where many cases fitting study inclusion are expected, or are being enrolled, we will control the number of enrollments to be sure that we have participation throughout the length of the study collection timeline so as to not miss a change in circulating virus. This will be done through initial assessment by collaborating clinic staff for historic caseload as well as regular evaluations of study enrollment. If we need to control the number of patients being enrolled at a hospital or clinic we will implement interval sampling of cases by selecting every  $N_{th}$  case from individuals who meet enrollment criteria. The interval will be determined in collaboration with the local research staff and implementing healthcare partners based on an evaluation of the enrolled participants to date and expected number of cases presenting at the site within a given year, in order to best achieve study design and sample size criteria and stay IRB compliant.

In terms of retention, we will express our gratitude to participants who are enrolled at participating hospital for their participation and discuss the research importance of the follow-up data collection. According to the regulation issued by the Department of Disease Control of Thailand, COVID-19 patients have to be admitted in hospital for at least 14 days and have to be isolated at home for 10 days after discharge, so we don't except loss in the follow-up on Day 7 and Day 14.

## **STUDY TIMELINE**

At each sampling time point, patients will be asked to volunteer approximately one hour of their time for participation in the study, including the informed consent process, providing biological samples, and completing the questionnaire.

This will be an ongoing one-year study from the time of award.

- We anticipate obtaining all required IRB approvals and local permissions within the first month of the study;
- We will start human subject enrollment at hospital sites within the first month of the study, and enrollment will continue through the study, to be completed by the end of the study;
- Human sample diagnostics and genomic analysis will start within the first month of the study at the earliest, with completion of all analyses by the end of the study.

2.9. Inclusion Enrollment Reports

IER ID#	Enrollment Location Type	Enrollment Location
<u>Study 1, IER 1</u>	Foreign	King Chulalongkorn Memorial Hospital



### Inclusion Enrollment Report 1

- 1. Inclusion Enrollment Report Title\* : Monitoring and characterizing SARS-CoV-2 variants in Thailand
- 2. Using an Existing Dataset or Resource\* :  Yes  No
- 3. Enrollment Location Type\* :  Domestic  Foreign
- 4. Enrollment Country(ies): THA: THAILAND
- 5. Enrollment Location(s): King Chulalongkorn Memorial Hospital
- 6. Comments:

#### Planned

Racial Categories	Ethnic Categories				Total
	Not Hispanic or Latino		Hispanic or Latino		
	Female	Male	Female	Male	
American Indian/ Alaska Native	0	0	0	0	0
Asian	96	96	0	0	192
Native Hawaiian or Other Pacific Islander	0	0	0	0	0
Black or African American	2	2	0	0	4
White	2	2	0	0	4
More than One Race	0	0	0	0	0
<b>Total</b>	100	100	0	0	200

#### Cumulative (Actual)

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	0	0	0	0	0	0	0	0	0	0
Asian	0	0	0	0	0	0	0	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0	0	0	0	0	0	0	0
Black or African American	0	0	0	0	0	0	0	0	0	0
White	0	0	0	0	0	0	0	0	0	0
More than One Race	0	0	0	0	0	0	0	0	0	0
Unknown or Not Reported	0	0	0	0	0	0	0	0	0	0
<b>Total</b>	0	0	0	0	0	0	0	0	0	0

### Section 3 - Protection and Monitoring Plans (Study 1)

3.1. Protection of Human Subjects

3.1\_Protection\_Human\_Subjects.pdf

3.2. Is this a multi-site study that will use the same protocol to conduct non-exempt human subjects research at more than one domestic site?

Yes    No    N/A

If yes, describe the single IRB plan

3.2\_sIRB\_plan.pdf

3.3. Data and Safety Monitoring Plan

3.4. Will a Data and Safety Monitoring Board be appointed for this study?

Yes    No

3.5. Overall structure of the study team

## PROTECTION OF HUMAN SUBJECTS

### 1. Risks to Human Subjects

#### 1.1 Human Subjects Involvement, Characteristics, and Design

This study is to monitor and characterize known and novel SARS-CoV-2 variants with active sample collection among COVID-19 patients in Thailand. Participants will be individuals aged between 16-90 years old, who are tested positive for COVID-19 and admitted at the King Chulalongkorn Memorial Hospital and during the study period. Participants will be enrolled on a voluntary basis and informed consent will be obtained from all participants and assent from all participants aged 16-17. Consenting participants will provide biological samples for SARS-CoV-2 genomic analysis, and data of demographic background, life history, clinical characteristics will be obtained from the medical records.

We will enroll participants at the King Chulalongkorn Memorial Hospital (KCMH), where is one of the central hospitals in Thailand for COVID-19 patients. A total of 200 participants who meet the eligibility criteria will be enrolled at this study hospital in two cohort based on the different immigration status for initial screening of SARS-CoV-2 variants, from which 100 participants will be assigned into different groups, 20 participants per group \* 5 groups based according to different linages for follow-up and sample collection on Day 7 and Day 14.

There are no data to suggest a gender or ethnic bias for SARS-CoV-2 infection, therefore individuals will be enrolled based on testing result criteria alone and individuals will not be excluded based on ethnicity or gender. We will also monitor enrollment to ensure equal representation of sex, demographic, and socio-economic factors.

#### 1.2 Sources of Materials

Biological samples to be collected and tested for SARS-CoV-2, known and novel variants, include whole blood, serum, and nasopharyngeal/throat swabs. Samples will be collected by well-trained medical personnel and a questionnaire will be administered by research or collaborating staff from the local hospitals and clinics.

Nasopharyngeal/throat swabs will be collected at enrollment. Samples will be tested to identify SARS-CoV-2 variants, followed by the whole genome sequencing (WGS). Additional nasopharyngeal/throat swabs and whole blood samples will be collected on Day 7 and Day 14 to assess antibodies neutralization and perform viral isolation. Swabs will be stored in viral transport media (VTM) and kept cold at 4-8 °C, and transported to be stored at ultralow (-80 °C) within 48-72 hours for analysis, whole blood will be aliquoted into at least one max. 500 µL whole blood and two 500 µL serum samples. Blood samples will be used to test SARS-CoV-2 neutralizing antibodies or to identify other causative viral pathogens.

In addition, information on the demographic background, life history, and clinical symptoms of participants will be reviewed to understand the clinical characteristics of different SARS-CoV-2 variants. All electronic data will be password protected, and all hardcopy files and biological samples will be stored in secure storage facilities. All consent forms and participant logs will be stored separately from research data in locked filing cabinets.

#### 1.3 Potential Risks

The potential risks to study participants as a result of study participation are minimal. The

biological specimen will be collected by locally certified healthcare professionals proficient in phlebotomy techniques, the volume of blood being collected is within normal safety limits and the swab sample is not overly invasive. There may be some stress or discomfort for participants who are informed that they have been exposed to SARS-CoV-2, to reduce the potential stress, counseling will be available and options for future medical care will be included in the discussion with the health official or physician reporting results back to individuals.

## **2. Adequacy of Protection against Risks**

### **2.1 Recruitment, Informed Consent and Assent**

Only consented participants will be enrolled in the study. No research procedures will be undertaken before the participant fully understands the research, agrees to the study procedures, and completes the consent process will they be enrolled in the study. Individuals 16-17 years of age will be considered a child and are eligible to participate in the study if they provide assent along with the informed consent of a parent or legal guardian.

Informed consent statements and forms, and project protocols will be translated into Thai. Research team members involved in this consent process will be required to be fluent in the local language in order to ensure that the subjects understand the study and all involved procedures. In-country protocol will indicate translated languages and provide copies of all translated documents.

If participants meet the criteria for enrollment, they will be invited to discuss the details of the study with research staff. Study staff will review an information sheet and informed consent form with the participant and the parent or legal guardian when applicable. Each individual will be provided with a copy of informed consent form that has been translated into the local language and written with a Flesch–Kincaid readability score equivalent to a 7th grade reading level or below, to assure that potential participants understand the information being shared. The informed consent form will explain the details of the study, including how and why the individual was selected, the study process and procedures, risks and benefits, financial considerations and the gift of appreciation, confidentiality of data shared, alternatives to participating, and how to obtain more information now or at a later date. The informed consent form will be read in Thai at a location ensuring participant privacy. This process will take approximately five minutes, after which individuals will have as much time as they would like to ask questions and discuss the study with study staff. The study staff will endeavor to ensure that the participant understands the information provided. The study staff will then ask the participant/parent or legal guardian to consider study participation. Participants will have as much time as required to consider the participation.

For the participation of a child, individuals aged 16-17 years, the parent or legal guardian will also be present during the entire consent process as described above. The child will provide verbal assent and the parent or legal guardian will sign the consent form. If unknown, the age of children will be estimated by asking a parent the date of birth of the child. Children not accompanied by a parent or legal guardian will not be allowed to participate. Capacity to consent/assent will be evaluated by trained members of the study team with care taken to ensure that only participants that have clearly followed and fully understood the study, along with all associated benefits and risks will be consented.

Those participants/parents or legal guardians who consent to the study will sign and date two copies of the consent form. These form copies will be countersigned and dated by the study staff. A copy of the signed consent form must be provided to the subject and the other copy will be kept by study staff. Informed consent paperwork will be kept until the end of the project in a locked box at the local country project office.

## **2.2 Protection against Risks**

The potential risks to study participants as a result of study participation are minimal. Collection of venous blood samples and nasopharyngeal/throat swab samples pose minimal risk to subjects. Potential complications associated with venipuncture include pain and/or hematoma at the site of collection. Trained medical professionals and/or clinic staff will monitor the blood collection site and treat any complications according to existing health facility protocols. A potential complication of nasopharyngeal/throat swab sampling is minor irritation at the time of collection. Employing trained medical and/or clinic staff to collect blood and swab samples will minimize the potential for complications.

Potential risks associated with use the information in the medical record on travel or immigration include consequences from local authorities if such practices are prohibited by local laws or the loss of confidentiality. To minimize this risk, this information will be reviewed by only the authorized study staff in a strictly confidential manner, following the in-country laws and policies at the study hospital on confidentiality and privacy protection. Biological specimen collection will be conducted in private areas, such as in a private room in a dwelling, or behind a curtain or similar barrier. All efforts will be made to ensure the privacy and confidentiality of participants.

If an individual decides to participate in this study, his/her participation and all information provided by the participant will be strictly confidential, and personal identifying information will not be shared with anyone outside of the study staff. Participants will not be identified or named in any reports or publications. Questionnaire information and all biological samples will be identified by an alphanumeric code, not by the participant's individual name. All records that contain names or other personal identifiers, such as informed consent forms and the confidential participant logbook, will be stored separately from study records. All personal information will be stored securely at the study site in locked files cabinets or password protected devices in areas with access limited to the research staff of this project. Research databases will be secured with password-protected access systems and controlled distribution web-based certificates and will not contain any identifying characteristics in relation to study participants (e.g. name, address, or telephone number). Access to all data will be limited to staff involved in this study. The health information disclosed by an individual will not be used by or disclosed (released) to another institution. Any report that is published or shared with partners will not contain any personal identifying information for individual participants

## **3. Potential Benefits to Subjects and Others**

There are no measurable benefits to the individual study participants enrolled in this study. There may be secondary benefits to the community and regional healthcare providers in understanding the risk of SARS-CoV-2, and the variants, circulating among the at-risk populations, to inform the disease control and prevention measures.

## **4. The Importance of Knowledge to be Gained**

There are valuable potential benefits to the general public from the knowledge to be gained from this study. One key benefit of this study to the community is understanding the risk of SARS-CoV-2, known or novel variants presenting among local population, as well as the contribution to the global SARS-CoV-2 variants monitoring effort to control the pandemic. Knowledge gained will also increase understanding of the conditions and human activities associated with the introduction of SARS-CoV-2 variants into human populations, which may have implications for disease control more broadly.

**SINGLE INSTITUTIONAL REVIEW BOARD (sIRB)**

In compliance with the NIH Policy on the use of a single IRB of record for multi-site research, EcoHealth Alliance will prepare, submit, and work the Institutional Review Board (IRB) that follows the ethical standards set forth by the HHS regulations at 45 CFR 46. Once this single IRB is approved in the US it will function as the IRB of record and will be relied on at all planned sites and any future sites.

We are working with HML IRB to serve as the IRB of record for all study sites under the parent grant (Award No. 1U01AI151797). All of our local research partners, partner institutions, and study staff rely on the IRB protocol that is approved at the IRB of record for all planned and future sites where data collection will occur. All data collection (biological and questionnaire) procedures and protocols and consent processes will be conducted using the same protocols outlined in the approved IRB of record and consistent for all location sites. The approved protocol at IRB of record will serve as the foundation for all locally submitted IRB packages in Thailand.

EcoHealth Alliance will submit for IRB amendment(s) as needed for this study, and maintain all records, and annually manage and submit for continuing review approvals at the IRB of record. Additionally, EcoHealth Alliance will manage the authorization and reliance agreements between partners and implement the communication plan. Partners implementing human subjects research in Thailand will maintain regular communication with scheduled updates to the EcoHealth Alliance point of contact on enrollment and recruitment numbers, breakdown of enrollment of special populations and report any adverse events within eight hours if not sooner.

Prior to commencing study enrollment or sample testing, the partner organization that is managing human subject enrollment in Thailand will sign a reliance agreement that will acknowledge the role of the IRB of record and responsibilities of the participating institutional partners.

## Section 4 - Protocol Synopsis (Study 1)

### 4.1. Study Design

4.1.a. Detailed Description

4.1.b. Primary Purpose

4.1.c. Interventions

Type	Name	Description
------	------	-------------

4.1.d. Study Phase

Is this an NIH-defined Phase III Clinical Trial?  Yes  No

4.1.e. Intervention Model

4.1.f. Masking  Yes  No

Participant  Care Provider  Investigator  Outcomes Assessor

4.1.g. Allocation

### 4.2. Outcome Measures

Type	Name	Time Frame	Brief Description
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### 4.3. Statistical Design and Power

### 4.4. Subject Participation Duration

4.5. Will the study use an FDA-regulated intervention?  Yes  No

4.5.a. If yes, describe the availability of Investigational Product (IP) and Investigational New Drug (IND)/ Investigational Device Exemption (IDE) status

4.6. Is this an applicable clinical trial under FDAAA?  Yes  No

### 4.7. Dissemination Plan

**Delayed Onset Studies**

Delayed Onset Study#	Study Title	Anticipated Clinical Trial?	Justification
The form does not have any delayed onset studies			



On Jun 10, 2021, at 07:49, Woodson, Sara (NIH/NIAID) [E]

(b) (6) wrote:

Dear CREID PIs and Program Managers,

Friendly reminder to submit your supplement applications **TODAY** if you are planning to submit. Additionally, once you have submitted your application, will you please download a copy of the application and email it to me (it can take a while to route through the system)?

Sincerely, Sara

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**From:** Woodson, Sara (NIH/NIAID) [E] (b) (6)

**Sent:** Wednesday, May 26, 2021 5:51 PM

**To:** (b) (6) Anavaj SAKUNTABHAI (b) (6)

Christine Kreuder Johnson (b) (6) Christopher M Barker

(b) (6) Eva Harris (b) (6); Michael J Gale

(b) (6) Josefina Coloma (b) (6) Kathryn Hanley

(b) (6) Kristian G. Andersen (b) (6) Lark L A Coffey

(b) (6) Njenga, M. Kariuki

(b) (6); (b) (6) Peter Daszak

(b) (6); Rabinowitz, Peter (b) (6) Garry, Robert

F (b) (6); Tierra Smiley Evans (b) (6) Van Voorhis,

Wes (b) (6); Vasilakis, Nikolaos

(b) (6) Wang, David (b) (6); Wasserheit, Judith

(b) (6) Weaver, Scott (b) (6); Aleksei Chmura

(b) (6); Barrett, Lynn (b) (6) Dawa, Jeanette

(b) (6); Michelle McGraw (b) (6); Nicole R

Gardner (b) (6); Paredes, Anne (b) (6) Prifti,

Kelly (b) (6) Weldon, Caroline (b) (6)

**Cc:** Tony Moody (b) (6) DonBrambilla (b) (6)

Beaubien, Candice (NIH/NIAID) [E] (b) (6) Challberg, Mark

(NIH/NIAID) [E] (b) (6); Dyall, Julie (NIH/NIAID) [E]

(b) (6) Florese, Ruth (NIH/NIAID) [E] (b) (6) Linde,

Amber (NIH/NIAID) [E] (b) (6) Patterson, Jean (NIH/NIAID) [E]

(b) (6) Woodson, Sara (NIH/NIAID) [E] (b) (6)

**Subject:** URGENT: SARS-CoV-2 Variant Supplements

**Importance:** High

Dear CREID Research Center PIs and Program Managers,

We would like to invite your Research Centers to submit a supplement request, as additional resources have become available to support critical gaps/needs for SARS-CoV-2 research with an emphasis on expanding/enhancing international genomic

surveillance for variants. The overall goal will be to leverage CREID sites in countries where viral surveillance is poor or not already being covered by other USG or international efforts, but also will entertain research aims that address a key scientific gap in the field. Please discuss within your Centers what those critical needs or gaps may be and send me (Sara) an email with your anticipated supplement requests **BEFORE** you submit them. We expect these resources to be limited, so we cannot guarantee funding of any supplement request at this time but we need them **submitted to eRA no later than COB, Thursday June 10<sup>th</sup>** for consideration, so please communicate with me accordingly.

**Important specifics:**

- Scope changes will not be allowed (i.e. no code changes for animals or humans)
- No *new* foreign components allowed
- For genomic surveillance activities, please make each site is it's **OWN** aim
- Please address data and resource sharing (ex. genomic sequence data will be uploaded to GISAID, NCBI or other suitable database).
- Administrative Supplements to Existing Grants

Notice: <https://grants.nih.gov/grants/guide/pa-files/PA-20-272.html>

If you have questions or concerns, please do not hesitate to reach out to me.

Sincerely, Sara

**Sara E. Woodson, PhD**

Program Officer

Virology Branch

Division of Microbiology and Infectious Diseases

National Institute of Allergy and Infectious Diseases, NIH

5601 Fishers Lane, Rm 8E56

Rockville, MD 20852

Tel: (b) (6)

(b) (6)

**Getting ready to publish? Share the good news with your program officer asap! NIAID may be able to help publicize your article. And, remember to list your NIAID grant or contract number in the publication.**

*Disclaimer: The information in this email and any of its attachments is confidential and may contain sensitive information. It should not be used by anyone who is not the originally intended recipient. If you have received this email in error, please inform the sender and delete it from your mailbox or any other storage devices. The National Institute of Allergy and Infectious Diseases shall not accept liability for any statements made that are the sender's own and not expressly made on behalf of NIAID by one of its representatives.*

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the The Henry M. Jackson Foundation for the Advancement of Military Medicine  
**Date:** Tuesday, February 23, 2021 11:38:00 AM  
**Attachments:** [HJF EID-SEARCH Contract\\_Y1 Final - signed.pdf](#)

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**From:** Hongying Li (b) (6)  
**Sent:** Tuesday, February 23, 2021 11:37 AM  
**To:** Gratton, Shaun (NIH/NIAID) [E] (b) (6) Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Cc:** Aleksei Chmura (b) (6); Peter Daszak (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with the The Henry M. Jackson Foundation for the Advancement of Military Medicine

Good Morning Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (23th February 2021) subaward agreement with The Henry M. Jackson Foundation for the Advancement of Military Medicine/Uniformed Services University under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

(b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



### CONTRACT AGREEMENT

NAME: The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

ADDRESS: 6720-A Rockledge Drive, Suite 100, Bethesda, Maryland, 20817

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 144676566

AGREEMENT AMOUNT: \$114,372.02

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

#### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

3. **Support for Acts of Terror:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. certifies and represents that no Significant Financial Conflict of Interest exists regarding Dr. Christopher Broder participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.

5. **Federal Funding Accountability and Transparency Act:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.
6. **Non-Discrimination Policy:** The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a -thirty (30) business day written notice if it determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. fails to comply with the conditions stated in this contract and fails to cure such breach after an additional thirty (30) business day written notice to cure. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for all incurred and non-cancellable expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s use of EcoHealth Alliance contract funds.

Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. remains a distinct and separate legal entity from that of EcoHealth Alliance

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. herein. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. , during business hours and with advanced written notice and

approval by HJF, by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. 30 days net of invoice..
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.
5. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 60-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. The legal name of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., who must be the sole owner of the account, must appear on the account. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	The Henry M. Jackson Foundation Operating Account
<b>Bank Name:</b>	Bank of America
<b>Bank Address:</b>	730 15 <sup>th</sup> Street, NW, Washington, DC 20005
<b>Account Number:</b>	(b) (6), (b) (4)
<b>ABA Code:</b>	(b) (6), (b) (4)
<b>Bank Telephone:</b>	XXXXXXXXXX

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES



As applicable, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. will provide EcoHealth Alliance with a copy of a most current audit report. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at a mutually agreeable time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. insofar as they relate to activities supported by this agreement.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount
2. Field Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with detailed and regular financial reports for all field equipment items.
3. Purchased services (e.g., field asst., boat hire) – detailed at the level of numbers 1 & 2, above. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
4. Vehicle associated costs – mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. and EHA or responsible party.
5. Travel – trip cost indicating departure/arrival dates and air/car/train/boat costs along with all boarding passes and receipts.
6. Accommodation – location and amounts per person along with all lodging receipts.
7. Other – any other items that do not fall into the categories above with same level of detail.

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order at EcoHealth Alliance's expense. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both the Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if, for cause, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. has materially failed to perform any of the terms of this agreement; and
4. The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for, HJF employees unless a separate arrangement has been made between EcoHealth Alliance and The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)  
(e) (b) (6)

#### XVII. LIABILITY

The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. and EcoHealth Alliance hereby mutually agree to be liable for their own negligent acts, errors or omissions EcoHealth acknowledges that the Principal Investigator for this award is Dr. Christopher Broder, who is employed by the United States Government with his office located at the Uniformed Services University of Health Sciences. For the avoidance of doubt, it is understood and agreed that no third parties, including government personnel, are agents of HJF or authorized to legally bind HJF for any purpose. To the extent authorized under the provisions of the Federal Tort Claims Act, including 28 U.S.C. sections 2671-2680, the United States Government will be liable for any loss, claim, damage, or expense caused by the negligent or wrongful act or omission of any employee of the Department of Defense or any member of the United States Armed Forces while acting within the scope of his or her office or employment.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by

an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

#### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse the Henry M. Jackson Foundation for the advancement of Military Medicine, Inc. for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



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Dr. Peter Daszak  
President, EcoHealth Alliance

**Yongkang Qiu**

Digitally signed by Yongkang Qiu  
DN: dc=org, dc=hjf, dc=ad, ou=HQ, ou=Users,  
ou=Research Administration, ou=OSP,  
cn=Yongkang Qiu, email=yqiu@hjff.org  
Date: 2021.02.22 13:33:47 -05'00'

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Yongkang Qiu  
Grants Manager  
Research Administration  
The Henry M. Jackson Foundation for the  
Advancement of Military Medicine, Inc.

Feb 23, 2021  
DATE

2/22/2021  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor and coordination of Co-Investigators Dr. Christopher Broder and Dr. Eric Laing, working close with the post-doctoral associate, the work will be implemented at The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. on the epidemiology and characterization of a series of coronaviruses (CoVs), paramyxoviruses (PMVs – particularly Henipaviruses) and filoviruses (FVs), including:

- Develop molecular and serology platforms for lab diagnostics of collected human and animal samples, including the generation of reagents for novel assays;
- Provide training to Thailand and Malaysia laboratory staff for technology transfer and serological and molecular protocols;
- Collaborate with the EID-SEARCH global team for data analysis, interpretation and contribute to scientific publications as agreed;
- Participate calls with the CREID network, and communicate regularly with EID-SEARCH global team at EHA as agreed;
- Contribute to the annual report and other programmatic report requested by NIAID;
- Represent EID-SEARCH on planning and other relevant meetings;
- Complete quarterly invoices and/or financial reports

**ATTACHMENT C: PROJECT BUDGET**

SALARY		Y1
Christopher Broder	Co-Investigator	(b) (6), (b) (4)
Eric Laing	Co-Investigator	
TBD	Research Asst.	
<b>TOTAL SALARY</b>		\$ 5,400.00
FRINGE	30.76%	\$ 1,660.99
<b>TOTAL SALARY + FRINGE</b>		\$ 7,060.99
TRAVEL		
Domestic		\$ 3,500.00
International		\$ 18,500.00
<b>TOTAL TRAVEL</b>		\$ 22,000.00
OTHER DIRECT COSTS		
Materials & Supplies		\$ 41,439.00
AKTA Service Contract		\$ 4,500.00
<b>TOTAL OTHER DIRECT COSTS</b>		\$ 45,939.00
<b>TOTAL DIRECT</b>		\$ 74,999.99
INDIRECT	30.45%	\$ 22,837.50
G&A	16.90%	\$ 16,534.53
<b>TOTAL</b>		\$ 114,372.02



# HJF EID-SEARCH Contract\_v2 Clean version (008) final

Final Audit Report

2021-02-23

Created:	2021-02-23
By:	Hongying Li (b) (6)
Status:	Signed
Transaction ID:	

## "HJF EID-SEARCH Contract\_v2 Clean version (008) final" History

-  Document digitally presigned by Yongkang Qiu (b) (6)  
2021-02-22 - 6:33:47 PM GMT- IP address: 160.39.50.243
-  Document created by Hongying Li (b) (6)  
2021-02-23 - 4:02:24 AM GMT- IP address: 160.39.50.243
-  Document emailed to Peter Daszak (b) (6) for signature  
2021-02-23 - 4:04:15 AM GMT
-  Email viewed by Peter Daszak (b) (6)  
2021-02-23 - 4:04:17 AM GMT- IP address: 66.249.91.177
-  Document e-signed by Peter Daszak (b) (6)  
Signature Date: 2021-02-23 - 2:40:21 PM GMT - Time Source: server- IP address: 98.109.77.29
-  Agreement completed.  
2021-02-23 - 2:40:21 PM GMT

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Monday, December 14, 2020 8:29:00 AM

---

**From:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 7:24 AM  
**To:** Aleksei Chmura (b) (6); Patterson, Jean (NIH/NIAID) [E]  
(b) (6)  
**Cc:** Peter Daszak (b) (6); Hongying Li (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Good Morning Aleksei,

I am writing to confirm receipt of the subaward agreement. We will review the agreement and get back to EchoHealth should we have any questions.

Sincerely,

--

Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

Disclaimer:

The information in this e-mail and any of its attachments is confidential and may contain sensitive information. It should not be used by anyone who is not the intended recipient. If you have received this e-mail in error please inform the sender and delete it from your mailbox or any other storage devices. The National Institutes of Allergy and Infectious Diseases (NIAID) shall not accept liability for any statement made that are the sender's own and not expressly made on behalf of the NIAID by one of its representatives.

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**From:** Aleksei Chmura (b) (6)  
**Sent:** Sunday, December 13, 2020 8:49 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E]  
(b) (6)  
**Cc:** Peter Daszak (b) (6); Hongying Li (b) (6)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation

Medicine Ltd (Malaysia)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksi

**Aleksei Chmura, PhD**  
*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Monday, December 14, 2020 8:32:00 AM  
**Attachments:** [Conservation Medicine Ltd EID-SEARCH CREID Subaward Signed.pdf](#)

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**From:** Aleksei Chmura (b) (6)  
**Sent:** Sunday, December 13, 2020 8:49 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Hongying Li (b) (6)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksei

**Aleksei Chmura, PhD**  
*Chief of Staff*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(b) (6) (mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



## CONTRACT AGREEMENT

NAME: Conservation Medicine Ltd

ADDRESS: Lot No 20, Level 1, Lazenda Commercial Centre,  
Phase 3, Jalan OKK Abdullah, 87000 Labuan FT., MALAYSIA

PROJECT TITLE Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of  
Southeast Asia

PERIOD 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 534409256

AGREEMENT AMOUNT: \$224,998.15

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This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Conservation Medicine Ltd.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

## I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Conservation Medicine Ltd and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below, or subject to availability of funds a \$25,000 advance to be spent on agreed project expenses. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Conservation Medicine Ltd agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Conservation Medicine Ltd agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Conservation Medicine Ltd's director, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Conservation Medicine Ltd.

3. **Support for Acts of Terror:** Conservation Medicine Ltd certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror

and that Conservation Medicine Ltd does not engage in or support, directly or indirectly, acts of terror.

4. **Financial Conflict of Interest:** Conservation Medicine Ltd certifies and represents that no Significant Financial Conflict of Interest exists regarding participation in this project that would influence the research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Conservation Medicine Ltd agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US government websites.
6. **Non-Discrimination Policy:** Conservation Medicine Ltd will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Conservation Medicine Ltd acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Conservation Medicine Ltd will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Conservation Medicine Ltd fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Conservation Medicine Ltd for all approved expenses prior to the effective date of termination.

EcoHealth Alliance and Conservation Medicine Ltd acknowledge that all funds under this agreement excluding the indirect costs will be paid to Conservation Medicine Ltd as trust monies for the sole purposes of this agreement, for which Conservation Medicine Ltd shall hold as trustee. Conservation Medicine Ltd indirect costs will accrue to Conservation Medicine Ltd and be used to cover operating expenses.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Conservation Medicine Ltd agrees to give prompt and detailed written notice to EcoHealth

Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Conservation Medicine Ltd agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Conservation Medicine Ltd also agrees to follow all requirements regarding scientific conduct.

#### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Conservation Medicine Ltd's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Conservation Medicine Ltd or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Conservation Medicine Ltd remains a distinct and separate legal entity from that of EcoHealth Alliance.

Conservation Medicine Ltd agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions utilizing the funds of this agreement.

#### V. REPORTING REQUIREMENTS

Conservation Medicine Ltd agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. CONFIDENTIALITY; PROPRIETARY INFORMATION AND DATA

The parties agree that all information and records exchanged in connection with this Agreement shall be treated as strictly confidential, and shall not be used or disclosed for any purpose other than the performance of the Agreement and implementation of the Project. Unless stated otherwise herein or agreed to in writing and signed by both parties, nothing contained in this Agreement shall, by express grant, implication, estoppel or otherwise, convey to either party any right, title, interest, or license in the inventions, patents, trademarks (including logos), technical data, computer software, or software documentation of the other party. EHA and the Subrecipient retain equal rights to and ownership of any and all media (photos, video, audio recorded by the Subrecipient as related to this Project) developed with respect to this Agreement and the implementation of the Project. Any publication of media must credit EcoHealth Alliance and Conservation Medicine Ltd. Intellectual property rights with regards to viral sequences and scientific publications will be co-owned by EHA and the subrecipient. The provisions of this paragraph shall survive the expiration or earlier termination of this Agreement. Further, the Subrecipient shall also adhere to EHA's other IP-sharing agreements insofar as they relate to data and products derived from work described in this agreement, e.g. sharing agreements with local in-country partners including but not limited to government agencies, NGOs and universities. EHA may provide details of data sharing agreements with other parties upon request from the Subrecipient.



## VII. PUBLICATION REVIEW AND APPROVAL

The parties agree that prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be shared for pre-publication review and recommendations for revision. The parties are under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. The parties will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance and Conservation Medicine Ltd, and as required by the parent award NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance or NIAID in the acknowledgements.

## VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Conservation Medicine Ltd by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

## IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Conservation Medicine Ltd shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Conservation Medicine Ltd should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Conservation Medicine Ltd must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.
3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Conservation Medicine Ltd in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Conservation Medicine Ltd.
5. Conservation Medicine Ltd acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Conservation Medicine Ltd.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Conservation Medicine Ltd. The legal name of Conservation Medicine Ltd, who must be the sole owner of the account, must appear on the account. Conservation Medicine Ltd shall provide the following banking information to EcoHealth Alliance:

**Organization Name:** Conservation Medicine Ltd  
**Bank Name:** CIMB BANK BERHAD  
**Bank Address:** Plaza Yeoh Tiong Lay, 55 Jalan Bukit Bintang, 55100, Kuala Lumpur, Malaysia  
**Account Number:** (b) (6), (b) (4)  
**ABA Code:** (b) (6), (b) (4)

X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Conservation Medicine Ltd agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Conservation Medicine Ltd acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Conservation Medicine Ltd agrees that all overhead charged to this grant shall not exceed the amount permitted by the applicable or de minimus federal indirect cost rate in effect during the performance period. Conservation Medicine Ltd shall provide EcoHealth Alliance if applicable with a copy of their most current federal indirect cost rate agreement. If requested, Conservation Medicine Ltd will provide EcoHealth Alliance with a copy of a most current audit report. Conservation Medicine Ltd agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Conservation Medicine Ltd for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Conservation Medicine Ltd insofar as they relate to activities supported by this agreement.

Conservation Medicine Ltd budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.  
**Please note that international travel requires EHA approval.**
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.

8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Conservation Medicine Ltd shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance's principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

For all capital equipment (items valued over US \$5,000 and with a useful life of one year or more) purchased under this agreement, a completed Capital Equipment Inventory must be submitted to EHA at the end of the Term (including any approved extensions). Conservation Medicine Ltd agrees to use this equipment for other projects or programs only with EHA approval and so long as such use does not interfere with the Project work for which it was originally acquired. Conservation Medicine Ltd also agrees to maintain it in proper working order.

All supply purchases over \$3,000 for a single item require the prior approval of EHA.

#### XII. UNUSED FUNDS

Conservation Medicine Ltd agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project, excluding the indirect funds. Conservation Medicine Ltd may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both Conservation Medicine Ltd and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION

With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Conservation Medicine Ltd to repay all portions of the agreement that are within Conservation Medicine Ltd's control. In addition, EcoHealth Alliance may require Conservation Medicine Ltd to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Conservation Medicine Ltd has failed to perform any of the terms of this agreement; and
4. Conservation Medicine Ltd in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Conservation Medicine Ltd also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel utilizing the funds of this subcontract, unless a separate arrangement has been made between EcoHealth Alliance and Conservation Medicine Ltd. By signing this agreement, Conservation Medicine Ltd relieves EcoHealth Alliance from any and all liability due to accident or injury to Conservation Medicine Ltd in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Conservation Medicine Ltd.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018  
(t) (b) (6)  
(e) (b) (6)

#### XVII. INDEMNIFICATION

Conservation Medicine Ltd and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action, including reasonable attorneys' fees and costs, whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional acts, errors or omissions of Conservation Medicine Ltd or EcoHealth Alliance.

For the avoidance of doubt, EcoHealth Alliance agrees to indemnify and hold the Subrecipient and his successors harmless from and against any claim by the Malaysian Inland Revenue Board arising from and relating to the funds flowing into Malaysia for the purposes of and in connection with this agreement, provided that the Subrecipient shall remain personally liable for his personal income tax obligations, if any.

## XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

## XIX. Biosafety

### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrn139t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrn139t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18ehl/CDC%20Biosafety%20Guidelines.pdf?dl=0>

### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

## XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.

Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Conservation Medicine Ltd for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



---

Dr. Peter Daszak  
President, EcoHealth Alliance

---

30 November 2020  
DATE



---

Thomas Hughes  
Director, Conservation Medicine Ltd.

---

30 November 2020  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

**Please answer the following questions Yes or No.**

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Conservation Medicine Ltd.'s business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Conservation Medicine Ltd.'s business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No

## **ATTACHMENT B: Scope of Work**

Under the supervisor of Mr. Tom Hughes, Co-Investigator

1. Coordinate and conduct all field work and lab work released to this contract in Malaysia.
  - Bat and rodent sampling at cave sites in Malaysia
  - Sampling of Orang Asli and other high risk communities
  - Syndromic surveillance
  - Further characterisation of the 15 novel paramyxoviruses and 12 novel corona viruses found through PREDICT
2. Coordinate fieldwork for this project in conjunction with DTRA activities for the Serological Biosurveillance for Spillover of Henipaviruses and Filoviruses at Agricultural and Hunting Human-Animal Interfaces in Peninsular Malaysia project in Malaysia (where applicable)
3. Facilitate and coordinate training workshops and capacity building efforts at partner institutions.
4. Facilitate communication between PI and in-country collaborators.
5. Ensure all in-country permits and permissions are in place to conduct the work.
6. Work with in-country partners to identify archived samples to screen, as appropriate
7. Work with the PI to prepare reports to stakeholders and collaborators
8. Contribute to data analysis, manuscript preparation, and dissemination of results to stakeholders



### ATTACHMENT C: PROJECT BUDGET

Item.	US Dollars per month.	Month	June 17th 2020 - May 31st 2021
<b>PERSONNEL</b>			
<b>Salaries and wages</b>			
Tom Hughes (Program Coordinator)			(b) (6), (b) (4)
Mei Ho Lee (Lab Coordinator)			
Jimmy Lee (Field Coordinator)			
Fernandes Opook (WHGFL Manager)			
Velsri Sharminie A/P Sathianarayanan (Program Assistant)			
Emily Sion EHA Lab Tech			
Suraya binti Hamid (PM CM Ltd Lab Tech)			
Alexter Japrin (Ranger)			
Ronald Bin Herbert M Tinggu (Ranger)			
Mohammad Yuery Wazlan Abdul Wahad (Ranger)			
Amirah Sungif (Ranger & Lab Tech)			
Ranger			
Ranger			
Vet			
<b>TOTAL SALARIES AND WAGES</b>			<b>\$ 120,023.89</b>
<b>Fringe</b>			
Insurance cover for Tom Hughes (monthly rate)	\$ 493.33	6	\$ 2,960.01
<b>TOTAL FRINGE</b>			<b>\$ 2,960.01</b>
<b>TOTAL PERSONNEL</b>			<b>\$ 122,983.89</b>
	<i>US Dollars</i>	<i>Unit #/LOE %</i>	<b>TOTAL (12 months)</b>
<b>EQUIPMENT</b>			
<b>TOTAL EQUIPMENT</b>			<b>\$ -</b>
<b>TRAVEL</b>			
Domestic Travel	\$ 1,030.90	12	\$ 12,370.84
<b>TOTAL DOMESTIC TRAVEL</b>			<b>\$ 12,370.84</b>
International Travel			\$ 4,808.00
<b>TOTAL INTERNATIONAL TRAVEL</b>			<b>\$ 4,808.00</b>
<b>TOTAL TRAVEL</b>			<b>\$ 17,178.84</b>
<b>SERVICES</b>			
WHGFL Lab Certification	\$ 3,600.00	1	\$ 3,600.00
<b>TOTAL SERVICES</b>			<b>\$ 3,600.00</b>
<b>DIAGNOSTICS</b>			
TBC	\$2,690.37	12	\$32,284.44
<b>TOTAL DIAGNOSTICS</b>			<b>\$ 32,284.44</b>
<b>SUPPLIES</b>			
TBC	\$ 2,690.37	12	\$ 32,284.44
<b>TOTAL SUPPLIES</b>			<b>\$ 32,284.44</b>
<b>OTHER COSTS</b>			
Indirect Costs 8%	\$ 1,388.88		\$ 16,666.53
<b>TOTAL OTHER COSTS</b>			<b>\$ 16,666.53</b>
<b>Project Costs Total.</b>			<b>\$ 224,998.15</b>

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: Quick question re our revised NoA  
**Date:** Friday, September 11, 2020 7:46:00 AM  
**Attachments:** [NIH\\_NOA\\_1U01AI151797-01\\_revised.PDF](#)  
**Importance:** High

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Hey Sara – fyi, maybe we can discuss later today. I am fully booked until 3 or 4pm.

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**From:** Peter Daszak (b) (6)  
**Sent:** Friday, September 11, 2020 1:35 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Aleksei Chmura (b) (6)  
**Subject:** Quick question re our revised NoA  
**Importance:** High

Dear Jean and Shaun,

I wondered if it's possible to set up a short call either Friday (tomorrow) afternoon, Monday or Tuesday, just to check with you on the details of one of the changes in our revised NoA (attached). We'll make sure we comply, of course, but just want to check on whether the 'biosafety monitoring plan' is a standardized format we can get the details of, and how much detail you'll need, and how often we'll need to file or audit our partner's labs.

Look forward to talking with you.

Cheers,

Peter

**Peter Daszak**

*President*

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-6507  
USA

Tel.: (b) (6)  
Website: [www.ecohealthalliance.org](http://www.ecohealthalliance.org)  
Twitter: [@PeterDaszak](https://twitter.com/PeterDaszak)



NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

**Grant Number:** 1U01AI151797-01 REVISED  
**FAIN:** U01AI151797

**Principal Investigator(s):**  
PETER DASZAK, PHD

**Project Title:** Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

Aleksei Chmura  
Authorized Organizational Representative  
460 West 34th Street, Suite 1701  
New York, NY 100012317

**Award e-mailed to:** [REDACTED] (b) (6)

**Period Of Performance:**  
**Budget Period:** 06/17/2020 – 05/31/2021  
**Project Period:** 06/17/2020 – 05/31/2025

Dear Business Official:

The National Institutes of Health hereby revises this award (see "Award Calculation" in Section I and "Terms and Conditions" in Section III) to ECOHEALTH ALLIANCE, INC. in support of the above referenced project. This award is pursuant to the authority of 42 USC 241 31 USC 6305 42 CFR 52 and is subject to the requirements of this statute and regulation and of other referenced, incorporated or attached terms and conditions.

Acceptance of this award including the "Terms and Conditions" is acknowledged by the grantee when funds are drawn down or otherwise obtained from the grant payment system.

Each publication, press release, or other document about research supported by an NIH award must include an acknowledgment of NIH award support and a disclaimer such as "Research reported in this publication was supported by the National Institute Of Allergy And Infectious Diseases of the National Institutes of Health under Award Number U01AI151797. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health." Prior to issuing a press release concerning the outcome of this research, please notify the NIH awarding IC in advance to allow for coordination.

Award recipients must promote objectivity in research by establishing standards that provide a reasonable expectation that the design, conduct and reporting of research funded under NIH awards will be free from bias resulting from an Investigator's Financial Conflict of Interest (FCOI), in accordance with the 2011 revised regulation at 42 CFR Part 50 Subpart F. The Institution shall submit all FCOI reports to the NIH through the eRA Commons FCOI Module. The regulation does not apply to Phase I Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) awards. Consult the NIH website <http://grants.nih.gov/grants/policy/coi/> for a link to the regulation and additional important information.

If you have any questions about this award, please contact the individual(s) referenced in Section IV.

Sincerely yours,

Regina E. Kitsoulis  
Grants Management Officer  
NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS DISEASES

Additional information follows

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**SECTION I – AWARD DATA – 1U01AI151797-01 REVISED****Award Calculation (U.S. Dollars)**

Salaries and Wages	\$272,938
Fringe Benefits	\$96,627
Personnel Costs (Subtotal)	\$369,565
Consultant Services	\$15,000
Materials & Supplies	\$7,918
Travel	\$72,225
Other	\$27,000
Subawards/Consortium/Contractual Costs	\$857,689

Federal Direct Costs	\$1,349,397
Federal F&A Costs	\$197,347
Approved Budget	\$1,546,744
Total Amount of Federal Funds Obligated (Federal Share)	\$1,546,744
<b>TOTAL FEDERAL AWARD AMOUNT</b>	<b>\$1,546,744</b>

**AMOUNT OF THIS ACTION (FEDERAL SHARE)** \$0

SUMMARY TOTALS FOR ALL YEARS		
YR	THIS AWARD	CUMULATIVE TOTALS
1	\$1,546,744	\$1,546,744
2	\$1,505,568	\$1,505,568
3	\$1,504,400	\$1,504,400
4	\$1,503,220	\$1,503,220
5	\$1,502,037	\$1,502,037

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**Fiscal Information:**

**CFDA Name:** Allergy and Infectious Diseases Research  
**CFDA Number:** 93.855  
**EIN:** 1311726494A1  
**Document Number:** UAI151797A  
**PMS Account Type:** P (Subaccount)  
**Fiscal Year:** 2020

IC	CAN	2020	2021	2022	2023	2024
AI	8472315	\$1,546,744	\$1,505,568	\$1,504,400	\$1,503,220	\$1,502,037

Recommended future year total cost support, subject to the availability of funds and satisfactory progress of the project

**NIH Administrative Data:**

**PCC:** M32F B / **OC:** 41026 / **Released:** (b) (6) 08/28/2020  
**Award Processed:** 08/29/2020 12:01:42 AM

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**SECTION II – PAYMENT/HOTLINE INFORMATION – 1U01AI151797-01 REVISED**

For payment and HHS Office of Inspector General Hotline information, see the NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm>

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**SECTION III – TERMS AND CONDITIONS – 1U01AI151797-01 REVISED**

This award is based on the application submitted to, and as approved by, NIH on the above-titled project and is subject to the terms and conditions incorporated either directly or by reference in the following:

- The grant program legislation and program regulation cited in this Notice of Award.
- Conditions on activities and expenditure of funds in other statutory requirements, such as

- those included in appropriations acts.
- c. 45 CFR Part 75.
- d. National Policy Requirements and all other requirements described in the NIH Grants Policy Statement, including addenda in effect as of the beginning date of the budget period.
- e. Federal Award Performance Goals: As required by the periodic report in the RPPR or in the final progress report when applicable.
- f. This award notice, INCLUDING THE TERMS AND CONDITIONS CITED BELOW.

(See NIH Home Page at <http://grants.nih.gov/grants/policy/awardconditions.htm> for certain references cited above.)

**Research and Development (R&D):** All awards issued by the National Institutes of Health (NIH) meet the definition of "Research and Development" at 45 CFR Part§ 75.2. As such, auditees should identify NIH awards as part of the R&D cluster on the Schedule of Expenditures of Federal Awards (SEFA). The auditor should test NIH awards for compliance as instructed in Part V, Clusters of Programs. NIH recognizes that some awards may have another classification for purposes of indirect costs. The auditor is not required to report the disconnect (i.e., the award is classified as R&D for Federal Audit Requirement purposes but non-research for indirect cost rate purposes), unless the auditee is charging indirect costs at a rate other than the rate(s) specified in the award document(s).

Carry over of an unobligated balance into the next budget period requires Grants Management Officer prior approval.

This award is subject to the requirements of 2 CFR Part 25 for institutions to receive a Dun & Bradstreet Universal Numbering System (DUNS) number and maintain an active registration in the System for Award Management (SAM). Should a consortium/subaward be issued under this award, a DUNS requirement must be included. See <http://grants.nih.gov/grants/policy/awardconditions.htm> for the full NIH award term implementing this requirement and other additional information.

This award has been assigned the Federal Award Identification Number (FAIN) U01AI151797. Recipients must document the assigned FAIN on each consortium/subaward issued under this award.

Based on the project period start date of this project, this award is likely subject to the Transparency Act subaward and executive compensation reporting requirement of 2 CFR Part 170. There are conditions that may exclude this award; see <http://grants.nih.gov/grants/policy/awardconditions.htm> for additional award applicability information.

In accordance with P.L. 110-161, compliance with the NIH Public Access Policy is now mandatory. For more information, see NOT-OD-08-033 and the Public Access website: <http://publicaccess.nih.gov/>.

In accordance with the regulatory requirements provided at 45 CFR 75.113 and Appendix XII to 45 CFR Part 75, recipients that have currently active Federal grants, cooperative agreements, and procurement contracts with cumulative total value greater than \$10,000,000 must report and maintain information in the System for Award Management (SAM) about civil, criminal, and administrative proceedings in connection with the award or performance of a Federal award that reached final disposition within the most recent five-year period. The recipient must also make semiannual disclosures regarding such proceedings. Proceedings information will be made publicly available in the designated integrity and performance system (currently the Federal Awardee Performance and Integrity Information System (FAPIIS)). Full reporting requirements and procedures are found in Appendix XII to 45 CFR Part 75. This term does not apply to NIH fellowships.

**Treatment of Program Income:**

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**SECTION IV – AI Special Terms and Conditions – 1U01AI151797-01 REVISED**

Clinical Trial Indicator: No

This award does not support any NIH-defined Clinical Trials. See the NIH Grants Policy Statement Section 1.2 for NIH definition of Clinical Trial.

REVISED AWARD:

Subaward Agreement Requirements: The ECOHEALTH ALLIANCE, INC. must provide NIAID with copies of all (existing and newly established) subaward agreements established under this award, including descriptions of the biosafety monitoring plans, within 30 days of establishment.

Federal Funding Accountability and Transparency Subaward Reporting System (FSRS) Requirements: This award is subject to the Transparency Act subaward reporting requirement of 2 CFR Part 170, which must be reported through the Federal Funding Accountability and Transparency Subaward Reporting System (FSRS). The ECOHEALTH ALLIANCE, INC. must provide NIAID with proof of documentation of timely entries of subaward information into the FSRS within 30 days of submitting to FSRS.

Supersedes previous Notice of Award dated **06/17/2020**. All other terms and conditions still apply to this award.

+++++++

This award does not include funds to support research subject to the [Department of Health and Human Services Framework for Guiding Funding Decisions about Proposed Research Involving Enhanced Potential Pandemic Pathogens](#) (DHHS P3CO Framework) Therefore:

- For Aim 1: Identify, characterize and rank spillover risk of high zoonotic potential viruses from wildlife, the building of chimeric SARS-like bat coronaviruses will be based on the SHC014 or the pangolin coronavirus molecular clones and the building of chimeric MERS-CoV will be based on the HKU5 strain. Prior to further altering the mutant viruses you must provide NIAID with a detailed description of the proposed alterations and supporting evidence for the anticipated phenotypic characteristics of each virus.
- Alternative approaches to those referenced above, including building chimeras based on SARS-CoV-1, SARS-CoV-2, and MERS-CoV, may be subject to the DHHS P3CO Framework and must be submitted to NIAID for review and approval prior to the work commencing.

If any of the experiments proposed for Aim 1 result in a virus with a phenotype of enhanced pathogenicity and/or transmissibility, enhanced growth by more than 10 fold when compared to wild type strains, or if the mice display significant increases in weight loss, viral titer, or mortality when compared to wild-type strains, the recipient must immediately stop the work and notify the NIAID Program Officer, Grants Management Specialist, and appropriate institutional biosafety committee. Policy changes regarding the classification of these experiments or components used in these experiments may be subject to immediate halting of experimentation. No NIH funding can be used to perform such experiments until these experiments have been approved by NIAID with a revised NOA.

\*\*\*\*\*

Dissemination of study data will be in accord with the Recipient's accepted genomic data sharing plan as stated on page(s) **373** of the application. Failure to adhere to the sharing plan as mutually agreed upon by the Recipient and the NIAID may result in Enforcement Actions as described in the NIH Grants Policy Statement.

\*\*\*\*\*

This award includes human subject research studies and must conform to the DHHS policies for the [Protection of Human Subjects](#) research, which are a term and condition of award. Human subjects research is covered by the 2018 Common Rule, and may not be initiated until the associated protocols have received IRB approval as specified in [45 CFR 46](#). Failure to comply

with the terms and conditions of award may result in the disallowance of costs and/or additional enforcement actions as outlined in Section 8.5 of the NIH Grants Policy Statement.

\*\*\*\*\*

The Research Performance Progress Report (RPPR), Section G.9 (Foreign component), includes reporting requirements for all research performed outside of the United States. Research conducted at the following site(s) must be reported in your RPPR:

**Jeppesen Field Consulting Australia - AUSTRALIA**  
**Conservation Medicine Ltd. - MALAYSIA**  
**Duke-NUS Medical School - SINGAPORE**  
**Chulalongkorn University - THAILAND**

\*\*\*\*\*

This award may include collaborations with and/or between foreign organizations. Please be advised that short term travel visa expenses are an allowable expense on this grant, if justified as critical and necessary for the conduct of the project.

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Conservation Medicine Ltd. - MALAYSIA** in the amount of **\$224,997** (**\$208,331** direct costs + **\$16,666** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Duke-NUS Medical School - SINGAPORE** in the amount of **\$108,000** (**\$100,000** direct costs + **\$8,000** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **Chulalongkorn University - THAILAND** in the amount of **\$215,944** (**\$199,948** direct costs + **\$15,996** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity with **The University of North Carolina at Chapel Hill** in the amount of **\$194,375** (**\$125,000** direct costs + **\$69,375** F&A costs).

\*\*\*\*\*

This Notice of Award (NoA) includes funds for activity **The Henry M. Jackson Fdn. for the Adv'mt. of Mil. Med., Inc.** in the amount of **\$114,373** (**\$75,000** direct costs + **\$39,373** F&A costs).

\*\*\*\*\*

In accordance with the NIAID Financial Management Plan, NIAID does not provide funds for inflationary increases. Committed future year (s) funding was adjusted accordingly. See: <https://www.niaid.nih.gov/grants-contracts/financial-management-plan>.

\*\*\*\*\*

This award is issued as a Cooperative Agreement, a financial assistance mechanism in which substantial NIH scientific and/or programmatic involvement is anticipated in the performance of the activity. This award is subject to the Terms and Conditions of Award as set forth in Section VI: Award Administrative Information of **RFA AI-19-028, "Emerging Infectious Diseases Research Centers,"** posted date **3/5/2019**, which are hereby incorporated by reference as special terms and conditions of this award.

This RFA may be accessed at: <http://grants.nih.gov/grants/guide/index.html>

\*\*\*\*\*

This award is subject to the Clinical Terms of Award referenced in the NIH Guide for Grants and Contracts, July 8, 2002, NOT AI-02-032. These terms and conditions are hereby incorporated by reference, and can be accessed via the following World Wide Web address:

<https://www.niaid.nih.gov/grants-contracts/niaid-clinical-terms-award> All submissions required by the NIAID Clinical Terms of Award must be forwarded electronically or by mail to the responsible NIAID Program Official identified on this Notice of Award.

\*\*\*\*\*

Select Agents:



Awardee of a project that at any time involves a restricted experiment with a select agent, is responsible for notifying and receiving prior approval from the NIAID. Please be advised that changes in the use of a Select Agent will be considered a change in scope and require NIH awarding office prior approval. The approval is necessary for new select agent experiments as well as changes in on-going experiments that would require change in the biosafety plan and/or biosafety containment level. An approval to conduct a restricted experiment granted to an individual cannot be assumed an approval to other individuals who conduct the same restricted experiment as defined in the Select Agents Regulation 42 CFR Part 73, Section 13.b (<http://www.selectagents.gov/Regulations.html>).

#### Highly Pathogenic Agent:

NIAID defines a Highly Pathogenic Agent as an infectious Agent or Toxin that may warrant a biocontainment safety level of BSL3 or higher according to the current edition of the CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) (<http://www.cdc.gov/OD/ohs/biosfty/bmbl5/bmbl5toc.htm>). Research funded under this grant must adhere to the BMBL, including using the BMBL-recommended biocontainment level at a minimum. If your Institutional Biosafety Committee (or equivalent body) or designated institutional biosafety official recommend a higher biocontainment level, the highest recommended containment level must be used.

When submitting future Progress Reports indicate at the beginning of the report:

If no research with a Highly Pathogenic Agent or Select Agent has been performed or is planned to be performed under this grant.

If your IBC or equivalent body or official has determined, for example, by conducting a risk assessment, that the work being planned or performed under this grant may be conducted at a biocontainment safety level that is lower than BSL3.

If the work involves Select Agents and/or Highly Pathogenic Agents, also address the following points:

Any changes in the use of the Agent(s) or Toxin(s) including its restricted experiments that have resulted in a change in the required biocontainment level, and any resultant change in location, if applicable, as determined by your IBC or equivalent body or official.

If work with a new or additional Agent(s)/Toxin(s) is proposed in the upcoming project period, provide:

- o A list of the new and/or additional Agent(s) that will be studied;
- o A description of the work that will be done with the Agent(s), and whether or not the work is a restricted experiment;
- o The title and location for each biocontainment resource/facility, including the name of the organization that operates the facility, and the biocontainment level at which the work will be conducted, with documentation of approval by your IBC or equivalent body or official. It is important to note if the work is being done in a new location.

## STAFF CONTACTS

The Grants Management Specialist is responsible for the negotiation, award and administration of this project and for interpretation of Grants Administration policies and provisions. The Program Official is responsible for the scientific, programmatic and technical aspects of this project. These individuals work together in overall project administration. Prior approval requests (signed by an Authorized Organizational Representative) should be submitted in writing to the Grants Management Specialist. Requests may be made via e-mail.

**Grants Management Specialist:** Shaun W Gratton

**Email:** (b) (6) **Phone:** (b) (6) **Fax:** 301-493-0597

**Program Official:** Jean Lois Patterson

**Email:** (b) (6) **Phone:** (b) (6)

**SPREADSHEET SUMMARY****GRANT NUMBER:** 1U01AI151797-01 REVISED**INSTITUTION:** ECOHEALTH ALLIANCE, INC.

Budget	Year 1	Year 2	Year 3	Year 4	Year 5
Salaries and Wages	\$272,938	\$272,938	\$272,938	\$272,938	\$272,938
Fringe Benefits	\$96,627	\$96,628	\$96,628	\$96,628	\$96,628
Personnel Costs (Subtotal)	\$369,565	\$369,566	\$369,566	\$369,566	\$369,566
Consultant Services	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
Materials & Supplies	\$7,918	\$7,918	\$7,918	\$7,918	\$7,918
Travel	\$72,225	\$72,225	\$72,225	\$72,225	\$72,225
Other	\$27,000	\$27,000	\$27,000	\$27,000	\$27,000
Subawards/Consortium/Contractual Costs	\$857,689	\$856,512	\$855,344	\$854,164	\$852,981
TOTAL FEDERAL DC	\$1,349,397	\$1,348,221	\$1,347,053	\$1,345,873	\$1,344,690
TOTAL FEDERAL F&A	\$197,347	\$157,347	\$157,347	\$157,347	\$157,347
TOTAL COST	\$1,546,744	\$1,505,568	\$1,504,400	\$1,503,220	\$1,502,037

Facilities and Administrative Costs	Year 1	Year 2	Year 3	Year 4	Year 5
F&A Cost Rate 1	32%	32%	32%	32%	32%
F&A Cost Base 1	\$616,708	\$491,709	\$491,709	\$491,709	\$491,709
F&A Costs 1	\$197,347	\$157,347	\$157,347	\$157,347	\$157,347

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation*

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Hongying Li](#); [Gratton, Shaun \(NIH/NIAID\) \[E\]](#)  
**Cc:** [Peter Daszak](#); [Aleksei Chmura](#); [Su Yadana](#); [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)  
**Date:** Friday, December 18, 2020 9:00:00 AM

---

Thank you, Hongying. We have received it!  
Jean

**From:** Hongying Li (b) (6)  
**Sent:** Friday, December 18, 2020 8:53 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (12th December 2020) subaward agreement with Chulalongkorn University (Thailand) under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

(b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)  
**Date:** Wednesday, January 6, 2021 8:53:00 AM  
**Attachments:** [CU EID-SEARCH CONTRACT Y1 Signed FINAL.PDF](#)

---

Here you go! LOL, got lucky.

---

**From:** Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Sent:** Wednesday, January 6, 2021 8:52 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Hi Jean,

I can't seem to find an email with the attachment that Hongying probably included in her email below. Would you be able to dig that out and forward it to me?

Sincerely, Sara

---

**From:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, December 18, 2020 9:01 AM  
**To:** Hongying Li (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6); Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Thank you, Hongying. We have received it!  
Jean

**From:** Hongying Li (b) (6)  
**Sent:** Friday, December 18, 2020 8:53 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6); Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Aleksei Chmura (b) (6); Su Yadana (b) (6)  
**Subject:** 1U01AI151797: Newly Established CREID EID-SEARCH Subaward Agreement with Chulalongkorn University (Thailand)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, attached please find a PDF of our newly established (12th December 2020) subaward agreement with Chulalongkorn University (Thailand)



# EcoHealth Alliance

## CONTRACT AGREEMENT

NAME: WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University

ADDRESS: Rama IV Road, Bangkok, 10330 Thailand

PROJECT TITLE: Understanding Risk of Zoonotic Virus Emergence in EID Hotspots of Southeast Asia

PERIOD: 17 June 2020 – 31 May 2021

PHONE: (b) (6)

EMAIL: (b) (6)

FUNDING SOURCE: NIH/NIAID/CREID/07-049-7012-52338

DUNS NUMBER: 659808836

AGREEMENT AMOUNT: \$215,944.56

This Agreement is by and between EcoHealth Alliance, a United States tax-exempt organization, located at 520 Eighth Avenue, Suite 1200, New York, New York, 10018, and Chulalongkorn University.

An authorized representative of EcoHealth Alliance has executed the original version of this agreement. Please sign the digital copy and return it via email. If EcoHealth Alliance does not receive a signed digital copy within thirty (30) days of mailing, this agreement may be deemed revoked. This agreement shall be effective only upon the receipt of a signed version by EcoHealth Alliance.

### I. TERM AND AMOUNT OF THE AGREEMENT

Subject to the continued availability of funding for this project, the term of this agreement shall be as per the period stated above, renewable for an additional term solely by written agreement between Chulalongkorn University and EcoHealth Alliance.

The amount of the contract as indicated on the preceding page and detailed in **Attachment C: Project Budget** is to be disbursed following receipt of a signed, detailed invoice(s), percentage of effort rate(s), and date(s) worked, or locations and dates for travel and all other details as elaborated in the Financial Responsibilities section below. All deliverables and project details are elaborated in **Attachment B: Scope of Work**.

## II. CONDITIONS OF THE AGREEMENT

The laws of the United States place certain restrictions on the use of funds awarded to organizations by charitable trusts and foundations. Therefore, Chulalongkorn University agrees to the following terms and conditions:

1. **Internal Revenue Code:** Funds awarded by EcoHealth Alliance may not be used for any forbidden political activities or for any purposes prohibited by the United States Internal Revenue Service Code.
2. **Foreign Corrupt Practices Act of 1977: as amended:** Chulalongkorn University agrees to be bound by this act that prohibits individuals and entities from making payments to foreign government officials for the purposes of obtaining business. This includes the offer, either directly or indirectly, of anything of value, to a foreign government official to influence that official in his or hers official capacity to do or omit any act in violation of their official capacity or lawful duty, or to secure any improper advantage in order to assist in obtaining or retaining business for or with, or directing business, to any person.

Chulalongkorn University's directors, officers, employees and agents have not and will not offer, pay, promise or authorize the payment, directly or indirectly through any other person or entity, of any monies or anything of value to any governmental official or employee or any political party or candidate for political office, for the purpose of inducing or rewarding any favorable action or influencing any act or decision of such official or of the government.

Funds in this agreement may not be used to finance the travel, per diem, hotel expenses, meals, conference fees or other conference costs for any member of a foreign government's delegation to an international conference sponsored by a public international organization, except as otherwise agreed upon by EcoHealth Alliance and Chulalongkorn University.

3. **Support for Acts of Terror:** Chulalongkorn University certifies and represent that they will be bound by U.S. anti-terrorism legislation that prohibit having transactions with and providing material support or resources to individuals or groups that engage in or support acts of terror and that Chulalongkorn University does not engage in or support, directly or indirectly, acts of terror.
4. **Financial Conflict of Interest:** Chulalongkorn University certifies and represents that no Significant Financial Conflict of Interest exists regarding PI Ralph Baric participation in this project that would influence their research. They furthermore agree that if such a conflict develops during the course of this project they will promptly notify and disclose that conflict in writing to the EHA Principal Investigator and the EHA Chief financial Officer and may be required to develop a plan of corrective action to resolve that matter. This requirement shall extend to all individuals with managerial oversight of this grant including their spouse and dependent children.
5. **Federal Funding Accountability and Transparency Act:** Chulalongkorn University agrees to fill out **Attachment A: FFATA** and provide EcoHealth Alliance with all information required by this law including, if required, executive compensation data for publication on applicable US

government websites. Chulalongkorn University shall obtain a unique DUNS number from Dun & Bradstreet and shall provide it to EcoHealth Alliance.

6. **Non-Discrimination Policy:** Chulalongkorn University will follow a comprehensive, consistent, and non-discriminatory policy to the extent it can accomplish this goal within the scope of the program objectives.

Chulalongkorn University acknowledges that EcoHealth Alliance is implementing, and over the course of this agreement will continue to implement, reasonable monitoring and oversight to assure the continuing truth of these representations and certifications and that, on request, Chulalongkorn University will provide documentation of the monitoring and oversight of these efforts.

Notwithstanding any term to the contrary, EcoHealth Alliance may terminate this contract with a five (5) business day written notice if it determines that Chulalongkorn University fails to comply with the conditions stated in this contract. In the event of termination, regardless of whether or not termination was due to breach of this contract, EcoHealth Alliance shall pay Chulalongkorn University for all approved expenses prior to the effective date of termination.

### III. USE OF FUNDS

The contract monies, including any interest earned, may only be used for the purpose(s) stated in this agreement, as contained in the approved budget in **Attachment C: Project Budget** and detailed in **Attachment B: Scope of Work**.

Funds may not be expended for any other purpose without the prior written approval of EcoHealth Alliance. Should there be a material change in the purpose, character, or method of operation of the agreement, Chulalongkorn University agrees to give prompt and detailed written notice to EcoHealth Alliance. The contract project shall be performed to EcoHealth Alliance's satisfaction as determined by EcoHealth Alliance.

Where appropriate, Chulalongkorn University agrees to conform to accepted animal care and use practices as laid out in the latest IACUC, if applicable, approved by EcoHealth Alliance, and filed with the appropriate regulatory authorities. Chulalongkorn University also agrees to follow all requirements regarding scientific conduct.

### IV. NATURE OF RELATIONSHIP

The parties hereto intend by this agreement solely to specify the terms for Chulalongkorn University's use of EcoHealth Alliance contract funds. Nothing in this agreement shall be construed as creating or constituting the relationship of employer and employee between EcoHealth Alliance and Chulalongkorn University or the continuation of funding from EcoHealth Alliance. During the course of completing the contract project work, Chulalongkorn University remains a distinct and separate legal entity from that of EcoHealth Alliance.

Chulalongkorn University agrees to conform to the laws and regulations of the location in which they operate and obtain all required permits, agreements and insurance required by local authorities. They



also agree to pay all fees and taxes levied on this project by applicable political authorities or designated subdivisions.

#### V. REPORTING REQUIREMENTS

Chulalongkorn University agrees to fulfill the program scope of services and reporting requirements that are incorporated into this agreement and detailed in **Attachment B: Scope of Work**.

#### VI. PHOTOGRAPHS AND VIDEO

EcoHealth Alliance shall own and have the right to use the recorded media (photos, video, audio) notwithstanding any licenses or other rights granted to Chulalongkorn University herein. Chulalongkorn University shall retain the unrestricted right to use the recorded media (photos, video, audio) for publication and for educational and research purposes. EcoHealth Alliance grants to Chulalongkorn University an irrevocable, royalty-free, non-transferable, non-exclusive right and license to use, reproduce, make derivative works, display, and perform publicly any material first developed and delivered under this contract.

#### VII. PUBLICATION REVIEW AND APPROVAL

At least thirty (30) days prior to the publication of any written work made possible by this EcoHealth Alliance contract agreement, or involving data or information gained in whole or in part from research or activity conducted under this agreement, a copy of such work must be sent to EcoHealth Alliance for pre-publication review and recommendations for revision by EcoHealth Alliance. Chulalongkorn University is under no obligation to make any changes to the requested publication, except to delete Confidential Information within the EcoHealth Alliance review period. EcoHealth Alliance will respond within thirty (30) days of notification. All published work must recognize EcoHealth Alliance or as may be otherwise determined by EcoHealth Alliance and required by the parent award from NIH/NIAID in the acknowledgements. Written work that is not approved by EcoHealth Alliance may not recognize EcoHealth Alliance in the acknowledgements.

#### VIII. EVALUATION OF THE AGREEMENT

At its own expense, EcoHealth Alliance may monitor and conduct an evaluation of operations under this contract agreement. Evaluation may include visits to Chulalongkorn University by representatives of EcoHealth Alliance in order to observe and discuss the funded project.

#### IX. DISBURSEMENT OF FUNDS

Unless otherwise stated below, contract funds shall be disbursed by EcoHealth Alliance based on the following criteria:

1. Chulalongkorn University shall submit a valid invoice to EcoHealth Alliance indicating the services performed, as well as the time period covered by the invoice. Chulalongkorn University should attach all supporting documentation needed to substantiate any out-of-pocket expenses.
2. Chulalongkorn University must sign the invoice as certification that the services rendered, and all expenses incurred have been pursuant to the scope of service contained in this agreement.



3. EcoHealth Alliance will invoice the funding source for the value of the invoice and remit the funds to Chulalongkorn University in a timely manner.
4. EcoHealth Alliance reserves the right to delay payment of any funds due to insufficient documentation submitted by Chulalongkorn University.
5. Chulalongkorn University acknowledges that all invoices must be submitted to EcoHealth Alliance no more than 45-days after the end of the contract. Invoices submitted after these periods may not be invoiced to the funding source and may not be paid to Chulalongkorn University.

Unless otherwise directed, EcoHealth Alliance shall remit US funds by bank wire made payable to Chulalongkorn University. The legal name of Chulalongkorn University, who must be the sole owner of the account, must appear on the account. Chulalongkorn University shall provide the following banking information to EcoHealth Alliance:

<b>Organization Name:</b>	<b>Chula Unisearch, Chulalongkorn University</b>
<b>Bank Name:</b>	<b>Bangkok Bank Public Company Limited (BBL)</b>
	<b>394 Rama 1 Rd. Phatumwan Bangkok 10330 Thailand</b>
<b>Branch:</b>	<b>Siam Square</b>
<b>Account Number:</b>	(b) (6), (b) (4)
<b>Swift code:</b>	(b) (6), (b) (4)

#### X. SUBCONTRACTOR 'S FINANCIAL RESPONSIBILITIES

As applicable, Chulalongkorn University agrees to adhere to all requirements contained in OMB Circular A-122 during the term of the agreement. Chulalongkorn University acknowledges responsibility for A-133 Federal Audit requirements for funds received under this agreement and will provide EcoHealth Alliance a copy of their most current A-133 or similar audit report as may be provided. Chulalongkorn University agrees that all overhead charged to this grant shall not exceed the amount permitted by the federal indirect cost rate in effect during the performance period. Chulalongkorn University shall provide EcoHealth Alliance with a copy of their most current federal indirect cost rate agreement. If requested, Chulalongkorn University will provide EcoHealth Alliance with a copy of a most current audit report. Chulalongkorn University agrees to keep systematic records of all expenditures relating to this agreement. A quarterly financial report is required along with a signed invoice for services and reimbursement of expenses. Documentation of expenses, consisting of bills, invoices, receipts, logbooks (acceptable only for gasoline for cars and boats), etc., must be retained by Chulalongkorn University for five (5) years after the close of the agreement period and must be available for inspection by representatives of EcoHealth Alliance at any time during this period. EcoHealth Alliance may, at its own expense, examine, audit, or have audited the records of Chulalongkorn University insofar as they relate to activities supported by this agreement.

Chulalongkorn University budget records must be itemized in the following categories, as applicable:

1. Salary or stipend – detailed by person, rate, date, and amount. Pay stubs or signed acknowledgement of receipt for stipend may be requested as documentation for personnel expenses.
2. Fringe – as applicable, same as above
3. Equipment – an original or copy (when original is not available) of all receipts or purchase orders must be provided with financial reports for all capital equipment items (items costing \$5,000 or above). **Please note that capital equipment purchases require EHA approval.**
4. Domestic Travel – trip cost indicating departure/arrival dates, air/car/train/boat costs, and accommodation cost per person along with all boarding passes and other receipts (including receipt for lodging). For vehicle –associated costs, mileage to be indicated along with any associated costs: driver, repairs, insurance, etc. Detailed logbooks (including dates, times, and signatures) are acceptable when signed by both Subrecipient and EHA or responsible party. **Includes meals in transit.** All domestic travel lodging, meal, and incidental expenses must be within United States Government per diem rates.
5. International Travel – same as above.
6. Purchased services (e.g., field asst., boat hire) – detailed at the level above.
7. Diagnostics – cost of testing, incl. lab disposables, labor (if not included above), use of equipment, etc.
8. Field Supplies – receipts must be supplied for all items.
9. Other – any other items that do not fall into the categories above with same level of detail

Chulalongkorn University shall submit detailed invoices to EcoHealth Alliance detailing actual expenditures compared to the approved budget or contract total. Invoices are subject to review and approval of EcoHealth Alliance’s principal investigator and/or grants and programs manager who shall certify that all expenses are in conformity with the award.

EcoHealth Alliance reserves the right to request documentation of all costs incurred as part of its normal practices in the use of federal funds.

#### XI. PURCHASE OF CAPITAL EQUIPMENT

All capital equipment, items valued over US \$5,000 and with a useful life of three years or more, purchased with agreement money remains the property of EcoHealth Alliance. The equipment shall be returned to EcoHealth Alliance at the end of the project, at the expense of EcoHealth Alliance unless EcoHealth Alliance agrees, in writing, to relinquish title to the equipment. Chulalongkorn University agrees to use this equipment solely for the purposes of this project and to maintain it in proper working order. For all such items, a completed Capital Equipment Inventory must be submitted to EcoHealth Alliance at the conclusion of the project.

#### XII. UNUSED FUNDS

Chulalongkorn University agrees to return to EcoHealth Alliance at the conclusion of the agreement period all agreement funds that have not been used to complete the project. Chulalongkorn University may not use agreement funds after the end of the agreement period without the written consent of EcoHealth Alliance unless both University of North Carolina at Chapel Hill and EcoHealth Alliance agree to an extension of this contract and both parties sign this in the form of an amendment.

#### XIII. REVOCATION AND REVERSION



With 30 day's notification and if EcoHealth Alliance determines at its sole discretion that continuation of the project is no longer in the best interests of EcoHealth Alliance, EcoHealth Alliance retains the right to cancel all unpaid installments of the agreement and to require Chulalongkorn University to repay all portions of the agreement that are within Chulalongkorn University's control. In addition, EcoHealth Alliance may require Chulalongkorn University to refund to EcoHealth Alliance funds that EcoHealth Alliance considers have been misused or misappropriated. Circumstances that may cause EcoHealth Alliance to revoke the agreement or demand repayment include, but are not limited to:

1. Material changes in the purpose, character, or method of operation of the agreement;
2. Contract agreement application or any required report is found by EcoHealth Alliance to be inaccurate in any material respect;
3. EcoHealth Alliance determines that Chulalongkorn University has failed to perform any of the terms of this agreement; and
4. Chulalongkorn University in the judgment of EcoHealth Alliance has misused EcoHealth Alliance's name or otherwise harmed the reputation of EcoHealth Alliance.

#### XIV. INSURANCE AND LIABILITY

By accepting the terms and conditions of this agreement, Chulalongkorn University also accepts full responsibility for any and all insurance needs, such as medical, vehicle, evacuation, etc. for themselves and all other project related personnel, unless a separate arrangement has been made between EcoHealth Alliance and Chulalongkorn University. By signing this agreement, Chulalongkorn University relieves EcoHealth Alliance from any and all liability due to accident or injury, or any other claims that may result from any activities conducted by Chulalongkorn University in relation to the contract project.

#### XV. ADDITIONAL SUPPORT

In making this contract agreement, EcoHealth Alliance assumes no obligation to provide other or additional support to Chulalongkorn University.

#### XVI. NOTICE

All correspondence and project reports should include the reference log number and follow the reporting guidelines described above. Copies should be directed to:

Dr. Aleksei Chmura  
EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018

(t) (b) (6)

(e) (b) (6)

#### XVII. INDEMNIFICATION

Chulalongkorn University and EcoHealth Alliance hereby mutually agree to indemnify and hold each other, respectively, and each other's affiliates, officers, employees, successors and assigns, harmless from and against claims, demands, actions, proceedings, investigation and right of action including



attorney's whether action is instituted or not and, if instituted, whether at any trial or appellate level, whether raised by the other party or a third party, arising from the intentional and/or negligent acts, errors or omissions of Chulalongkorn University or EcoHealth Alliance to the extent permitted by applicable law.

#### XVIII. PARTIAL INVALIDITY

If any term or provision of this agreement to any person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of this agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

#### XIX. Biosafety

##### Laboratory

- EcoHealth Alliance will review and evaluate the lab biosafety at project research sites, provide annual trainings, and conduct laboratory inspections as needed.
- All partner laboratories are required to submit applicable approval documents from their Institutional Biosafety Committees (IBC) to EcoHealth Alliance for review following signed contracts, to ensure the compliance with *NIH and CDC guidelines* (link below) or comparable. No laboratory work may be conducted without confirmed receipt by EcoHealth Alliance of these documents.
- Biosafety review and evaluation for all partner laboratories will be conducted following the *NIH and CDC Guidelines* (link below) or comparable.
- Any accident or concern related to work funded under this award must be reported to EcoHealth Alliance and your Institutional Biosafety Committee (IBC) within 72 hours and will be investigated by an independent auditor. Work will be suspended immediately until an investigation is completed to the satisfaction of EcoHealth Alliance.

NIH Guidelines: [https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH\\_Guidelines%202019.pdf?dl=0](https://www.dropbox.com/s/sa0g11uyfrnl39t/NIH_Guidelines%202019.pdf?dl=0)

CDC Laboratory Biosafety Manual:

<https://www.dropbox.com/s/bp1g59x6bq18eh1/CDC%20Biosafety%20Guidelines.pdf?dl=0>

##### Field

- EcoHealth Alliance will have oversight of the field work biosafety, provide training, and enforcing biosafety regulations in the field for all work with animals.
- In-country Institutional Animal Care and use Committee (IACUC) and Institutional Review Board (IRB) approvals to work with wild animals and human subjects are required to be submitted to EcoHealth Alliance following signed contracts. No fieldwork may be conducted without confirmed receipt by EcoHealth Alliance of these approvals.
- Review and approval will be conducted globally and locally with the IACUCs and IRBs.
- Field biosafety trainings will be conducted every other year or more frequently as necessary. Online refresher trainings will be made available every year for all members of teams working with wild animals, humans, and relevant specimens.

#### XX. OTHER PROVISIONS

This agreement may not be transferred or assigned by either party without the prior written consent of the other, and any breach of this prohibition will deem the agreement null and void.



Both parties agree that either party may terminate this agreement following confirmation of a 30 day notice to the other party. Ecohealth Alliance will reimburse Chulalongkorn University for all approved costs incurred up to the point of termination.

Each party represents and warrants that its authorized agent(s) have duly executed this agreement on its behalf.

This agreement constitutes a single integrated contract expressing the entire agreement of the parties hereto. There are no other agreements, written or oral, express or implied, between the parties hereto, concerning the subject matter hereof, except the agreements set forth in this agreement. Any amendment to this agreement is effective only if set forth in writing and signed by both parties.



\_\_\_\_\_  
Dr. Peter Daszak  
President, EcoHealth Alliance

\_\_\_\_\_  
10 December 2020  
DATE



\_\_\_\_\_  
(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University  
Grants Manager & Team Lead, Chulalongkorn University



\_\_\_\_\_  
12 December 2020  
DATE

## ATTACHMENT A: FFATA

The Federal Funding Accountability and Transparency Act (FFATA) was signed on September 26, 2006 and requires information on federal awards (federal financial assistance and expenditures) be made available to the public via a single, searchable website, which is [www.USASpending.gov](http://www.USASpending.gov). All contractors receiving funds from EcoHealth Alliance are required to provide the following information as a condition of receiving funds.

Please answer the following questions Yes or No.

- a. In the previous tax year, was your company's gross income from all sources above \$300,000?

Yes  No

- b. In Chulalongkorn University's business or organization's preceding completed fiscal year, did its business or organization (the legal entity to which the DUNS number it provided belongs) receive (1) 80 percent or more of its annual gross revenues in U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements; **and** (2) \$25,000,000 or more in annual gross revenues from U.S. federal contracts, subcontracts, loans, grants, subgrants, and/or cooperative agreements?

Yes  No

- c. Does the public have access to information about the compensation of the executives in Chulalongkorn University's business or organization (the legal entity to which the DUNS number it provided belongs) through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986?

Yes  No

- d. Does your business or organization maintain an active registration in the System for Award Management ([www.SAM.gov](http://www.SAM.gov))?

Yes  No



## ATTACHMENT B: Scope of Work Year 1 (17 June 2020 – 31 May 2021)

Under this contract, supervised and coordinated by the co-Investigators Dr. Supaporn Wacharapluesadee and Dr. Thiravat Hemachudha, the Thai Red Cross Emerging Infectious Diseases Health Science Centre (TRC-EID), Chulalongkorn Hospital, Faculty of Medicine, Chulalongkorn University will:

- 1. Work with the EID-SEARCH global team to develop work plan to:**
  - 1.1 Identify the surveillance sites for animal, human community, and hospital syndromic study
    - Work with the modelling team at EHA to identify the surveillance sites, targeted animal species, targeted sample sizes, for Coronaviruses, Paramyxoviruses, and Filoviruses.
  - 1.2 Develop protocol and questionnaires for community and hospital syndromic surveillance
  - 1.3 Pilot the questionnaire in country and provide feedbacks
- 2. Obtain local research approval document including:**
  - 2.1 Chulalongkorn University Animal Care and Use Protocol (CU-ACUP) approval for animal investigation
  - 2.2 Institutional Review Board (IRB) approval for human subject research
  - 2.3 Institutional Biosafety Committee (IBC) approval for lab work
  - 2.4 Permissions for animal capture
- 3. Laboratory testing**
  - 3.1 Full genome characterization of previously identified CoVs in animals. This could also include full Spike protein sequencing for CoVs (e.g. if full genome capture doesn't work) (n=10-20)
  - 3.2 Investigations of archived specimens from undiagnosed human infections available at Chula WHO-CC by performing available PCR and/or serological testing (n>100) for coronaviruses, influenza, filoviruses, and paramyxoviruses or NGS.
  - 3.3 For newly collected animal specimens, if applicable, complete viral family PCR testing of coronaviruses, influenza, filoviruses, paramyxoviruses and conduct DNA barcoding for confirmation of field species identification as necessary on a subset of the specimens.
  - 3.4 Collaborating with EID-SEARCH partner for the validation of newly developed serological assays.
- 4. Conduct scoping survey and initial wild animal surveillance at selected sites**
  - 4.1 Scoping survey on human-animal interfaces at selected site, and possibly pilot the questionnaire in Ratchaburi province (one site)
  - 4.2 Start initial specimen collection from bat, rodent, and macaque individuals (1 rectal swab + 1 swab/individual) in the province of Ratchaburi (one site; 300 animals including 100 each of bat, rodent and macaque).
- 5. Results and data sharing, analysis, reporting**
  - 5.1 Sharing of specimens will ONLY be possible for diagnostic purposes when capacity is not available in Thailand, or when it's part of the capacity building and training program.
  - 5.2 Participate in the CREID Working Group discussions and work with EID-SEARCH global team to develop data management and sharing policies.
  - 5.3 Maintain current contacts to whom results will be reported at in-country government ministries responsible for human health, livestock/agriculture, and wildlife.
  - 5.4 Collaborate with the EID-SEARCH global team for data cleaning, analysis, interpretation and contribute to scientific publications as agreed.



- 5.5 Complete the following programmatic and financial reporting by requested deadlines:
- Annual reports to NIAID
  - Quarterly invoices and financial reports
  - Other reports requested by NIAID
- 5.6 Reach out to communities and present appropriately available findings and public health information

**6. Communication**

- 6.1 Participate on calls with the EID-SEARCH global team at EHA as requested; hold regular team calls as agreed.
- 6.2 Represent EID-SEARCH on planning and other relevant meetings.

**7. Project Timeline**

ACTIVITIES	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.4.a. sampling targets																				
1.4.b. sample size justifications																				
1.4.c. sample collection & testing																				
1.4.d. NGS																				
1.4.e. sequencing Spike GP																				
1.5.a. human cell infection																				
1.5.b. receptor binding																				
1.5.c. host-pathogen dynamics																				
1.5.d. viral strain prioritization																				
1.5.e. animal models																				
2.4 target population & sample sizes																				
2.5 community data collection																				
2.6.a serological testing																				
2.6.b RT-PCR testing																				
2.6.c virus characterization																				
2.7 epidemiological analysis																				
3.4.a cohort selection																				
3.4.b clinic enrollment & follow-up																				
3.4.c clinical data collection																				
3.5 sample testing																				
3.6 risk characterization																				
annual meeting																				

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**ATTACHMENT C: PROJECT BUDGET**

<b>Items</b>	
<b>Personnel</b>	\$55,666.67
<b>Travel</b>	
1. Site scoping / pilot questionnaire for community study	\$10,780.00
2. Animal sampling	\$16,551.00
<b>Diagnosis</b>	
1. Full genome characterization of archived CoV positive animal specimens (NGS)	\$32,391.00
2. Investigation of undiagnosed archived human specimens (family PCR and NGS)	\$21,560.00
3. Animal study (300 animals x 1 site) 3 viral families	\$63,000.00
<b>Total direct cost</b>	199,948.67
<b>Indirect cost (8%)</b>	\$15,995.89
<b>Total</b>	\$215,944.56

**Financial arrangements**

	<b>Deliverable</b>	<b>Amount</b>
1	Countersigned Contract	\$25,000.00
2	Progress Report-1	\$110,000.00
3	Progress Report-2	\$55,944.56
4	Annual Report	\$25,000.00





POWER OF ATTORNEY

August 3, 2020

We, Chulalongkorn University represented by Professor Dr. Bundhit Eua-arporn, President of Chulalongkorn University, do hereby empower Dr. Supichai Tangjaitrong, Managing Director of Chula Unisearch, Chulalongkorn University, to be authorized lawful attorney to represent the organization for submission of "WHO-CC for Research and Training on Viral Zoonoses, Chulalongkorn University" including any acts performed under this circumstance.

Signed  Principal

(Professor Bundhit Eua-arporn, Ph.D.)  
President  
Chulalongkorn University

Signed  Attorney

(Supichai Tangjaitrong, Ph.D.)  
Managing Director  
Chula Unisearch, Chulalongkorn University

Signed  Witness

(Mr. Torsak Purksaritanont)  
Manager  
Department of Office Administration

Signed  Witness

(Mrs. Kitiya Jumpa)  
Legal Officer

(b) (6)

(b) (6)

ect

This IL

under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know if you have any questions about it. Thank you very much!

Best regards,  
Hongying

**Hongying Li, MPH**  
*Senior Program Coordinator & Research Scientist*

EcoHealth Alliance  
520 Eighth Avenue, Ste. 1200  
New York, NY 10018

(b) (6) (mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*

**From:** [Patterson, Jean \(NIH/NIAID\) \[E\]](#)  
**To:** [Woodson, Sara \(NIH/NIAID\) \[E\]](#)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)  
**Date:** Monday, December 14, 2020 8:31:00 AM

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You read my mind...coming!

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**From:** Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 8:32 AM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Hi Jean,  
Can you forward me the attachment (if there was one)? It didn't come through.....  
Sincerely, Sara

---

**From:** Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 8:30 AM  
**To:** Woodson, Sara (NIH/NIAID) [E] (b) (6)  
**Subject:** FW: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

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**From:** Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Sent:** Monday, December 14, 2020 7:24 AM  
**To:** Aleksei Chmura (b) (6); Patterson, Jean (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6); Hongying Li (b) (6)  
**Subject:** RE: 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Good Morning Aleksei,

I am writing to confirm receipt of the subaward agreement. We will review the agreement and get back to EchoHealth should we have any questions.

Sincerely,

--  
Shaun Gratton  
Grants Management Program  
Division of Extramural Activities  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
5601 Fishers Lane, Rm. 4G48  
Rockville, Maryland 20852  
Telephone Number: (b) (6)  
Email Address: (b) (6)

Note:

**Effective January 1, 2017**, NIH closeout documentation policy has changed (see [NOT-OD-17-022](#)). NIH is no longer accepting Final Progress Reports (FPR). Grantees must now report final project outcomes using the new F-RPPR. For instruction on how to submit the new F-RPPR please see instructions on the [NIH RPPR Page](#).

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Disclaimer:

The information in this e-mail and any of its attachments is confidential and may contain sensitive information. It should not be used by anyone who is not the intended recipient. If you have received this e-mail in error please inform the sender and delete it from your mailbox or any other storage devices. The National Institutes of Allergy and Infectious Diseases (NIAID) shall not accept liability for any statement made that are the sender's own and not expressly made on behalf of the NIAID by one of its representatives.

---

**From:** Aleksei Chmura (b) (6)  
**Sent:** Sunday, December 13, 2020 8:49 PM  
**To:** Patterson, Jean (NIH/NIAID) [E] (b) (6) Gratton, Shaun (NIH/NIAID) [E] (b) (6)  
**Cc:** Peter Daszak (b) (6) Hongying Li (b) (6)  
**Subject:** 1U01AI151797: Newly Established EID-SEARCH CREID Subaward Agreement with Conservation Medicine Ltd (Malaysia)

Dear Jean and Shaun,

As per our revised notice of award from 28 August 2020, find attached a PDF of our newly established (30th November 2020) Conservation Medicine Ltd (Malaysia) subaward agreement established under this award (1U01AI151797), including a description of the biosafety monitoring plan.

Please confirm receipt and let me know, if you have any questions about our subaward agreement.

Many thanks!

-Aleksei

**Aleksei Chmura, PhD**  
Chief of Staff

EcoHealth Alliance  
520 Eighth Avenue, Suite 1200  
New York, NY 10018-4182

(b) (6) (office)  
(b) (6) (mobile)  
[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation.*



**From:** [Lauer, Michael \(NIH/OD\) \[E\]](#)  
**To:** [Aleksi Chmura](#); [Peter Daszak](#)  
**Cc:** [Stemmy, Erik \(NIH/NIAID\) \[E\]](#); [Erbelding, Emily \(NIH/NIAID\) \[E\]](#); [Linde, Emily \(NIH/NIAID\) \[E\]](#); [Bulls, Michelle G. \(NIH/OD\) \[E\]](#); [Compliance Review](#); [Ta, Kristin \(NIH/OD\) \[E\]](#)  
**Subject:** Re: PLEASE READ -- Re: Please read and acknowledge receipt -- update regarding 2R01AI110964-06  
**Date:** Friday, October 23, 2020 2:57:44 PM  
**Attachments:** [NIH Response to EcoHealth Response to Suspension 10 23 20.pdf](#)

---

Dear Dr. Chmura and Dr. Daszak

Please see attached.

Sincerely,  
Michael S Lauer, MD

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
1 Center Drive, Building 1, Room 144  
Bethesda, MD 20892  
Phone: (b) (6)  
Email: (b) (6)



National Institutes of Health  
National Institute of Allergy  
and Infectious Diseases  
Bethesda, Maryland 20892

23 October 2020

Drs. Aleksei Chmura and Peter Daszak  
EcoHealth Alliance, Inc.  
460 W 34<sup>th</sup> St  
Suite 1701  
New York, NY 10001

Re: NIH Grant R01AI110964

Dear Drs. Chmura and Daszak:

I am following up on Mr. Krinsky's August 13, 2020, letter on behalf of EcoHealth Alliance, Inc. ("EcoHealth") responding to NIH's suspension of grant R01AI110964, which funds the project *Understanding the Risk of Bat Coronavirus Emergence* (the "Project"). Per my letter of July 8, 2020, NIH reinstated the grant but suspended all award activities because we have concerns that the Wuhan Institute of Virology (WIV), which previously served as a subrecipient of the Project, had not satisfied safety requirements that applied to its subawards with EcoHealth, and that EcoHealth had not satisfied its obligations to monitor the activities of its subrecipient to ensure compliance. EcoHealth objected to the suspension on the grounds that WIV has no *current* connection to the Project or EcoHealth's research, and EcoHealth had not issued any subawards in connection with the Grant *at the time of the suspension*.

The fact that EcoHealth does not currently have a subrecipient relationship with WIV and had not issued subawards to WIV at the time of suspension does not absolve EcoHealth of any past non-compliance with the terms and conditions of award for grant R01AI110964. While EcoHealth did not issue a subaward to WIV for year 6 of the grant, WIV served as a subrecipient for years 1 through 5. NIH awarded EcoHealth grant R01AI110964 in 2014, with a project period of June 1, 2014, through June 30, 2024, as renewed. In EcoHealth's grant application, EcoHealth listed Drs. Zheng Li Shi and Xing Yi Ge of WIV as co-investigators and senior/key personnel. It stated that "Drs. Shi, Zhang, and Daszak have collaborated together since 2002 and have been involved in running joint conferences, and shipping samples into and out of China." EcoHealth listed WIV as a Project/Performance Site Location. In describing WIV's facilities, EcoHealth described WIV as China's premier institute for virological research" and touted WIV's "fully equipped biosafety level 3 laboratory" and "a newly opened BLS-4 laboratory." In support of the application, Dr. Zheng Li Shi's personal statement indicated that "My lab will be responsible for diagnosis, genomics and isolation of coronavirus from wild and domestic animals in Southern China and for analyzing their receptor binding domains." The application stated that "Wuhan Institute of Virology and the Wuhan University Center for Animal Experiment BSL-3

lab have an Internal Biosafety Committee and are accredited BSL-2 and BSL 3 laboratories. All experimental work using infectious material will be conducted under appropriate biosafety standards. Disposal of hazardous materials will be conducted according to the institutional biosafety regulations.”

EcoHealth requested funding specifically for activities to be carried out by WIV. NIH awarded EcoHealth a total of \$749,976 for WIV’s work in the following annual amounts for years 1 through 5:

	-Yr 1	-Yr 2	-Yr 3	-Yr 4	-Yr 5
Total Direct Costs	\$123,699	\$128,718	\$147,335	\$147,335	\$147,335
F&A Costs @ 8%	\$9,896	\$10,297	\$11,787	\$11,787	\$11,787
TOTAL COSTS	\$133,595	\$139,015	\$159,122	\$159,122	\$159,122

As stated in the Notices of Award for each budget period of the grant, the awards were subject to terms and conditions, which include the NIH Grants Policy Statement (GPS) and applicable HHS grant regulations. As I indicated in my letter of July 8, 2020, as a term and condition of award EcoHealth was required to “monitor the activities of the subrecipient as necessary to ensure that the subaward is used for authorized purposes, in compliance with Federal statutes, regulations, and the terms and conditions of the subaward . . .” 45 C.F.R. § 75.352(d). See also, 45 C.F.R. § 75.342(a) (“The non-Federal entity is responsible for oversight of the operations of the Federal award supported activities.”). Moreover, EcoHealth was required to “Establish and maintain effective internal control over the Federal award that provides reasonable assurance that the non-Federal entity is managing the Federal award in compliance with Federal statutes, regulations, and the terms and conditions of the Federal award[.]” 45 C.F.R. § 75.303(a). The Notice of Award stated that as a term and condition of award, “Research funded under this grant must adhere to the [CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL)].” Moreover, the NIH GPS provides that NIH grant recipients are expected to provide safe working conditions for their employees and foster work environments conducive to high-quality research. NIH GPS, Section 4. The terms and conditions of the grant award flow down to subawards to subrecipients, so these terms applied to WIV. 45 C.F.R. § 75.101.

As I stated, NIH has concerns of non-compliance with terms and conditions of award—namely, that WIV had not satisfied safety requirements under the award and that EcoHealth Alliance had not satisfied its obligations to monitor the activities of its subrecipient to ensure compliance. Accordingly, NIH suspended all activities related to R01AI110964, pursuant to 45 C.F.R. § 75.371, Remedies for Noncompliance, which permits suspension of award activities in cases of non-compliance, and the NIH GPS, Section 8.5.2, which permits NIH to take immediate action to suspend a grant when necessary to protect the public health and welfare.

In my letter of July 8, 2020, I provided EcoHealth with the opportunity to object and to provide information and documentation challenging the suspension. Specifically, I sought information and materials that speak to WIV’s lab safety and EcoHealth’s oversight of its subrecipient, and an inspection of WIV’s laboratory records and facilities. I indicated that as a specific condition of award, during the period of suspension, EcoHealth Alliance may not allow research under this

project to be conducted and that no funds from grant R01AI110964 may be provided to or expended by EcoHealth Alliance or any subrecipients.

EcoHealth objected to the requests on the grounds that “NIAID is not authorized under 45 CFR §§ 75.371, 75.205, and 75.207, entitled *Specific Award Conditions*, to impose, *inter alia*, conditions that consist of demands for information regarding entities that are neither subrecipients of grant funds nor project affiliates.”

These provisions are irrelevant to NIH’s requests. NIH is required to permit the opportunity for recipients to object and provide information and documentation challenging a suspension, 45 C.F.R. § 75.374, so we specifically gave EcoHealth the opportunity to provide information that speaks to NIH’s concerns. Moreover, as a granting agency, NIH is required to “manage and administer the Federal award in a manner so as to ensure that Federal funding is expended and associated programs are implemented in full accordance with U.S. statutory and public policy requirements: Including, but not limited to, those protecting public welfare [and] the environment[.]” 45 C.F.R. § 75.300(a). In addition to seeking information that speaks to compliance with terms and conditions of award, NIH is entitled to “make site visits as warranted by program needs.” 45 C.F.R. § 75.342. As a term and condition of award, NIH “must have the right of access to any documents, papers, or other records of the non-Federal entity which are pertinent to the Federal award, in order to make audits, examinations, excerpts, and transcripts” (45 C.F.R. § 75.364); and must have “timely and reasonable access to the non-Federal entity’s personnel for the purpose of interview and discussion related to such documents” (*id.*). These requirements flow down to subawards to subrecipients. 45 C.F.R. § 75.101. “Non-Federal entities must comply with requirements in [45 C.F.R. Part 75] regardless of whether the non-Federal entity is a recipient or subrecipient of a Federal award.” 45 C.F.R. 75.101. As the grantee, EcoHealth was required to have in place, “A requirement that the subrecipient permit the pass-through entity and auditors to have access to the subrecipient’s records and financial statements as necessary for the pass-through entity to meet the requirements of this part.” 45 C.F.R. § 75.352(a)(5). For each of these reasons, NIH is justified in seeking the materials, information, and a site visit specified in my letter of July 8, 2020.

In addition to objecting to NIH’s authority to seek the materials, information, and a site visit, EcoHealth has responded that it lacks knowledge or information regarding the requests; that it is not in possession, custody, or control of the specified items; and that it has no authority to grant NIAID and the U.S. National Academy of Sciences access to WIV’s facility to conduct an inspection. EcoHealth’s responses have not satisfied NIH’s concerns that EcoHealth had failed to adequately monitor the compliance of its subrecipient, and that the subrecipient, WIV, had failed to comply with safety requirements.

Notwithstanding this, NIH is providing an additional opportunity for EcoHealth to provide information and documentation challenging these concerns of non-compliance. Accordingly, in addition to reiterating our prior requests (1) through (6) per our letter of July 8, 2020, NIH requests the following information and materials, which must be complete and accurate:

1. Provide copies of all EcoHealth Alliance – WIV subrecipient agreements as well as any other documents and information describing how EcoHealth Alliance monitored WIV’s compliance with the terms and conditions of award, including with respect to biosafety.
2. Describe EcoHealth’s efforts to evaluate WIV’s risk of noncompliance with Federal statutes, regulations, and the terms and conditions of the subaward.
3. Provide copies of all WIV biosafety reports from June 1, 2014 through May 31, 2019.

During the ongoing period of suspension, NIH will continue to review the activities under this award, taking into consideration information provided by EcoHealth Alliance, to further assess whether EcoHealth Alliance and WIV complied with the terms and conditions of award, including compliance with other terms and conditions of award that may be implicated. We remind you that during the period of suspension, EcoHealth Alliance may not allow research under this project to be conducted. Further, no funds from grant R01AI110964 may be provided to or expended by EcoHealth Alliance or any subrecipients; all such charges are unallowable. It is EcoHealth Alliance’s responsibility as the recipient of this grant award to ensure that the terms of this suspension are communicated to and understood by all subrecipients. EcoHealth Alliance must provide adequate oversight to ensure compliance with the terms of the suspension. Any noncompliance of the terms of this suspension must be immediately reported to NIH. EcoHealth Alliance will receive a revised Notice of Award from NIAID indicating the continued suspension of these research activities and funding restrictions as a specific condition of award.

Please note that this action does not preclude NIH from taking additional corrective or enforcement actions pursuant to 45 C.F.R. Part 75, including, but not limited to, terminating the grant award or disallowing costs. NIH may also take other remedies that may be legally available if NIH discovers other violations of terms and conditions of award on the part of EcoHealth Alliance or WIV.

Sincerely,

Michael S. Lauer -S Digitally signed by Michael S. Lauer-S  
Date: 2020.10.23 13:34:25 -04'00'

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
Email: [REDACTED] (b) (6)

cc: Dr. Erik Stemmy (NIAID)  
Ms. Emily Linde (NIAID)

**From:** [Lauer, Michael \(NIH/OD\) \[E\]](#)  
**To:** [Matthew R.Torsiello](#)  
**Cc:** [Linde, Emily \(NIH/NIAID\) \[E\]](#); [Stemmy, Erik \(NIH/NIAID\) \[E\]](#); [Andrew N. Krinsky](#); [Nels T. Lippert](#); [Black, Jodi \(NIH/OD\) \[E\]](#); [Erbelding, Emily \(NIH/NIAID\) \[E\]](#); [Bulls, Michelle G. \(NIH/OD\) \[E\]](#); [Peter Daszak](#); [Aleksi Chmura](#); [Lauer, Michael \(NIH/OD\) \[E\]](#)  
**Subject:** Re: EcoHealth Alliance re Suspension of NIH Grant No. 2R01 AI 110964-6  
**Date:** Friday, August 14, 2020 5:17:14 AM  
**Attachments:** [image001.png](#)  
[EcoHealth Alliance - Letter to NIH re Grant Suspension 8-13-2020 \(with Exhibits\)\[2\].pdf](#)

---

Dear Mr. Torsiello – letter received.

Thank you, Mike

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
1 Center Drive, Building 1, Room 144  
Bethesda, MD 20892  
Phone: (b) (6)  
Email: (b) (6)

---

**From:** "Matthew R.Torsiello" (b) (6)  
**Date:** Thursday, August 13, 2020 at 5:54 PM  
**To:** "Lauer, Michael (NIH/OD) [E]" (b) (6)  
**Cc:** "Linde, Emily (NIH/NIAID) [E]" (b) (6); "Stemmy, Erik (NIH/NIAID) [E]" (b) (6); "Andrew N. Krinsky" (b) (6); "Nels T. Lippert" (b) (6); "Black, Jodi (NIH/OD) [E]" (b) (6); "Erbelding, Emily (NIH/NIAID) [E]" (b) (6); "Bulls, Michelle G. (NIH/OD) [E]" (b) (6); Peter Daszak (b) (6); Aleksi Chmura (b) (6); "Linde, Emily (NIH/NIAID) [E]" (b) (6)  
**Subject:** EcoHealth Alliance re Suspension of NIH Grant No. 2R01 AI 110964-6

Dr. Lauer:

Please see the attached letter from Andrew Krinsky on behalf of EcoHealth Alliance, Inc., regarding the decision by NIH to suspend NIH Research Grant 2R01 AI 110964-6 on or about July 8, 2020.

Please confirm receipt. Thank you.

Best,

Matthew



**Matthew R. Torsiello | Associate**

D: (b) (6) | F: 212-216-8001

(b) (6) | [Bio](#)

Tarter Krinsky & Drogin LLP  
1350 Broadway | New York | NY | 10018  
[www.tarterkrinsky.com](http://www.tarterkrinsky.com) | [LinkedIn](#)  
[COVID-19 RESOURCE CENTER](#)

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Tarter Krinsky & Drogin is fully operational. All attorneys and staff have been and will continue to be working remotely and TKD has put measures in place to ensure our services continue uninterrupted. However, because of anticipated delays in receiving regular mail and other deliveries, please e-mail copies of anything you send by regular mail or delivery, including issuing remittances electronically, until

**From:** [Lauer, Michael \(NIH/OD\) \[E\]](#)  
**To:** [Aleksei Chmura](#); [Peter Daszak](#)  
**Cc:** [Black, Jodi \(NIH/OD\) \[E\]](#); [Stemmy, Erik \(NIH/NIAID\) \[E\]](#); [Erbelding, Emily \(NIH/NIAID\) \[E\]](#); [Linde, Emily \(NIH/NIAID\) \[E\]](#); [Lauer, Michael \(NIH/OD\) \[E\]](#); [Bulls, Michelle G. \(NIH/OD\) \[E\]](#)  
**Subject:** PLEASE READ -- Re: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06  
**Date:** Friday, April 24, 2020 4:48:19 PM  
**Attachments:** [Daszak letter 4 24 20.pdf](#)  
[EcoHealth Alliance re AI grant 4 19 20.pdf](#)  
**Importance:** High

---

Dear Dr. Chmura and Dr. Daszak

Please see attached.

Sincerely,

Michael S Lauer, MD

Michael S Lauer, MD

NIH Deputy Director for Extramural Research

1 Center Drive, Building 1, Room 144

Bethesda, MD 20892

Phone: (b) (6)

Email: (b) (6)

---

**From:** Aleksei Chmura (b) (6)

**Date:** Thursday, April 23, 2020 at 1:50 PM

**To:** "Lauer, Michael (NIH/OD) [E]" (b) (6)

**Cc:** Peter Daszak (b) (6) "Black, Jodi (NIH/OD) [E]"

(b) (6) "Stemmy, Erik (NIH/NIAID) [E]" (b) (6) "Erbelding, Emily (NIH/NIAID) [E]" (b) (6)

**Subject:** Re: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

Dear Mike,

I read that we are in agreement and in compliance with all requests. Please let us know if anything further is required. We will continue in our usual close communication with our Program Officer Erik Stemmy.

Sincerely,

-Aleksei

**Aleksei Chmura**

*Chief of Staff &*

*Authorized Organizational Representative*

EcoHealth Alliance

460 West 34th Street, Suite 1701

New York, NY 10001

(b) (6) (office)

(b) (6) (mobile)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

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On Apr 21, 2020, at 19:28, Lauer, Michael (NIH/OD) [E] (b) (6)



National Institutes of Health  
National Institute of Allergy  
and Infectious Diseases  
Bethesda, Maryland 20892

24 April 2020

Drs. Aleksei Chmura and Peter Daszak  
EcoHealth Alliance, Inc.  
460 W 34<sup>th</sup> St  
Suite 1701  
New York, NY 10001

Re: Termination of NIH Grant R01 AI 110964

Dear Drs. Chmura and Daszak:

I am writing to notify you that the National Institute of Allergy and Infectious Diseases (NIAID), an Institute within the National Institutes of Health (NIH), under the Department of Health and Human Services (HHS) has elected to terminate the project *Understanding the Risk of Bat Coronavirus Emergence*, funded under grant R01 AI110964, for convenience. This grant project was issued under the authorization of Sections 301 and 405 of the Public Health Service Act as amended (42 USC 241 and 284). This grant was funded as a discretionary grant as outlined in the [NIH Grants Policy Statement](#), which states that the decision not to award a grant, or to award a grant at a particular funding level, is at the discretion of the agency, in accordance with NIH's dual review system.

At this time, NIH does not believe that the current project outcomes align with the program goals and agency priorities. NIAID has determined there are no animal and human ethical considerations, as this project is not a clinical trial, but rather an observational study.

As a result of this termination, a total of \$369,819.56 will be remitted to NIAID and additional drawdowns will not be supported. The remaining funds have been restricted in the HHS Payment Management System, effective immediately.

Please let me know if you have any questions concerning the information in this letter.

Sincerely,

Lauer, Michael (NIH/OD) [E]

Digitally signed by Lauer, Michael (NIH/OD) [E]  
Date: 2020.04.24 16:41:16 -04'00'

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
Email: [REDACTED] (b) (6)

cc: Dr. Erik Stemmy  
Ms. Emily Linde





Date: April 19, 2020

From: Michael S Lauer, MD  
NIH Deputy Director for Extramural Research

Lauer, Michael  
(NIH/OD) [E]  
Digitally signed by Lauer,  
Michael (NIH/OD) [E]  
Date: 2020.04.19 10:47:40  
-04'00'

To: Kevin Olival, PhD  
Vice-President for Research  
EcoHealth Alliance  
[REDACTED] (b) (6)

Naomi Schrag, JD  
Vice-President for Research Compliance, Training, and Policy  
Columbia University  
[REDACTED] (b) (6)

Subject: Project Number 2R01AI110964-06

Dear Dr. Olival and Ms. Schrag:

EcoHealth Alliance, Inc. is the recipient, as grantee, of an NIH grant entitled “Understanding the Risk of Bat Coronavirus Emergence.” It is our understanding that one of the sub-recipients of the grant funds is the Wuhan Institute of Virology (“WIV”). It is our understanding that WIV studies the interaction between corona viruses and bats. The scientific community believes that the coronavirus causing COVID-19 jumped from bats to humans likely in Wuhan where the COVID-19 pandemic began. There are now allegations that the current crisis was precipitated by the release from WIV of the coronavirus responsible for COVID-19. Given these concerns, we are pursuing suspension of WIV from participation in Federal programs.

While we review these allegations during the period of suspension, you are instructed to cease providing any funds from the above noted grant to the WIV. This temporary action is authorized by 45 C.F.R. § 75.371(d) (“Initiate suspension or debarment proceedings as authorized under 2 C.F.R. part 180”). The incorporated OMB provision provides that the funding agency may, through suspension, immediately and temporarily exclude from Federal programs persons who are not presently responsible where “immediate action is necessary to protect the public interest.” 2 C.F.R. § 180.700(c). It is in the public interest that NIH ensure that a sub-recipient has taken all appropriate precautions to prevent the release of pathogens that it is studying. This suspension of the sub-recipient does not affect the remainder of your grant assuming that no grant funds are provided to WIV following receipt of this email during the period of suspension.

wrote:

Many thanks Peter for your response.

We note that:

- No monies have gone to WIV on the Type 2 award and no contract has been signed.
- You agree that you will not provide any funds to WIV until and unless directed otherwise by NIH.
- All foreign sites for the Type 1 and Type 2 awards have been documented in the progress reports submitted to NIH.

We appreciate your working with us.

Best, Mike

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
1 Center Drive, Building 1, Room 144  
Bethesda, MD 20892  
Phone: (b) (6)  
Email: (b) (6)

---

**From:** Peter Daszak (b) (6)  
**Date:** Tuesday, April 21, 2020 at 7:07 PM  
**To:** "Lauer, Michael (NIH/OD) [E]" (b) (6)  
**Cc:** "Black, Jodi (NIH/OD) [E]" (b) (6); Aleksei Chmura  
(b) (6); "Stemmy, Erik (NIH/NIAID) [E]"  
(b) (6); "Erbelding, Emily (NIH/NIAID) [E]"  
(b) (6)

**Subject:** RE: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

Dear Michael – Confirming receipt of your email. I'm also cc'ing the following people so they're aware of this request:

1. Our AOR – Dr. Aleksei Chmura, who has access to all our records
2. My Program Officer for this award, Dr. Erik Stemmy & the Division Director (DMID), Dr. Emily Erberding, so they are informed and aware of the request and our response.

That said we need some time to go through the request for information and will provide this as quickly as we can.

However, **I can categorically state that no funds form 2R01AI110964-06 have been sent to Wuhan Institute of Virology, nor has any contract been signed.** Furthermore, we will comply with NIAID requirements, of course.

Concerning the request for information on all of the sites linked to this award in China, you should be aware that these are documented in our progress reports over the course of the grant. As you can understand we are under enormous pressure to generate data related to the current pandemic, and we do not want to divert staff to this effort. We are hoping the previously filed reports will satisfy this request. We are well aware of the political concerns over the origins of this outbreak. Our collaboration with Wuhan Institute of Virology has been scientific and we have been consistently impressed with the scientific capabilities of that laboratory and its research staff. Our joint work has led to a series of critical papers published in high impact

journals that served to raise awareness of the future threat coronaviruses pose for global health and therefore US national security. Scientific insights with epidemiological significance have been jointly published and our relationship has always been open and transparent and with one concern only, scientific validity. We are concerned that current actions may jeopardize 15 years of fruitful collaboration with colleagues in Wuhan, who are working at the leading edge to design vaccines and drugs that could help us fight this new threat in future years. It is quite remarkable that of the 5 vaccine candidates listed by WHO that are already in human trials, 3 have been developed in China. That said, we of course will do all we can to make sure any further questions from NIH or any Federal agency are addressed to our fullest knowledge.

Yours sincerely,

**Peter Daszak**

*President*

EcoHealth Alliance

460 West 34<sup>th</sup> Street

New York, NY 10001

USA

Tel.: [REDACTED] (b) (6)

Website: [www.ecohealthalliance.org](http://www.ecohealthalliance.org)

Twitter: [@PeterDaszak](https://twitter.com/PeterDaszak)

*EcoHealth Alliance develops science-based solutions to prevent pandemics and promote conservation*

---

**From:** Lauer, Michael (NIH/OD) [E] [REDACTED] (b) (6)

**Sent:** Monday, April 20, 2020 4:31 PM

**To:** Kevin Olival [REDACTED] (b) (6) Peter Daszak

[REDACTED] (b) (6)

**Cc:** Naomi Schrag [REDACTED] (b) (6) Black, Jodi (NIH/OD) [E]

[REDACTED] (b) (6) Lauer, Michael (NIH/OD) [E] [REDACTED] (b) (6)

**Subject:** Re: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

**Importance:** High

Thank you Kevin

- We need to work with a senior responsible business official – usually PI’s and senior business officials are different people.
- When I looked you up on the web, I see the Columbia logo (see attached screenshot). Specifically, it appears to be Columbia University > Ecology, Evolution, and Environmental Biology > EcoHealth Alliance (labeled as an “Affiliation/Department”). Thus the web profile makes it look to me as if EcoHealth Alliance is linked to Columbia University.
- In any case, I’m looping in Dr. Daszak.
- We need to know all sites in China that have been in any way linked to this award (Type 1 and Type 2). We have data in NIH, but we want to make absolutely sure that we’re of the same understanding.

We greatly appreciate your prompt attention to this matter.

Best, Mike

Michael S Lauer, MD  
NIH Deputy Director for Extramural Research  
1 Center Drive, Building 1, Room 144  
Bethesda, MD 20892  
Phone: (b) (6)  
Email: (b) (6)

---

**From:** Kevin Olival (b) (6)  
**Date:** Monday, April 20, 2020 at 4:14 PM  
**To:** "Lauer, Michael (NIH/OD) [E]" (b) (6)  
**Cc:** Naomi Schrag (b) (6) "Black, Jodi (NIH/OD) [E]"  
(b) (6)

**Subject:** Re: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

Dear Mike,

I received the attached letter, however please note:

1. I am not the PI on this award. You should contact Dr. Peter Daszak (b) (6) who is the PI and leading this project for EcoHealth Alliance.
2. Columbia University is not involved in this NIH project, and it is not clear to me why Naomi and Columbia University were included.

Thank you,

Kevin

**Kevin J. Olival, PhD**

*Vice President for Research*

EcoHealth Alliance  
460 West 34th Street, Suite 1701  
New York, NY 10001

(b) (6) (direct)  
(b) (6) (mobile)

1.212.380.4465 (fax)

[www.ecohealthalliance.org](http://www.ecohealthalliance.org)

EcoHealth Alliance develops science-based solutions to prevent pandemics *and* promote conservation

On Apr 20, 2020, at 2:16 PM, Lauer, Michael (NIH/OD) [E]

(b) (6) wrote:

Many thanks Naomi – it would be helpful for us to know about **all** China-based participants in this work since the Type 1 grant started in 2014 – who they were and how much money they received. The sooner you can get us that information, the better.

Best, Mike

---

**From:** Naomi Schrag (b) (6)

**Date:** Sunday, April 19, 2020 at 11:59 AM

**To:** "Lauer, Michael (NIH/OD) [E]" (b) (6)  
(b) (6)

Naomi Schrag (b) (6)

**Cc:** "Black, Jodi (NIH/OD) [E]" (b) (6)

**Subject:** RE: Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

Dear Dr. Lauer,

I am acknowledging receipt of this letter and will get back to you as soon as I can.

Sincerely,

Naomi Schrag

---

**From:** Lauer, Michael (NIH/OD) [E] (b) (6)

**Sent:** Sunday, April 19, 2020 11:00 AM

**To:** (b) (6) Naomi Schrag (b) (6)

**Cc:** Black, Jodi (NIH/OD) [E] (b) (6)

**Subject:** Please read and acknowledge receipt -- Actions needed regarding 2R01AI110964-06

**Importance:** High

Dear Dr. Olival and Ms. Schrag

Please see attached.

Many thanks, Mike

Michael S Lauer, MD

NIH Deputy Director for Extramural Research

1 Center Drive, Building 1, Room 144

Bethesda, MD 20892

Phone: (b) (6)

Email: (b) (6)

<EcoHealth Alliance re AI grant 4 19 20.pdf>

<EcoHealth Alliance re AI grant 4 19 20[2].pdf><NoA R01AI110964-06.pdf><NoA R01AI110964-01.pdf>

**From:** [Rodriguez, Elizabeth \(NIH/NIAID\) \[E\]](#)  
**To:** [Stemmy, Erik \(NIH/NIAID\) \[E\]](#)  
**Cc:** [DMID GrantOps](#)  
**Subject:** RE: Award Error for R01AI110964-06 PI Daszak  
**Date:** Friday, August 2, 2019 12:30:23 PM

---

Dear Erik,

Yes, it's ok that the total award exceeds the \$500K cap. According to the submission requirements for [PA-18-484](#), the FOA in which 2R01AI110964-06 was received, the \$500K cap is for direct costs and does *not* apply to consortium F&A expenses.

Thus it is allowed if the budget for indirect costs brings the award above \$500K. There shouldn't be an issue with the adjusted award total of \$538,991.

You're most welcome-glad I could help. Please let us know if you need any additional info.

Liz

---

**From:** Stemmy, Erik (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, August 2, 2019 11:52 AM  
**To:** Rodriguez, Elizabeth (NIH/NIAID) [E] (b) (6) >  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Award Error for R01AI110964-06 PI Daszak

Hi Liz,

I've heard back from the GMS on this. She said that original proposed budget did not include indirect costs for one of the subcontracts. GM wants to reduce the DC of the award to \$499,989 (as listed in the grantee letter) + \$39,002 (the consortium Indirect cost) = \$538,991 (see attached). Is that ok since it is above the \$500 cap? It appears that in their letter the PI accounted for the sub indirects along with the total indirect costs, and not in the direct cost budget.

Ultimately, she said that by shifting the accounting the total costs of the award will actually be less than what the PI proposed in their letter.

Thanks for your help!

Erik

---

**From:** Rodriguez, Elizabeth (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, July 26, 2019 11:09 AM  
**To:** Stemmy, Erik (NIH/NIAID) [E] (b) (6)  
**Cc:** DMID GrantOps (b) (6)  
**Subject:** RE: Award Error for R01AI110964-06 PI Daszak

Dear Dr. Erik Stemmy,

It appears that figures from the corrected budget letter that accompanied the ARA submitted on 11/14/18 (see attached) may not have been taken into account when calculating the award. We recommend working with the GMS to get this sorted out. Please let us know if we can be of further assistance.

Thank You,

Liz

Elizabeth Rodriguez, MS  
Health Specialist, DMID Grant Ops  
OSCPO/DMID/NIAID/NIH  
5601 Fishers Lane, Room 7G46  
Rockville, MD 20852  
Phone: (b) (6)  
(b) (6)

---

**From:** Stemmy, Erik (NIH/NIAID) [E] (b) (6)

**Sent:** Thursday, July 25, 2019 12:31 PM

**To:** DMID GrantOps (b) (6)

**Subject:** Award Error for R01AI110964-06 PI Daszak

Hi GrantOps,

The NoA for the award above just went out this week, and the dollar amount was very wrong. Originally, the application came in last year mistakenly over the \$500k cap and we did an ARA with the PI saying they would reduce the budget to be within the cap (see attached email thread and letter). It looks like the NoA was issued for an amount that even exceeds the original budget request (\$593,362 vs \$515,358). Should I work with the GMS on this or is this something you can help with? Thanks!

Erik

Erik J. Stemmy, Ph.D.

Program Officer

Respiratory Diseases Branch

Division of Microbiology and Infectious Diseases NIAID/NIH/HHS

5601 Fishers Lane, (b) (4)

Bethesda, MD 20892-9825

Phone: (b) (6)

Email: (b) (6)

Getting ready to publish? Share the good news with your program officer asap! NIAID may be able to help publicize your article. And, remember to list your NIAID grant or contract number in the publication.

\*\*\*\*\*

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R01AI10452-06	Sadat, SAYED	BUCALA, RICHARD	YALE UNIVERSITY	of Adaptive Immunity by Plasmodium MIF	\$418,750	\$418,750	\$0	\$0	\$418,750	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M44 B	6/00/20	201905	5	5569
1 R01AI146342-01	Liang, Shan	TANG, HENGLI	FLORIDA STATE UNIVERSITY	Perturbation of Host DNA Replication and Cell Cycle Progression by Zika Virus	\$378,998	\$378,998	\$0	\$0	\$378,998	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M32C B	6/00/21	201905	5	5569
1 R01AI145883-01	Girma, Tsehay	YANG, WAN	COLUMBIA UNIVERSITY HEALTH SCIENCES	Disease Persistence and Population Dynamics: Modeling Measles under Mass Vaccination	\$507,841	\$507,841	\$0	\$0	\$507,841	8472364(8472364)/PAYLINE/NIAD OD	PAR17-267	M32A B	6/00/25	201905	5	5569
1 R01AI146078-01	Lundgren, Jason	BAYER, ARNOLD	LA BIOMED RES INST/ HARBOR UCLA MED CTR	Dicarboxylate-Mediated Enhancement of Beta-Lactam-MRSA Killing: Mechanisms and Clinical Translatability	\$300,838	\$300,838	\$0	\$0	\$300,838	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M38A BR	6/00/25	201905	5	5569
1 R01AI139307-01A1	Carlisle, Tina	FARKAS, TIBOR	LOUISIANA STATE UNIV A&M COL BATON ROUGE	Determinants of Enteric Calicivirus Infection.	\$370,000	\$370,000	\$0	\$0	\$370,000	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M64E B	7/00/23	201905	5	5569
1 R01AI147628-01	Mpinja, Bora	MANCIA, FILIPPO	COLUMBIA UNIVERSITY HEALTH SCIENCES	Leveraging PICRT Structure to Discern Function and Predict Emergence of Drug-Resistant Malaria	\$421,253	\$421,253	\$0	\$0	\$421,253	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M91 BR	7/00/23	201905	5	5569
1 R01AI141953-01A1	Smith, Philip	BALIGA, NITIN	INSTITUTE FOR SYSTEMS BIOLOGY	A systems approach to manipulate microbial adaptation to structured environments	\$930,885	\$930,885	\$0	\$0	\$930,885	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M63 BR	7/00/27	201905	5	5569
1 R01AI140400-01A1	Granton, Shaun	BACHMANN, BRIAN	VANDERBILT UNIVERSITY	Biosynthesis and Synthetic Biology of Antibiotic Oligosaccharides	\$474,925	\$474,925	\$0	\$0	\$474,925	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M30C BR	8/00/24	201905	4	5569
2 R01AI091594-06A1	Briggs, Jenna	PATEL, ROBIN	MAYO CLINIC ROCHESTER	Novel Electrochemical Handgrip for Treatment of Wound Infections	\$581,092	\$581,092	\$0	\$0	\$581,092	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M38A B	8/00/28	201905	5	5569
1 R01AI147681-01	Madow, David	DOWDY, DAVID	JOHNS HOPKINS UNIVERSITY	Innovative contact tracing strategies for detecting TB in mobile rural and urban South African populations	\$653,813	\$653,813	\$0	\$0	\$653,813	8472364(8472364)/PAYLINE/NIAD OD	PA18-345	M33E B	9/00/20	201905	5	5569
1 R01AI143709-01A1	Fato, Michael	YANG, ZHILONG	KANSAS STATE UNIVERSITY	Mechanisms regulating poxvirus post-replicative protein synthesis	\$375,906	\$375,906	\$0	\$0	\$375,906	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M34A B	9/00/25	201905	5	5569
1 R01AI147129-01	Pone, Laura	RUBINSTEIN, FERNANDO	INSTITUTO DE EFECTIVIDAD CLINICA Y SANIT	TB-TST (TB treatment support tools): Refinement and evaluation of an interactive mobile app and direct adherence monitoring on TB treatment outcomes	\$396,560	\$396,560	\$0	\$0	\$396,560	8472364(8472364)/PAYLINE/NIAD OD	PA18-722	M33E B	9/00/26	201905	5	5569
1 R01AI141626-01A1	Smith, Philip	VISWANATHAN, V	UNIVERSITY OF ARIZONA	Host-cell mitochondrial alterations play a central role in EPEC pathogenesis	\$352,489	\$352,489	\$0	\$0	\$352,489	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M64A B	9/00/28	201905	5	5569
2 R01AI01047-06A1	Wolcott, Roberta	WANG, BAOZHONG	GEORGIA STATE UNIVERSITY	Novel Influenza nano vaccines for broad cross protection	\$763,035	\$763,035	\$0	\$0	\$763,035	8472364(8472364)/PAYLINE/NIAD OD	PA18-859	M51A B	9/00/28	201905	5	5569
1 R01AI146241-01	Diallo, MARIAMA	RAO, GAURI	UNIV OF NORTH CAROLINA CHAPEL HILL	Pharmacology of intrathecal/intraventricular polymyxins: A systems-based approach	\$597,848	\$597,848	\$0	\$0	\$597,848	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M30C BR	9/00/29	201905	5	5569
1 R01AI143265-01A1	Pone, Laura	ADAMS WALDORF, KRISTINA	UNIVERSITY OF WASHINGTON	JAK-STAT Control of Zika Virus-Induced Fetal Injury	\$919,949	\$919,949	\$0	\$0	\$919,949	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M32C B	10/00/26	201905	5	5569
1 R01AI146914-01	Lundgren, Jason	RALSTON, KATHERINE	UNIVERSITY OF CALIFORNIA AT DAVIS	The role of Entamoeba histolytica trophozoites (trogoo- nibbles) in the pathogenesis of amoebiasis	\$372,773	\$372,773	\$0	\$0	\$372,773	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M44 B	10/00/26	201905	5	5569
1 R01AI147325-01	Smith, Philip	WANG, JUN	UNIVERSITY OF ARIZONA	High Throughput Screening of Inhibitors Targeting the Enterovirus A71 and D68 2A Proteases	\$537,177	\$537,177	\$0	\$0	\$537,177	8472364(8472364)/PAYLINE/NIAD OD	PAR17-438	M55 B	10/00/28	201905	4	5569
1 R01AI141656-01A1	Heath, Kevin	BELISLE, JOHN	COLORADO STATE UNIVERSITY	Host Metabolic Biosignatures for the Diagnosis of Lyme Disease	\$781,156	\$781,156	\$0	\$0	\$781,156	8472364(8472364)/PAYLINE/NIAD OD	PA16-243	M35 B	11/00/27	201905	5	5569
1 R01AI143850-01A1	Mpinja, Bora	RAMAGE, HOLLY	UNIVERSITY OF PENNSYLVANIA	Defining the Role of West Nile Virus-Host Protein Interactions in Evading Antiviral Immunity	\$402,500	\$402,500	\$0	\$0	\$402,500	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M32C B	11/00/27	201905	5	5569
2 R01AI019641-33A1	Saeed, Saifan	MURPHY, TIMOTHY	STATE UNIVERSITY OF NEW YORK AT BUFFALO	Genome Evolution During Bacterial Persistence in the Human Airways in COPD	\$648,435	\$648,435	\$0	\$0	\$648,435	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M54A BR	11/00/27	201905	5	5569
2 R01AI094623-07A1	Granton, Shaun	KALODIMOS, CHARALAMPOS	ST. JUDE CHILDRENS RESEARCH HOSPITAL	Structural insight into novel mechanisms of type III secretion	\$448,750	\$448,750	\$0	\$0	\$448,750	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M64A B	11/00/27	201905	5	5569
1 R01AI141633-01A1	Girma, Tsehay	THANASSI, DAVID	STATE UNIVERSITY NEW YORK STONY BROOK	Modulation of Host Cell Responses by Francisella tularensis	\$549,471	\$549,471	\$0	\$0	\$549,471	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M46B B	11/00/30	201905	5	5569
1 R01AI145960-01	Powell, Tamsa	BALDWIN, MICHAEL	UNIVERSITY OF MISSOURI-COLUMBIA	Mechanism of botulinum neurotoxin transport across membranes	\$358,900	\$358,900	\$0	\$0	\$358,900	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M64C B	11/00/30	201905	5	5569
2 R01AI027655-31A1	Alford, Trevor	PORTNOY, DANIEL	UNIVERSITY OF CALIFORNIA BERKELEY	How Listeria senses and responds to different host environments	\$370,714	\$370,714	\$0	\$0	\$370,714	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M64A B	11/00/30	201905	5	5569
1 R01AI140766-01A1	Granton, Shaun	SCHULTZ-CHERRY, STACEY	ST. JUDE CHILDRENS RESEARCH HOSPITAL	Effects of obesity on the dynamics of Influenza transmission	\$769,323	\$769,323	\$0	\$0	\$769,323	8472364(8472364)/PAYLINE/NIAD OD	PA18-859	M51B B	12/00/24	201905	5	5569
1 R01AI146172-01	Hernandez, Raul	OGINO, TOMOAKI	CASE WESTERN RESERVE UNIVERSITY	Dissecting catalytic and regulatory functions of nonsegmented negative strand RNA viral polymerases	\$360,000	\$360,000	\$0	\$0	\$360,000	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M32A B	12/00/26	201905	5	5569
1 R01AI147640-01	Kitsoulis, Regina	WAN, XIUFENG	MISSISSIPPI STATE UNIVERSITY	Use of Clinical Samples to Identify Influenza Virus Antigenic Variants	\$530,007	\$530,007	\$0	\$0	\$530,007	8472364(8472364)/PAYLINE/NIAD OD	PA18-859	M51B B	12/00/27	201905	5	5569
1 R01AI146160-01	Nee, Mable	ZHOU, QI	PURDUE UNIVERSITY	Advancing innovative therapies against prandip-resistant Gram-negative superbugs	\$673,485	\$673,485	\$0	\$0	\$673,485	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M58A BR	12/00/31	201905	5	5569
1 R01AI141671-01A1	Kitsoulis, Regina	BARBIER, MARIETTE	WEST VIRGINIA UNIVERSITY	Vaccine Development Against Bacterial Pathogens Based on Iron Acquisition Proteins	\$524,949	\$524,949	\$0	\$0	\$524,949	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M58A B	12/00/34	201905	5	5569
1 R01AI146199-01	Carlisle, Tina	SCARAFFIA, PATRICIA	TULANE UNIVERSITY OF LOUISIANA	Mechanistic regulation of ammonia metabolism in Aedes aegypti mosquitoes	\$391,993	\$391,993	\$0	\$0	\$391,993	8472364(8472364)/PAYLINE/NIAD OD	PA18-484	M43 B	13/00/25	201905	5	5569
1 R01AI139267-01A1	Heath, Kevin	PETERSEN, CHRISTINE	UNIVERSITY OF IOWA	Field trial and modeling of transmission blocking vaccine to prevent Lyme disease	\$728,991	\$728,991	\$0	\$0	\$728,991	8472364(8472364)/PAYLINE/NIAD OD	PA16-243	M35 B	13/00/28	201905	5	5569

I RD1A1145954-01	Pose, Laura	MOUGOUS, JOSEPH	UNIVERSITY OF WASHINGTON	Identity, function and control of Francisella effectors encoded outside its pathogenicity island	\$719,446	\$719,446	\$0	\$0	\$719,446	8472364(8472364)/PAYLINE/NIAID OD	PA18-484	M46B B	13.00/31	201905	5	5569
I RD1A1146063-01	Rojas, Cynthia	ZHU, XIAOPING	UNIV OF MARYLAND, COLLEGE PARK	FcRn-Targeted Mucosal Vaccination Against Influenza Infections	\$599,064	\$599,064	\$0	\$0	\$599,064	8472364(8472364)/PAYLINE/NIAID OD	PA18-859	MS1A B	13.00/35	201905	5	5569
I RD1A1146129-01	Saad, Sufyan	ACHKAR, JACQUELINE	ALBERT EINSTEIN COLLEGE OF MEDICINE, INC	Characteristics and protective efficacy of human antibodies against M. tuberculosis	\$788,818	\$788,818	\$0	\$0	\$788,818	8472364(8472364)/PAYLINE/NIAID OD	PA18-484	M35A B	14.00/25	201905	5	5569
I RD1A1146123-01	Powell, Tania	KORPE, POONUM	JOHNS HOPKINS UNIVERSITY	Household Transmission of Cryptosporidium	\$766,094	\$766,094	\$0	\$0	\$766,094	8472364(8472364)/PAYLINE/NIAID OD	PA18-484	M90 B	14.00/29	201905	5	5569
I RD1A1146101-01	Mpinja, Bora	PARDI, NORBERT	UNIVERSITY OF PENNSYLVANIA	Development of Universal Influenza Virus Vaccines Using Nucleoside-Modified Messenger RNA	\$641,792	\$641,792	\$0	\$0	\$641,792	8472364(8472364)/PAYLINE/NIAID OD	PA18-859	MS1A B	14.00/37	201905	5	5569

Let me know if you have any Questions.  
Thank you,

**From:** [Park, Eun-Chung \(NIH/NIAID\) \[E\]](#)  
**To:** [Bateman, Karen \(NIH/NIAID\) \[E\]](#)  
**Subject:** FW: AI79231 Daszak--can you ask Ann Devine about this  
**Date:** Tuesday, April 1, 2008 2:52:23 PM  
**Attachments:** [R01AI079231-01.PDF](#)

---

Karen,

I have not heard from Jackie yet, re: [REDACTED] (b) (5)  
[REDACTED] I am enclosing  
the summary statement for this application. Thank you.

*Best,  
Eunchung*

Eun-Chung Park, PhD, MPA  
Virology Branch, DMID, NIAID, NIH  
6610 Rockledge Dr., Rm 4103  
Bethesda, MD 20892-7630  
(Zip for Express Mail Only: 20817)

Tel: [REDACTED] (b) (6) (Direct)  
[REDACTED] (b) (6) (Main Office)  
FAX: 301-480-1594

NIAID, National Institutes of Health, DHHS

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**From:** Park, Eun-Chung (NIH/NIAID) [E]  
**Sent:** Monday, March 31, 2008 11:30 AM  
**To:** Johnson, Jackie (NIH/NIAID) [E]  
**Cc:** Bateman, Karen (NIH/NIAID) [E]  
**Subject:** AI79231 Daszak

Jackie,  
I have a question [REDACTED] (b) (5)

[REDACTED] (b) (5)

(b) (5)

(b) (5)

Let us know if this can be done. Thank you.

*Best,  
Eunchung*

Eun-Chung Park, PhD, MPA  
Virology Branch, DMID, NIAID, NIH  
6610 Rockledge Dr., Rm 4103  
Bethesda, MD 20892-7630  
(Zip for Express Mail Only: 20817)

Tel: (b) (6) (Direct)  
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FAX: 301-480-1594

NIAID, National Institutes of Health, DHHS

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**SUMMARY STATEMENT**  
( Privileged Communication )

*Release Date:* 02/20/2008

**PROGRAM CONTACT:**  
Eun-Chung Park

(b) (6) 3

(b) (6)

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*Application Number:* 1 R01 AI079231-01

**Principal Investigator**

**DASZAK, PETER PHD**

**Applicant Organization: WILDLIFE TRUST**

*Review Group:* IRAP

Infectious Diseases, Reproductive Health, Asthma and Pulmonary Conditions  
Study Section

*Meeting Date:* 02/07/2008

*Council:* MAY 2008

*Requested Start:* 07/01/2008

*RFA/PA:* PA07-246

*PCC:* M34A

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**Project Title:** Risk of Viral Emergence from Bats

**SRG Action:** Priority Score: (b) (5) Percentile: (b) (5)

**Human Subjects:** 10-No human subjects involved

**Animal Subjects:** 30-Vertebrate animals involved - no SRG concerns noted

<b>Project Year</b>	<b>Direct Costs Requested</b>	<b>Estimated Total Cost</b>
1	499,347	610,004
2	499,001	609,582
3	499,966	610,760
4	499,713	610,451
5	499,997	610,798
<b>TOTAL</b>	<b>2,498,024</b>	<b>3,051,596</b>

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**ADMINISTRATIVE BUDGET NOTE:** The budget shown is the requested budget and has not been adjusted to reflect any recommendations made by reviewers. If an award is planned, the costs will be calculated by Institute grants management staff based on the recommendations outlined below in the COMMITTEE BUDGET RECOMMENDATIONS section.

**BIOHAZARD, BUDGET MODIFICATIONS**

**1R01AI079231-01 DASZAK, PETER**

**BIOHAZARD COMMENT  
COMMITTEE BUDGET RECOMMENDATIONS**

**RESUME AND SUMMARY OF DISCUSSION:** The goal of this excellent application is to model risks of infectious diseases emerging from animal reservoirs, particularly zoonotic viruses from bats. In recent years, wild bat populations have been the reservoir for SARS, Ebola virus, and Nipah virus, all emerging infectious diseases of global significance because of their high morbidity and mortality. The significance of this application is in its potential to identify particular areas of the world that need more active surveillance. The application has many strengths, including the outstanding team of investigators and the inclusion of state-of-the-art laboratory methods to be utilized both at the bench and in the field. It is innovative in its integration of broad geographic predictive models, targeted viral sampling and molecular/cell biology techniques into one research endeavor. However, there are a few weaknesses in the application as currently written. The scope of the overall project is too wide, particularly Aim 3. There is no discussion about how viruses will be isolated from tissue samples and the lack of a sustainable bat cell line will preclude completion of all the specific aims. There are no plans for including a human component in the study despite the goal to study zoonotic and human-to-human transmission dynamics. There is no discussion of protecting workers against biohazards. The use of publications from one scientific journal to evaluate biases is curious. The reviewers are in consensus that the weaknesses are potentially addressable. However, they do offset somewhat the otherwise high level of scientific and technical merit of the proposed research.

**DESCRIPTION (provided by investigator):** Emerging zoonoses are a significant threat to global public health and our economies. The majority are caused by pathogens that emerge with increasing frequency from wildlife hosts (e.g. HIV-1 from chimpanzees, SARS CoV from bats and civets, Nipah virus from fruit bats). This group of diseases alone causes tens of thousands of deaths each year, and some outbreaks (e.g. SARS) have cost the global economy tens of billions of dollars. However, despite the huge social, demographic and economic impact of EIDs, there has been little advance in our understanding of the underlying process of how these wildlife zoonoses emerge, and in developing predictive approaches to prevent future emergence. Developing predictive and proactive approaches to zoonotic emergence is a key challenge to medical science. New zoonoses emerge regularly from wildlife in a seemingly random way, from disparate regions of the globe, and from a wide diversity of wildlife species. Our ability to understand what drives this process is hampered by a lack of rigorous analyses of the processes that cause emergence; our lack of knowledge of the diversity of microbes in wildlife (the 'zoonotic pool') from which new zoonoses regularly emerge; and our poor understanding of pathogenic factors that explain why some viruses are able to cross the species barrier while others are not. In this application, we bring together a multidisciplinary team of emerging disease ecologists and modelers, viral bioinformaticists, and molecular virologists who are leaders in their fields, and who have already collaborated together to study zoonotic disease emergence. Building on preliminary data that demonstrates bats are a key wildlife reservoir, and that emergence is due to a range of anthropogenic drivers, this team will 1) develop predictive models of global 'hotspots' for the future emergence of bat viruses; 2) use a large repository of bat biological samples to conduct targeted surveillance in these 'hotspots' for known and undiscovered bat pathogens, elucidating the unknown diversity of the bat 'virome' and; 3) using a range of in vitro techniques (including infection in bat cell culture), examine the pathogenesis of these new viruses, and a pool of available bat viruses which have not yet emerged in humans. This multidisciplinary approach represents the first, concerted effort to understand the depth and breadth of the process of emergence within a key group of wildlife hosts associated with the recent emergence of SARS, Nipah, Hendra, Ebola and Marburg viruses. **PUBLIC HEALTH RELEVANCE** Emerging zoonoses (e.g. HIV/AIDS, Influenza) are a major threat to health globally, causing tens of thousands of deaths each year in the USA and abroad and a number of these have emerged from bats recently (SARS, Ebola, Nipah). This research provides a way to predict the regions where the next new emerging zoonoses from bats is most likely to emerge, and proposes targeted surveillance of these

animals using state-of-the-art molecular techniques in those regions. It will characterize new viruses, and study the pathogenesis of these, and a bank of known bat viruses that have not yet emerged in the human population: It is therefore a predictive, proactive approach to combating the most high profile group of emerging pathogens.

## **CRITIQUE 1**

(b) (5)



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(b) (5)



**CRITIQUE 2**

(b) (5)



(b) (5)



**CRITIQUE 3**

(b) (5)



(b) (5)



(b) (5)



## MEETING ROSTER

### Infectious Diseases, Reproductive Health, Asthma and Pulmonary Conditions Study Section Health of the Population Integrated Review Group CENTER FOR SCIENTIFIC REVIEW IRAP

February 07, 2008 - February 08, 2008

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