



**DEPARTMENT OF HEALTH & HUMAN SERVICES**

Public Health Service

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Via Email: [petesorenson@gmail.com](mailto:petesorenson@gmail.com)

November 28, 2022

C. Pete Sorenson  
Sorenson Law Office  
PO Box 10836  
Eugene, Oregon, 97440

Re: NIH FOIA Case No.: 54696; US Right to Know v. NIH, Case No. 20cv3196

Dear Mr. Sorenson:

This is a partial response to the Freedom of Information Act (FOIA) request that is the subject of the complaint filed in US Right to Know v. NIH, Case No. 20cv3196, now pending in the U.S. District Court for the District of Columbia. Your FOIA request, dated July 10, 2020, was received by the National Institutes of Allergy and Infectious Diseases (NIAID) on the same day.

You requested three parts pertaining to the following employees:

1. Anthony Fauci, Director, National Institute of Allergy and Infectious Diseases (NIAID)
2. Hugh Auchincloss, NIAID Principal Deputy Director
3. Paula Bryant, Director, Office of Biodefense, Research Resources and Translational Research, NIAID
4. F. Gray Handley, Associate Director for International Research Affairs
5. Gayle Bernabe, Regional Program Officer, East Asia-Pacific, NIAID
6. Heinz Ulrich Feldmann, Senior Investigator, Disease Modeling and Transmission Section, NIAID

“For this FOIA request we are seeking copies of records created, received and/or in the possession of NIH, including cross-references. Specifically, we are seeking records that reflect communications – whether in writing or verbal communications that were later reduced to writing (including any emails and their attachments, non-email correspondence, or other forms of communication) – to, from, or in the possession of the above-named individuals -- containing any of the following keywords or domains:

Part I of this request pertains to communications containing any of the following keywords or domains:

- East China Normal University
- Wuhan Institute of Virology OR WIV OR [@wh.iov.cn](mailto:@wh.iov.cn)
- Wuhan Center for Disease Control and Prevention



- Wuhan University Institute of Medical Virology
- EcoHealth Alliance OR EcoHealth OR [@ecohealthalliance.org](mailto:@ecohealthalliance.org)
- Christophe Mérieux Laboratory located in Beijing

Part II of this request pertains to communications containing any of the following combinations of keywords:

- “China” within 25 “biothreat”
- “China” within 25 “bioincident”
- “China” within 25 “Dual Use Research of Concern” OR “China” AND “DURC” OR “China” within 25 “GOF”
- “China” within 25 “biodefense”
- “China” within 25 “US Army Medical Research Institute of Infectious Diseases” OR “China” within 25 “USAMRIID”

For Part III, please search for all email correspondence to or from above listed employees—including attachments, CC and BCC – and the following person(s):

- Fang Li OR [lifang@umn.edu](mailto:lifang@umn.edu)
- George Gao OR [gaof@im.ac.cn](mailto:gaof@im.ac.cn)
- Linfa Wang OR [linfa.wang@duke-nus.edu.sg](mailto:linfa.wang@duke-nus.edu.sg)
- Christian Bréchet OR [cbrechot@usf.edu](mailto:cbrechot@usf.edu)
- Ralph Baric OR [rbaric@email.unc.edu](mailto:rbaric@email.unc.edu)
- Ian Lipkin OR [wil2001@columbia.edu](mailto:wil2001@columbia.edu)
- James Le Duc OR [jwleduc@utmb.edu](mailto:jwleduc@utmb.edu)
- Thomas Ingelsby OR [tinglesby@jhu.edu](mailto:tinglesby@jhu.edu)

In accordance with the Court’s order dated September 30, 2021, we have processed 312 pages of responsive records this month. The information being withheld is protected from release pursuant to Exemptions 4, 5, and 6 of the FOIA, 5 U.S.C. § 552 (b)(4), (b)(5) and (b)(6); and sections 5.31(d), (e) and (f) of the HHS FOIA Regulations, 45 CFR Part 5. Exemption 4 protects from disclosure trade secrets and commercial or financial information that is privileged and confidential. Exemption 5 permits the withholding of internal government records which are predecisional and contain staff advice, opinion, and recommendations. This exemption is intended to preserve free and candid internal dialogue leading to decision-making. Exemption 6 exempts from disclosure records the release of which would cause a clearly unwarranted invasion of personal privacy.

Please direct any questions regarding this response to Dedra Curteman of the Department of Justice, who can be reached at [Dedra.Curteman@usdoj.gov](mailto:Dedra.Curteman@usdoj.gov), or (202) 252-2550.

Sincerely,

*for* Gorka Garcia-Malene  
Freedom of Information Act Officer, NIH

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**From:** LeDuc, James W. (b) (6)  
**Sent:** 2/11/2020 11:07:56 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** proofs  
**Attachments:** Biocontainment labs-bioeconomy-IS Feb2020.pdf

Hugh, please see attached manuscript that will be published soon. Not directly relevant to what I need to discuss with you, but somewhat related.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
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## COMMENTARY

# BIOCONTAINMENT LABORATORIES: A CRITICAL COMPONENT OF THE US BIOECONOMY IN NEED OF ATTENTION

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James W. Le Duc

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A UNIQUE AND CRITICAL COMPONENT of the national bioeconomy is that which deals with biodefense and the risk to national health and security arising from especially dangerous emerging infectious diseases caused by pathogens such as Ebola virus and antibiotic resistant microbes. An essential element in the critical national infrastructure required to safely and securely address these dangerous threats is the existing national network of academic biocontainment laboratories developed by NIH in cooperation with states and constructed over a decade ago.<sup>1</sup> The value of these labs to medical research is well established; however, there is concern about the sustainability of the network as facilities age and cost of operations continues to rise.

## ESPECIALLY DANGEROUS PATHOGENS

In the United States, dangerous pathogens are grouped by the severity of the diseases they cause, their ease of transmission, and the availability of vaccines to prevent infection and therapeutics to treat those who become infected. Pathogens are classified as biological safety level (BSL) risk groups 2, 3, or 4, with BSL-4 reserved for the most dangerous pathogens for which no effective treatment or vaccines are available. BSL-4 laboratories are specially constructed to protect the welfare of the workforce in-

involved in research and development, and to ensure the safety and security of the surrounding community and environment against possible release due to a breach in containment. BSL-3 laboratories have only slightly less rigorous infrastructure requirements and handle pathogens such as plague and anthrax, among many others.

The safety and security of the entire dangerous pathogen research and development enterprise is overseen by the US Centers for Disease Control and Prevention (CDC), Division of Select Agent and Toxins, under the Federal Select Agent Program (FSAP), mandated by federal law. Those pathogens that are of agricultural importance are managed by the Department of Agriculture (USDA) Animal and Plant Health Inspection Service, Agriculture Select Agent Services, and microbes that may cause disease in both humans and animals are jointly managed by both CDC and the USDA.<sup>2</sup>

## CRITICAL NATIONAL INFRASTRUCTURE

The critical national infrastructure established to support research on especially dangerous pathogens currently includes 9 BSL-4 biocontainment laboratories in the United States, with others now under construction. Historically, the few biocontainment laboratories in operation were located only in the federal sector; however, following the

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**BIOCONTAINMENT LABORATORIES AND US BIOECONOMY**


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F1 ► 9/11 attacks and the anthrax mailings, the National Institutes of Health (NIH), working in partnership with states, invested approximately \$1 billion for the construction of 12 regional BSL-3 biocontainment laboratories and 2 national maximum containment facilities (BSL-4) on academic campuses across the nation (Figure 1). The goal was to harness the strengths of the academic sector for basic and applied research by providing selected academic centers with the critical infrastructure required to safely and securely investigate the most dangerous pathogens.

F2 ► In addition to the network of academic biocontainment laboratories, today there are 5 BSL-4 laboratories managed by the US government, 1 by a private foundation, and 1 BSL-4 agriculture laboratory is under construction (Figure 2). A small BSL-4 laboratory on an academic campus pre-dates the development of the National Institute of Allergy and Infectious Diseases (NIAID) network. A large number of BSL-3 laboratories were also independently constructed by both the commercial and academic sectors, usually with limited federal government investment.

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**PERSONNEL**


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Personnel handling select agents in biocontainment laboratories undergo background checks by the Department of Justice; they must be enrolled in an occupational health program, and they require extensive training in biosafety and biosecurity prior to gaining access to the laboratory. They may work in various aspects of research and development, from basic discovery research to advanced product preclinical testing and evaluation. Basic and applied research often depends on having access to highly specialized equipment, instrumentation, and continuously evolving technology. Similarly, the need for comprehensive documentation, record keeping, and complete external audit of records that is required by the Food and Drug Administration (FDA) makes the conduct of well-documented studies to demonstrate the efficacy of candidate vaccines and therapeutics in laboratory animals both challenging and expensive from a study design and personnel standpoint. Successful operation of biocontainment laboratories requires skilled building engineers and safety officers adept at managing the unique requirements of these complex facilities. Veterinarians and animal

Figure 1. The Network of Academic Biocontainment Laboratories for Biodefense and Emerging Infectious Diseases

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**National Biocontainment Laboratories (BSL-3 and BSL-4 capabilities)**

- Galveston National Laboratory, University of Texas Medical Branch, Galveston, TX
- National Emerging Infectious Diseases Laboratory, Boston University, Boston, MA
- Georgia State University, Atlanta, GA\*

**Regional Biocontainment Laboratories (BSL-3 capabilities only)**

- Colorado State University, Fort Collins, CO
- Duke University, Durham, NC
- George Mason University, Fairfax, VA
- Rutgers University, New Brunswick, NJ
- Tufts University, Boston, MA
- Tulane University, New Orleans, LA
- University of Alabama, Birmingham, AL
- University of Chicago, Chicago, IL
- University of Louisville, Louisville, KY
- University of Missouri, Columbia, MO
- University of Pittsburgh, Pittsburgh, PA
- University of Tennessee, Memphis, TN

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\*Not part of the NIH-constructed network of biocontainment laboratories for biodefense and emerging infectious diseases.



Figure 2. Federal and Foundation BSL-4 Biocontainment Laboratories (affiliation) Independent of the NIAID Academic Network

- Centers for Disease Control and Prevention, Atlanta, GA; includes new laboratory planned for construction (DHHS/CDC)
- United States Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD; includes new laboratory under construction (DOD)
- Integrated Research Facility, Fort Detrick, Frederick, MD (DHHS/NIH)
- National Biodefense Analysis and Countermeasures Center, Fort Detrick, Frederick, MD (DHS)
- Rocky Mountain Laboratory, Hamilton, MT (DHHS/NIH)
- Texas Biomedical Research Institute, San Antonio, TX (independent nonprofit institution)
- National Bio- and Agro-defense Facility, Manhattan, KS; an agriculture research facility now under construction (DHS for construction and commissioning; ownership to be transferred to USDA following commissioning)

care staff also require extensive training prior to working in a high-containment laboratory. Collectively, the workforce that exists today in the biocontainment laboratory network is uniquely skilled and represents a major investment by universities that are home to this critical national infrastructure.

## DEMONSTRATED SUCCESS

Over the past decade, the network of academic biocontainment laboratories has repeatedly proven its value to the nation and the world through scientific advances in the understanding of the most dangerous pathogens and development of products needed for their prevention and control. For example, the academic network of BSL-4 laboratories contributed to the development of the vaccines, therapeutics, and diagnostics now in use to diagnose, treat, and prevent Ebola virus infections among healthcare workers and exposed persons in the Democratic Republic of the Congo.<sup>3,4</sup> Similarly, network scientists rapidly worked to understand the devastating disease seen among pregnant women following infection with Zika virus and helped lead the effort to advance a vaccine for this terrible disease.<sup>5</sup> Many other success stories exist involving globally important diseases and biodefense threats, such as glanders, tuberculosis, anthrax, plague, influenza, West Nile, eastern equine encephalitis, and infections due to antimicrobial resistant microbes.<sup>6</sup>

## SUSTAINING INVESTMENTS FOR PREPAREDNESS AND RESPONSE

The network of academic regional and national biocontainment laboratories (the NIAID biodefense laboratory

network) faces grave challenges regarding the sustainability of this critical national infrastructure. The network is threatened by high operating costs that cannot be met through traditional facilities and administrative costs typically associated with extramural research grants and contracts; the increasing regulatory burden associated with the FSAP; and the demands for a highly trained workforce. The business model originally envisioned to sustain the network through facilities and administrative costs associated with extramurally funded research and development projects has simply failed to meet the extraordinary operations costs of these unique facilities.

Further, several biocontainment laboratories are currently being built or contemplated around the world, many in countries that lack the rigorous oversight, the specially trained workforce, or the engineering controls needed to ensure their safe and secure operations. The NIAID network of BSL-3 and BSL-4 laboratories on US academic campuses has the infrastructure and experience that positions these facilities and their personnel as resources for global collaborators who are less experienced with the critical operation and management of biocontainment labs. By facilitating collaborations, personnel exchanges, and training opportunities, partnerships between the network and international biocontainment laboratories can reduce the potential for accidental release of dangerous pathogens and the risk of misuse by nefarious actors interested in developing biological weapons.

To ensure the sustainability of the NIAID biocontainment laboratory network, the US government should consider several issues. Specifically:

- *Operations Costs.* The safety and security of modern biocontainment laboratories rest on a complex foundation of facility infrastructure and physical security.

## BIOCONTAINMENT LABORATORIES AND US BIOECONOMY

Physical security is provided by police and guards, restrictive card key and biometric access, and tech-based surveillance systems, leading to controlled access to ensure that only approved, appropriately trained individuals are allowed entry to the facilities. Mechanical systems include sophisticated air handling to create directional airflow within the facilities and ensure that exhaust from all BSL-4 and many BSL-3 containment labs is filtered and free of pathogens. Solid and liquid wastes are treated before leaving the facility, with solid wastes disposed of through specialized incineration. Biocontainment laboratories require higher air changes than ordinary laboratory environments, because air flow is directional, often single pass, filtered, and may employ redundant systems. As a result, the energy costs for biocontainment laboratories greatly exceed those of a traditional research laboratory. In addition, the network labs have been in operations for over a decade, and essential equipment is reaching end of life and requires replacement as technology advances.

The costs of maintaining these laboratories greatly exceeds the financial support provided by research sponsors for facilities and administrative cost recovery, resulting in a significant financial burden on the universities where these facilities are located. While the 2 national biocontainment laboratories housing BSL-4 capabilities receive limited federal support to help offset their BSL-4 operational costs, the BSL-3 laboratories at both the national and regional facilities receive none. An independent assessment funded by NIAID in 2017 found that *annual* operational costs for biocontainment laboratories were approximately 5% to 8% of the original multimillion dollar construction costs of the facilities. The current approach to financing this important national resource network is insufficient to meet operational needs.

- *Regulatory Burden.* Oversight of biocontainment laboratories handling select agents is mandated in federal law and provided by CDC and by the USDA through FSAP. Certain pathogens are further designated as tier 1 agents and require additional special documentation, enhanced access control to laboratory spaces where they are handled, and additional personnel monitoring. Federal oversight includes documentation that all individuals having access to select agents have undergone a background check by the Department of Justice, have been enrolled in an entity-specific occupational health program, and are appropriately trained for their duties. Files that document training must be maintained for each individual involved in work with select agents or others who must enter select agent spaces (eg, maintenance personnel), and all records must be maintained for 3 years.

Facilities are approved to handle and store specific select agents, and although these microbes can be easily grown at any time, FSAP nonetheless requires an accurate inventory of individual vials containing each registered pathogen, thereby adding a significant accounting burden for investigators. Inter-entity transfer of select agents requires prior approval from FSAP, and the shipping permit is valid for only 30 days. All shipments must be documented by both the sending and receiving entities, and records must be maintained for a minimum of 3 years. BSL-4 laboratories are inspected annually, during which pathogen inventories, personnel training files, pathogen transfer records, building maintenance records, and other items are reviewed. BSL-3 facilities are inspected at least every 3 years, and there are often unannounced inspections in between. All audits are to the same level of detail.

The compliance burden placed on universities to meet the FSAP requirements is substantial and growing. Each select agent inspection requires preparation by all staff handling select agents prior to the visit, then time spent with inspectors to review records and document inventories during the inspections. The accounting burden of documenting the use of each vial of a pathogen used in an experiment or the increase in the number of vials when new stocks are grown is substantial. Documentation requirements for the removal of specimens from biocontainment are likewise burdensome. Communications with the select agent program before, during, and after each site visit is time consuming, and failure to meet any requirements may force the removal of an individual from the laboratory, closure of a specific program, or removal of select agent registration approval for the entire entity.

As the select agent program continues to evolve, more of the administrative burden is placed on the regulated entities. There is no program in place to allow universities to recoup the expenses of maintaining compliance with the select agent program; consequently, universities are forced to sustain the costs of this mandatory program using already limited institutional funds.

- *Skilled Labor Force.* Personnel working in biocontainment are uniquely trained and represent a wide range of technical skills. Entities managing biocontainment laboratories are required to maintain extensive records that document not only formal education degrees, but also specialized training in biosafety and biosecurity appropriate for the work their employees undertake. Requirements for independent entry to biocontainment are not standardized across the nation, but rather are established by each individual entity. In addition to formal university training and advanced degrees providing the essential skills needed to conduct their individual research or development project, each individual is usually required to have some level of general and specific training to work at the level of biocontainment appropriate for their

duties. This often includes a period of formal mentorship at the side of a more experienced individual and represents a significant training burden.

Maintenance personnel and those involved in ensuring the safe and secure operations of the facility may have different specific training requirements, but nonetheless must complete demanding and time-consuming biocontainment-specific training and orientation. Support personnel, particularly those from equipment suppliers involved in providing equipment and instrumentation installation, calibration, service, and repairs often are not willing to enter into biocontainment spaces, leaving programs with few options to sustain these essential resources. For personnel safety, there are few options for biosafety training by commercial vendors or partner universities; thus most universities of the national network maintain their own independent training programs. This represents yet another unfunded mandate assumed by the universities to sustain this critical national infrastructure.

- *International Engagement.* The United States has always been a global leader in research and development involving especially dangerous pathogens. We were among the first to construct dedicated biocontainment facilities, and we pioneered the development of biosafety and biosecurity equipment and programs required to ensure the safety of our workforce and the surrounding community. Our preeminence in the field is, however, dwindling. Today there are more than 50 BSL-4 laboratories in operation or under construction around the world. In the past, we were able to offer new facilities assistance to establish best practices for safe and secure operations of their facilities. Unfortunately, funding for such activities is no longer available, leaving a massive gap in global security as more and more biocontainment facilities obtain dangerous pathogens and begin their own independent investigations, often without the benefit of adequate training or the experience and good counsel that US experts traditionally provided. The risk of accidental releases or purposeful misuse of dangerous pathogens is greater without meaningful engagement between US labs and our colleagues working in biocontainment around the world.

## SPECIFIC ACTIONS

The US government should consider the following specific actions, which will help sustain the bioeconomy's critical national infrastructure that deals with biodefense and the risk to national health and security arising from especially dangerous emerging infections.

*Strategically Targeted Funding for Biocontainment Laboratory Operations:* We must create a sustained funding

mechanism for maintenance and operations costs of the critical national infrastructure that exists in the network of academic BSL-3 and BSL-4 biocontainment laboratories.

*Policy and Regulatory Opportunities:* We should explore ways to reduce the regulatory burden on entities handling select agents.

- Entities should be held accountable for the dangerous pathogens under their control; however, they should not be wasting time and effort accounting for individual vials of replicating agents.
- Scientific progress requires efficient specimen transport and sharing between entities. The regulatory burden placed on entities and the commercial transportation sector should be reviewed, recognizing the critical role they play in facilitating research on especially dangerous pathogens.

*Training and Continued Development of a Skilled Workforce:* We need to invest in ways to sustain and enhance the uniquely trained workforce essential to the successful operations of biocontainment laboratories and the implementation of cutting-edge research. Development of coordinated training programs for both domestic and foreign talent working in biocontainment should be explored. Academia has a proven track record of success in providing such training for national and international partners; however, funding to support this critical endeavor has eroded and novel strategies must be developed.

*International Opportunities:* We should establish a formal program to support international engagement with foreign biocontainment laboratories to ensure their safety and security by (1) providing training in best practices in biosafety and biosecurity, and (2) conducting collaborative research activities to enhance mutual transparency and reduce the potential risk of intentional misuse of dangerous pathogens.

The NIAID network of biocontainment laboratories provides a unique resource to the nation by marrying cutting-edge discoveries with the ability to test novel concepts and products with the real pathogen, not a surrogate model system. The students educated at these facilities graduate with unparalleled experience working in biocontainment and know firsthand the challenges and opportunities facing the biodefense community. They represent a critical resource for the future.

The risk of bioterrorism and the emergence of novel, highly dangerous pathogens are real threats to our nation. The NIAID network of biocontainment laboratories was created to contribute to the national defense against these threats, and their contributions to our security and well-being are undeniable. As the network completes a decade of service, we as a nation need to pay attention to the maintenance and sustainability of this critical resource in the bioeconomy. With relatively minor investments and modifications to overly burdensome regulations, we can sustain this national treasure for years to come.



## BIOCONTAINMENT LABORATORIES AND US BIOECONOMY

### ACKNOWLEDGMENTS

Dr. Le Duc is the PI on NIH/NIAID award 5UC7A094660, which provides support for the operations of the BSL-4 components of the Galveston National Laboratory, of which he is the director.

### REFERENCES

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Address correspondence to:

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Galveston National Laboratory  
University of Texas Medical Branch  
301 University Blvd.  
Galveston, TX 77555-0610

Email: (b) (6)

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 2/16/2020 9:30:33 PM  
**To:** Dobos, Karen [(b) (6)]  
**CC:** [(b) (6)] [(b) (6)] [(b) (6)] David Alland [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d113debeb42341baa81e9468dd209ac5-DavidDouta]; [(b) (6)] [(b) (6)] Roy, Chad [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b7446d36fdc4d088a77b023caf2e024-croy.tulane]; [(b) (6)] Missiakas, Dominique [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=828ae6faf9964fc28e7badc5fc09cc69-dmissiak.bs]; [(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)]  
Broadhurst, Mara J [(b) (6)] [jana.broad (b) (6)] Pyles, Richard B. [(b) (6)] Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Holubar, Connie J. [(b) (6)] Lawler, James V [(b) (6)] Caneva, Duane [(b) (6)]  
**Subject:** Re: COVID-19 surveillance opportunity for RBL/NBL  
Carter Mecher [(b) (6)] Plante, Kenneth S. [(b) (6)]

Great. Thanks Karen. More later.

Btw, if you or others need [(b) (4)]  
He's copied here.

Thanks. Jim

Sent from my iPhone

On Feb 16, 2020, at 1:34 PM, Dobos, Karen <[(b) (6)]> wrote:

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hello Jim,

CSU is interested and able to support this effort, and have just completed IBC and IACUC approval for a number of studies here on COVID-19 in anticipation of working on the virus. Of note, we are not CLIA certified; we do have a veterinary diagnostic laboratory with appropriate certification for veterinary diagnostics (American Association of Veterinary Laboratory Diagnosticians), in case this additional testing becomes necessary.

Karen

---

**From:** LeDuc, James W. <[(b) (6)]>  
**Sent:** Friday, February 14, 2020 2:01 PM  
**To:** [(b) (6)] Dobos, Karen <[(b) (6)]> [(b) (6)]  
[(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)]  
[(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)]  
[(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)]  
**Cc:** Broadhurst, Mara J [(b) (6)] <[(b) (6)]> Pyles, Richard B.

< (b) (6) Auchindloss, Hugh (NIH/NIAID) [E] ( (b) (6)  
< (b) (6) Nancy (NIH/NIAID) Boyd ( (b) (6)  
< (b) (6) Holubar, Connie J. < (b) (6) Lawler, James V  
< (b) (6) Caneva, Duane < (b) (6) Carter Mecher  
< (b) (6)

**Subject:** COVID-19 surveillance opportunity for RBL/NBL

**Importance:** High

Colleagues,

You are all aware of the growing COVID-19 epidemic raging in China and threatening the rest of the world. The DHHS Office of the Assistant Secretary of Preparedness and Response is exploring the possibility of rapidly establishing diagnostic screening for COVID-19 focused on influenza-like illness patients seen across the country with the goal of testing 100,000 clinical specimens per day nationwide. To accomplish this, they are seeking collaborations with the Regional Biocontainment Labs to assist in conducting the tests along with labs associated with the NETEC network and other academic centers and the larger commercial testing facilities. Tests would likely be done for surveillance purposes only and would not involve patient identification. Results would not be added to patients medical records and the testing should not require human use approval or CLIA certified laboratory conditions. (Nonetheless, please let us know if your laboratory is CLIA certified or if you are interested in obtaining CLIA certification.) We propose to use a standard PCR-based assay across all testing centers. The assay may be based on the CDC recommended assay and reagents—this is still under discussion. Our goal will be to establish an overarching EUA that is flexible enough to take into account that various testing platforms and equipment are in use among the laboratories, but will use standardized reagents, control panels and SOPs. Assays would be locally validated and appropriate controls included in each run. Results will be reported daily to a central hub and positive findings would be immediately reported to the source healthcare facility and state and local health officials. We are exploring if duplicate sample aliquots could be made to allow positive samples to be rapidly transported to a reference facility for confirmatory testing.

Funding will be provided to cover anticipated costs of consumable supplies and personnel time and other associated expenses. It is unclear if equipment purchases will be allowed.

With this brief (and evolving) background, please let me know if you are interested in participating in this emergency response. Please indicate your ability conduct diagnostic PCR testing as proposed, the patient population from which you would likely draw samples, and an approximation of the maximum number of specimens you could test per day once your system is validated and reagents/consumables are secured.

This is an excellent opportunity for the RBL network to demonstrate its value to the nation in addressing a critical emerging infectious disease.

Thanks, Jim

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(f) 409-266-6810  
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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 2/18/2020 3:19:23 PM  
**To:** [(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)] David Alland  
[ /o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=d113debeb42341baa81e9468dd209ac5-DavidDoutta];  
[(b) (6)] [(b) (6)] Roy, Chad [ /o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=8b7446d36fdc4d088a77b023caf2e024-croy.tulane]; [(b) (6)]  
Missiakas, Dominique [ /o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=828ae6faf9964fc28e7badc5fc09cc69-dmissiak.bs];  
[(b) (6)]; [(b) (6)] [(b) (6)] [(b) (6)]  
**CC:** Broadhurst, Mara J [(b) (6)] [(b) (6)] Pyles, Richard B.  
[(b) (6)] Auchincloss, Hugh (NIH/NIAID) [E] [ /o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Boyd, Nancy  
(NIH/NIAID) [E] [ /o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Holubar, Connie J.  
[(b) (6)]; Lawler, James V [james. (b) (6)]; Caneva, Duane [(b) (6)]  
Carter Mecher [(b) (6)] Plante, Kenneth S. [(b) (6)]  
**Subject:** RE: COVID-19 surveillance opportunity for RBL/NBL  
**Attachments:** RBL-NBL lab capacity-2020.xlsx

Thank you all for your prompt and positive response to our inquiry below about participating in a national surveillance effort for COVID-19. We are preparing a submission to ASPR for funding to implement the program and hope to submit as soon as tomorrow given the urgency of the situation. To help us prepare, could you please take a moment and fill out the very brief attached spreadsheet to summarize you existing capabilities. If you do not currently have robotic liquid handling instrumentation, please include a comment if you would like to incorporate that capacity in your laboratory. It is not clear if we will have resources for instrumentation purchases, but we will include that as an option in our submission.

Please add an additional column with comments as needed. For example, you may wish to expand on the potential clinical population from which you would draw samples.

(b) (4)

Thank you again for your willingness to assist in this national emergency response.

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) (b) (6)  
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**From:** LeDuc, James W.  
**Sent:** Friday, February 14, 2020 3:01 PM  
**To:** [(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)]

(b) (6) (b) (6) (b) (6) (b) (6) (b) (6)  
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**Cc:** Broadhurst, Mara J ( (b) (6) < (b) (6) Pyles, Richard B.  
< (b) (6) Auchindloss, Hugh (NIH/NIAID) [E] ( (b) (6) < (b) (6)  
Nancy (NIH/NIAID) Boyd ( (b) (6) < (b) (6) Holubar, Connie J. < (b) (6)  
Lawler, James V < (b) (6) Caneva, Duane < (b) (6) Carter Mecher  
< (b) (6)

**Subject:** COVID-19 surveillance opportunity for RBL/NBL

**Importance:** High

Colleagues,

You are all aware of the growing COVID-19 epidemic raging in China and threatening the rest of the world. The DHHS Office of the Assistant Secretary of Preparedness and Response is exploring the possibility of rapidly establishing diagnostic screening for COVID-19 focused on influenza-like illness patients seen across the country with the goal of testing 100,000 clinical specimens per day nation-wide. To accomplish this, they are seeking collaborations with the Regional Biocontainment Labs to assist in conducting the tests along with labs associated with the NETEC network and other academic centers and the larger commercial testing facilities. Tests would likely be done for surveillance purposes only and would not involve patient identification. Results would not be added to patients medical records and the testing should not require human use approval or CLIA certified laboratory conditions. (Nonetheless, please let us know if your laboratory is CLIA certified or if you are interested in obtaining CLIA certification.) We propose to us a standard PCR-based assay across all testing centers. The assay may be based on the CDC recommended assay and reagents—this is still under discussion. Our goal will be to establish an overarching EUA that is flexible enough to take into account that various testing platforms and equipment are in use among the laboratories, but will use standardized reagents, control panels and SOPs. Assays would be locally validated and appropriate controls included in each run. Results will be reported daily to a central hub and positive findings would be immediately reported to the source healthcare facility and state and local health officials. We are exploring if duplicate sample aliquots could be made to allow positive samples to be rapidly transported to a reference facility for confirmatory testing.

Funding will be provided to cover anticipated costs of consumable supplies and personnel time and other associated expenses. It is unclear if equipment purchases will be allowed.

With this brief (and evolving) background, please let me know if you are interested in participating in this emergency response. Please indicate your ability conduct diagnostic PCR testing as proposed, the patient population from which you would likely draw samples, and an approximation of the maximum number of specimens you could test per day once your system is validated and reagents/consumables are secured.

This is an excellent opportunity for the RBL network to demonstrate it value to the nation in addressing a critical emerging infectious disease.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
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James W. Le Duc, Ph.D.  
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National and Regional Biocontainment labs							
Institution	Location	Contact (s)	Nucleic acid extraction instrument(s)	Real-time PCR instrument(s)	Robotic liquid handling instrument(s)	Max daily throughput	LDT in use/planned







With this brief (and evolving) background, please let me know if you are interested in participating in this emergency response. Please indicate your ability conduct diagnostic PCR testing as proposed, the patient population from which you would likely draw samples, and an approximation of the maximum number of specimens you could test per day once your system is validated and reagents/consumables are secured.

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Thanks, Jim

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 2/28/2020 11:07:48 PM  
**To:** [(b) (6)] [(b) (6)] [(b) (6)] [(b) (6)] David Alland  
[o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=d113debeb42341baa81e9468dd209ac5-DavidDoutta];  
[(b) (6)] [(b) (6)] Roy, Chad [o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=8b7446d36fdc4d088a77b023caf2e024-croy.tulane]; [(b) (6)]  
Missiakas, Dominique [o=ExchangeLabs/ou=Exchange Administrative Group  
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[(b) (6)]; [(b) (6)] [(b) (6)] [(b) (6)]  
**CC:** Broadhurst, Mara J [(b) (6)] [(b) (6)] Pyles, Richard B.  
[(b) (6)] Auchincloss, Hugh (NIH/NIAID) [E] [o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Boyd, Nancy  
(NIH/NIAID) [E] [o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Holubar, Connie J.  
[(b) (6)] Lawler, James V [(b) (6)] Caneva, Duane [(b) (6)]  
Carter Mecher [(b) (6)] Hamel, Joseph (OS/ASPR/IO) [o=ExchangeLabs/ou=Exchange Administrative  
Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=1c07abf020fa4790a0120ea0e37f60c5-Joseph.Hame]  
**Subject:** RE: COVID-19 surveillance opportunity for RBL/NBL  
**Attachments:** COVID letter update 22720.docx; RBL-NBL lab capacity-2020. (1).xlsx

Colleagues,

Thank you all for your response to our earlier inquiry regarding surveillance testing for COVID-19. I apologize for the significant delay in getting back to you, but we have had to work through several technical challenges. Attached please find a letter drafted by Rick Pyles of our lab that describes our efforts to develop and validate a diagnostic test for the new virus. We have nearly completed validation testing on the assay here using spiked specimens and we plan to send the complete assay to Jana Broadhurst at UNMC where she will test against clinical specimens from confirmed patients. We hope to submit an EUA to FDA for approval as soon as possible.

As described in Rick's letter, for next steps, we are seeking up to 3 labs willing to test a validation panel on their extraction and PCR platforms to create the necessary data pack to submit for a broad EUA to cover the efforts of this lab network. Optimally the labs will have different equipment for testing medium-high throughput extraction and RTPCR. Please let us know if you are interested in participating as soon as possible.

Reporting of results will follow standard routing to your organization and local/state health officials.

The question whether testing labs must be CLIA certified remains unresolved; nonetheless, we want to make sure that all labs in the network that would like to have diagnostic testing capabilities have access to it. Please let us know if you remain interested in receiving the test.

The original proposal to conduct widespread testing for surveillance purposes alone is still under discussion; however, as the virus spreads the value of such testing is probably diminished.

The attached spreadsheet has capabilities of some labs. Please update the information (or add it if not complete) so that we have a complete summary of capabilities.

We are preparing a proposal to fund the activities of the network for COVID-19 diagnosis (+/- surveillance). Our notional plan is to provide each collaborating laboratory with validation panels and sufficient reagents to begin testing. Each lab would then submit a budget to sustain testing based on their capacity and demand. We will be working with DHHS/ASPR to determine optimum strategies for budgeting.

Thanks for your willingness to collaborate on this important project.

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
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## RBL and Surveillance team labs-

The UTMB lab team effort has identified, optimized and preliminarily validated RTPCR assays that were designed to be applicable across many equipment platforms. The assays have been derived from both CDC and WHO published methods as well as an in-house developed target. The three assays provide a 'tie-breaker' option for discordant outcomes with two assays. The goal of our approach is higher throughput screening with reduced labor. This kitted approach will make use of 96 well formats. The 3 selected assays have been validated for SYBR detection with subsequent high-resolution melt temp analysis to add specificity. They are also being validated for TaqMan probe use but the original probes required modification to address observed degradation creating false positives. The double quenched probe formats have been delayed in production but are expected early next week when validation will be completed. The single quenched probes have shown the assays to be useful but produced unacceptably high false positive rates. Comparisons of commercial one step chemistries with data from multiple PCR platforms led to selection of formulations with and without SYBR. Based on our screening results with the assays, iTaQ Universal SYBR-Green one step kit and Reliance one step multiplexing supermix have been selected. Both products are from Bio-Rad. The iTaQ Universal is currently backordered as the stock was recently purchased in bulk in support of COVID testing in other countries. The Reliance is in stock. Discussions are underway with the company to ensure adequate supplies can be produced and have been told that additional iTaQ will be available mid to late next week. Primers and probes would be purchased by each site after initial validation efforts are completed.

For testing, we utilized COVID-19 RNA to spike both transport medium and tested-negative clinical NP biomatrix material allowing us to test each assay with controlled dilutions of viral target. We also cloned amplimers to create plasmid controls that can be utilized for basic positive and negative material. Isolated COVID RNA can also be made available. Biosafety concerns currently limit the use of viral spiked material to BSL3 facilities. We are currently testing the inactivation of virus stocks using the Roche MagNA Pure lysis solution but until that data is available, sharing viral spiked positive control material will require BSL3 level shipping and facilities. For BSL2 labs, the only current option would be use of isolated viral RNA. It would be of great help if any of your labs have such inactivation data that could be used by the network to obtain local permissions for the use of viral spikes instead of RNA. Other lysis solutions will need to be tested for inactivation to support alternate extraction methods as directed by local biosafety oversight groups. These types of samples would be needed to validate extraction platforms in use in each lab. Such data would be needed for a broader EUA application to support multiple platforms empowering the lab. A common set of testing reagents is a priority for our group to support these efforts.

For the RT-PCR stage, we have evaluated a total of 7 COVID SYBR-based assays. As noted, single quencher probe versions have been evaluated but have had unacceptably high false positive rates because of probe degradation during the one-step PCR programs. After the double quench probes are received and evaluated we will share updates on those assay options. For the SYBR assays, after testing the sensitivity, specificity and robustness of the three CDC COVID-

19 N gene targets, the N2 assay proved optimal after some modifications to the PCR program to enhance use on multiple cyclers. This assay has occasionally amplified clinical material positive for the common circulating CoV strains. These amplifications produced off target melt temps easily distinguished from COVID but this has raised concerns over specificity and therefore the overall quality of this assay. The N2 positive samples were subsequently tested by the E target (modified from the WHO method) and orf target (UTMB developed) assays yielding negative outcomes. Testing of a panel of over 50 deidentified, discarded clinical NP samples that included clinical fluA, fluB and CoV positives, were negative for amplification by the E and orf assays. Known positive clinical material has not been tested.

Positive validation samples were created by spiking three concentrations of COVID-19 RNA into a pooled NP biomatrix confirmed to be negative for COVID amplification. These samples were consistently positive by N2, E and orf assays with proper melt temps and tightly clustered Ct values consistent with the input RNA.

As for next steps, we are seeking up to 3 labs willing to test a validation panel on their extraction and PCR platforms to create the necessary data pack to submit for a broad EUA to cover the efforts of this lab network. Optimally the labs will have a different equipment for testing medium-high throughput extraction and RTPCR. The SYBR assays would be utilized first followed later by the optimized probe-based systems. Local discarded, deidentified NP samples should be obtainable without IRB protocols but each lab should follow the direction of their institution. We would recommend a minimum of 50 positive and 46 negative samples optimally in clinical NP biomatrix backgrounds. For multi-site assay validation, we would provide premade positive spike material at three concentrations and pooled negative biomatrix in blinded fashion to test the equipment and methods. Based on recent reports, saliva would be a next likely target for biomatrix analysis. At this time COVID RNA would likely be the only option to create synthetic positives unless a specific lab has permission and access to utilize known COVID positive clinical material. Dr. Susan McLellan at UTMB and the NETEX system has arranged an IRB-based request process to obtain positive clinical material but this will require BSL3 level functionality.

UTMB legal is working to prepare an EUA application once the data pack is ready to submit.



National and Regional Biocontainment labs								Notes
Institution	Location	Contact (s)	Nucleic acid extraction instrument(s)	Real-time PCR instrument(s)	Robotic liquid handling instrument(s)	Max daily throughput	LDT in use/planned	
Rutgers		David Alland (b) (6)	No	six 16-bay 10 color GeneSxpress plus six 4-bay instruments (2 in BSL3). Plus one Roche light cycler LC80 with robotic plate loader	Echo 660 should be ordered soon	depends on assay configuration but the Echo is amazing at assembling assays quickly if volumes are	?	Not CLIA certified. Also, our human capital may soon be diverted to a crash program in COVID POC assay development and testing
University of Tennessee		Collen Jonsson	Kingfisher	Quantstudio 6	Janus	160	To purchase 85K more in equipment would double capacity if needed	
Tufts University	Grafton, Massachusetts	Sam Telford	None	ABI 7500 FAST	None	288 samples (3x96 well plates)	None currently for coronavirus; would prefer to adopt standardized assays, e.g. LRN protocols and reagents	
UAB	Birmingham, Al	W. Britt (Diagnostic Virology Lab)	Roche-Magna Pure 96	x3-96 well cyclers		currently we run 45 respiratory panels/d		
Public Health Reference Lab VA National Public Health Ref Lab	Palo Alto, CA	Mark Holodniy, MD (b) (6) (b) (6)	Qiagen Qiasymphony Roche MagnaPure 96 Abbott M2000	(2) AB 7500Fast Real-time Systems (1) Life Technologies QuantStudio	Qiagen Biorobot	?? Would have to assess for	CDC EUA COVID-19 kit for Veteran patient testing across all VA as part of LRN	Testing Veteran samples Not associated with RBL
Duke_DHVI_IVQAC Lab	GSRB2	Thomas Denny	Qiagen Qiasymphony	QuantStudio 3 Real-time PCR system		Currently at Capacity		
Duke_DHVI_IVQAC Lab	GSRB2	Thomas Denny		StepOnePlus Real-time PCR System		Currently at Capacity		
Duke_DHVI_IVQAC Lab	GSRB2	Thomas Denny		7500 Real-Time PCR System with Win7 Pro Optiplex XE Computer		Available for use		
Duke_DHVI_IVQAC Lab	GSRB2				Qiagen Qiasymphony	Currently at Capacity		
Duke_DHVI_IVQAC Lab	SANDS				TECAN FREEDOM EVO 150	Currently at Capacity		
University of Louisville	Clinical and Translational Research Building, Room 627, Louisville, KY 40202	Kenneth E. Palmer	TecanEvo 96	ABI 7500HT with a robotic arm Biorad CFX96	EpMotion TecanEvo 96	600 samples	In use	See details on our infectious disease epidemiology study <a href="http://www.uoflnews.com/post/uoftoday/pfizer-inc-designates-uofl-first-of-its-kind-center-of-excellence-for-epi">http://www.uoflnews.com/post/uoftoday/pfizer-inc-designates-uofl-first-of-its-kind-center-of-excellence-for-epi</a> email from Kenneth Palmer
George Mason University	Manassas, VA	Charles Bailey	N/A	ABI Step One Plus	N/A	200	If equipment money is provided, we would purchase both nucleic acid extraction and robotic liquid handling instruments to increase our throughput (see below)	
			Promega Maxwell RSC48 (\$70k) PerkinElmer Chamagic 360 (\$70k)	ABI Step One Plus (~\$20k)	Promega MaxPrep Liquid Handler RSC48 (\$90k) PerkinElmer Janus (\$80-90k)	200-300 300-400	Potential equipment purchase options, would increase our daily throughput as indicated.	
University of Chicago		Dominique Missiakas, HTL Director						
Tulane University		Chad Roy						
Boston University, NEIDL		Ron Corley						
Colorado State University		Karen Dobos						Not CLIA
University of Pittsburgh		Paul Duprex						Not CLIA but access to UPMC



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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 3/25/2020 2:13:13 AM  
**To:** Mascola, John (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7f78b40a596b4ca4a2850a429d1ae3f2-jmascola]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Erbelding, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbeldingj]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Pei yong. Shi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3cf21b1e8f4f4251801f0da03f3261b6-peshi.UTMB.]; Holubar, Connie J. [REDACTED] (b) (6) Graham, Barney (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=171892ff532b4c208a546e6fc7e87b8a-bgraham]; Koup, Richard (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=33f3958c4eb34e619306d6991297f922-rkoup]; Ledgerwood, Julie (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5dc9f31ded594eff8ac506d2c4103c15-ledgerwood]  
**Subject:** Re: <https://www.businesswire.com/news/home/20200324005381/en/Q2-Solutions-IQVIA-Quest-Diagnostics-Joint-Venture>

Hi John

Pei-Yong is copied here and can reply to your inquiries but I think we are about ready to go. We need some positive sera to finish validation and we are working on getting some soon.

We are excited about this capacity and hope that it will be useful going forward.

Be safe

Jim

Sent from my iPhone

On Mar 24, 2020, at 7:23 PM, Mascola, John (NIH/VRC) [E] <[REDACTED] (b) (6)> wrote:

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Jim,  
Thanks for letting us know about this.

[REDACTED] (b) (4) but this sounds intriguing.

Few questions

Can Pei-Yong share the details of the assay?

Can you do the assay in fairly short turn-around to support some ongoing preclinical or even clinical vaccine studies?

Thanks,  
John

John R. Mascola, M.D.  
Director, Vaccine Research Center  
National Institute of Allergy and Infectious Diseases  
National Institutes of Health  
email: (b) (6)  
office tel: (b) (6)

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**From:** LeDuc, James W. <(b) (6)>  
**Sent:** Tuesday, March 24, 2020 3:26 PM  
**To:** Boyd, Nancy (NIH/NIAID) [E] <(b) (6)> Erbelding, Emily (NIH/NIAID) [E] <(b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <(b) (6)> Mascola, John (NIH/VRC) [E] <(b) (6)>  
**Cc:** Pei yong. Shi <(b) (6)> Holubar, Connie J. <(b) (6)>  
**Subject:** FW: <https://www.businesswire.com/news/home/20200324005381/en/Q2-Solutions-IQVIA-Quest-Diagnostics-Joint-Venture>

You may find the link of interest. Using the infectious clone we developed, we were able to create a labeled virus (GFP, luciferase or red fluorescence) that will allow rapid, quantitative neutralization testing for vaccine development and epidemiological studies. Pei-Yong is copied here and can follow up with details as needed.

If anybody has convalescent sera from recovered patients, please let us know. We desperately need to validate the assays.

Be safe,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
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Galveston, TX 77555-0610  
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**From:** Shi, Pei yong <(b) (6)>  
**Sent:** Tuesday, March 24, 2020 1:46 PM  
**To:** LeDuc, James W. <(b) (6)>  
**Subject:** <https://www.businesswire.com/news/home/20200324005381/en/Q2-Solutions-IQVIA-Quest-Diagnostics-Joint-Venture>

Hi Jim,  
This is today's announce with Q2 Solutions (belongs to Quest) about our serology test.

Cheers,  
Pei-Yong

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 3/24/2020 7:26:20 PM  
**To:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Erbelding, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbeldingej]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Mascola, John (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7f78b40a596b4ca4a2850a429d1ae3f2-jmascola]  
**CC:** Pei yong. Shi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3cf21b1e8f4f4251801f0da03f3261b6-peshi.UTMB.]; Holubar, Connie J. [(b) (6)]  
**Subject:** FW: <https://www.businesswire.com/news/home/20200324005381/en/Q2-Solutions-IQVIA-Quest-Diagnostics-Joint-Venture>

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Jim

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**Sent:** Tuesday, March 24, 2020 1:46 PM  
**To:** LeDuc, James W. <[(b) (6)]>  
**Subject:** <https://www.businesswire.com/news/home/20200324005381/en/Q2-Solutions-IQVIA-Quest-Diagnostics-Joint-Venture>

Hi Jim,  
This is today's announce with Q2 Solutions (belongs to Quest) about our serology test.  
Cheers,  
Pei-Yong



---

**From:** Erbeling, Emily (NIH/NIAID) [E] [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=E976EBF7B14142FBB3C5C294EFB334FE-ERBELDINGEJ]  
**Sent:** 4/3/2020 12:29:56 PM  
**To:** James Leduc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=89e5cd6106194c4d919065f18dd0cbea-jwleduc.utm]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]  
**CC:** Pei yong. Shi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3cf21b1e8f4f4251801f0da03f3261b6-peshi.UTMB.]  
**Subject:** RE: Major publication due out Friday

Thanks for the update Jim.  
Very important work.  
Emily

Emily Erbeling, M.D., M.P.H.  
Director, Division of Microbiology and Infectious Diseases  
NIAID/NIH  
5601 Fishers Lane  
Rockville, MD 20852  
Tel: (b) (6)

---

**From:** LeDuc, James W. <(b) (6)>  
**Sent:** Thursday, April 2, 2020 5:20 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <(b) (6)> Erbeling, Emily (NIH/NIAID) [E] <(b) (6)> Boyd, Nancy (NIH/NIAID) [E] <(b) (6)>  
**Cc:** Pei yong. Shi <(b) (6)>  
**Subject:** Major publication due out Friday

Hugh, Emily and Nancy,

Pasted below is Pei-Yong Shi's note to our communications office about the release tomorrow of our paper on the development of a reverse genetics system and report SARS-CoV-2 virus. This is a major accomplishment and we want to give you a heads up that it will be appearing soon.

Our paper on developing the reverse genetic system and reporter SARS-Cov-2 will be published online tomorrow. This represents one of the most important tools (if not the most important) to study the virus replication, transmission, and pathogenesis.

More importantly, the reporter virus will unleash our limitation to perform serodiagnosis, vaccine evaluation, and therapeutic development. (b) (4)

Our technology has attracted partnership with leading pharmaceutical companies (e.g., Q2 Solutions, Gilead, and others) to jointly fight COVID-19.

Be safe,

Jim

James W. Le Duc, Ph.D.

Director

Galveston National Laboratory

University of Texas Medical Branch

Galveston, TX 77555-0610

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(f) 409-266-6810

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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 4/13/2020 3:13:16 PM  
**To:** Cassetti, Cristina (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=cc6481e6535f426db66e7069ee98b644-ccassetti]  
**CC:** Ksiazek, Thomas (Galveston National Laboratory-UT) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=630dd80b583042f2995c2ea6166fd6be-tgksiaze.ut]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Pyles, Richard B. [REDACTED] (b) (6)  
**Subject:** RE: SARS-2 serology

Thanks very much, Cristina. Tom will reply to you directly regarding his needs for control sera/plasma.

We have good capacity for serological testing in the GNL with robotics to assist in processing. As you know, Pei-Yong has developed the labeled reporter virus to allow for rapid neutralization testing, and the positive control sera will be essential for validating his assay as well.

The GNL lab is now dedicated to PCR testing and we are routinely doing about 300-500 specimens/day, with a capacity to easily expand to about 730/day. This, coupled with our hospital clinical lab has kept us in good shape for testing. We have ample reagents and Rick Pyles developed a novel process to eliminate the extraction bottleneck which we are happy to share if you like. We are providing support to some of our Houston colleagues and the prison system where UTMB has a longstanding contract to provide care.

Thanks for your help,

Jim

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**From:** Cassetti, Cristina (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
**Sent:** Monday, April 13, 2020 9:02 AM  
**To:** LeDuc, James W. <[REDACTED] (b) (6)>  
**Cc:** Ksiazek, Thomas G. <[REDACTED] (b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
**Subject:** RE: SARS-2 serology

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Hi Jim,

Thanks for your message. We have in fact been struggling to obtain sufficient volumes to satisfy the overwhelming demand from academic researchers and vaccine/diagnostic developers. Things should ease a bit soon since we now have a large number of cases in US and several people have now recovered.

How much convalescent serum would Tom need? Would Plasma be OK as well?  
Does it matter when it was collected post resolution of symptoms?

Stay safe,

Cristina

Cristina Cassetti, Ph.D.  
Deputy Director

Division of Microbiology and Infectious Diseases  
National Institute of Allergy and Infectious Diseases, NIH  
5601 Fishers Lane, Room 7G51  
Rockville, MD 20852  
Tel: (b) (6)  
(b) (6)

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**From:** LeDuc, James W. (b) (6)  
**Sent:** Friday, April 10, 2020 11:59 AM  
**To:** Cassetti, Cristina (NIH/NIAID) [E] (b) (6)  
**Cc:** Ksiazek, Thomas (Galveston National Laboratory-UT) (b) (6); Auchincloss, Hugh (NIH/NIAID) [E] (b) (6)  
**Subject:** SARS-2 serology

Hi Cristina,

I hope you're doing well during these trying times. I spoke to Hugh Auchincloss earlier today and mentioned that we were having a terrible time getting convalescent sera from known COVID-19 patients for use in development of serological assays. As you know, Tom Ksiazek is an expert in this area and has already prepared an antigen and partially characterized it using monoclonal antibodies and human convalescent sera from SARS and MERS patients, but he lacks convalescent sera from confirmed cases. Hugh suggested that we contact you as your group is apparently collecting sera for just this purpose. Tom is copied here and perhaps you and he can work something out to help get us started.

With best wishes and sincere thanks—and stay safe!

Jim

James W. Le Duc, Ph.D.  
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University of Texas Medical Branch  
Galveston, TX 77555-0610  
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(f) 409-266-6810  
(m) (b) (6)



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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 4/10/2020 3:58:51 PM  
**To:** Cassetti, Cristina (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=cc6481e6535f426db66e7069ee98b644-ccassetti]  
**CC:** Ksiazek, Thomas (Galveston National Laboratory-UT) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=630dd80b583042f2995c2ea6166fd6be-tgksiaze.ut]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** SARS-2 serology

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With best wishes and sincere thanks—and stay safe!

Jim

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(f) 409-266-6810  
(m) [(b) (6)]

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**From:** LeDuc, James W. (b) (6)  
**Sent:** 4/21/2020 4:38:11 PM  
**To:** Erbeling, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbelingej]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Pei yong. Shi [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3cf21b1e8f4f4251801f0da03f3261b6-peshi.UTMB.]; Ksiazek, Thomas (Galveston National Laboratory-UT) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=630dd80b583042f2995c2ea6166fd6be-tgksiaze.ut]; Pyles, Richard B. (b) (6)  
**Subject:** RE: NBL/RBL testing network

Thanks Emily. I will follow up with the RBL/NBL directors and get a plan together for you. Two issues immediately come to mind that you may wish to consider as you expand PCR testing. First, it would be wonderful if there could be some waiver of CLIA authorization for research labs conducting this testing. We are CLIA certified as are one or two others from the network, but the majority are not. Second, it would be nice if a single EUA could be accepted for the testing to be done. We attempted to do this by engaging with some of the RBLs to use different testing platforms with standard reagents packages. We were able to obtain consistent, accurate results among labs using different testing platforms, but I'll need to follow up to see what the current status is.

Rick Pyles directed our PCR lab development and now our current capacity for PCR testing is about 1800 specimens per day using both our hospital clinical lab and the GNL, and to date we have never exceeded about 1000 specimens per day, so we have excess capacity. We have reached out to surrounding communities and hospitals with moderate success but welcome additional specimens. We are currently OK with reagents and Rick developed a unique work-around to overcome the extraction reagents bottleneck. We're happy to share the protocol if others are interested.

Tom Ksiazek is also standing up antibody assays using a traditional ELISA assay that can be formatted to IgM capture, standard IgG or complete immunoglobulin. We have produced, inactivated and safety tested antigen for about 75,000 IgG assays and we have made an antigen for the IgM capture assay, but are still working on identifying an appropriate indicator antibody. These assays could be shared quickly; however, the challenges of CLIA and EUA for widespread use would need to be addressed.

Finally, as you know, Pei-Yong Shi has developed a live SARS-2 virus that incorporates a label that is expressed when a cell is infected that is being validated as a rapid neutralization assay. We are scaling up for high through-put testing here, and Pei-Yong has already made the virus available for non-commercial use by others.

Thanks, Jim

James W. Le Duc, Ph.D.  
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(f) 409-266-6810

(m) (b) (6)

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**From:** Erbeling, Emily (NIH/NIAID) [E] <(b) (6)>  
**Sent:** Monday, April 20, 2020 6:41 PM  
**To:** LeDuc, James W. <(b) (6)>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] <(b) (6)> Auchincloss, Hugh (NIH/NIAID) [E]  
<(b) (6)>  
**Subject:** RE: NBL/RBL testing network

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Jim,

There is a forceful movement toward expansion of testing, since most experts believe that reopening businesses and society will not be successful unless public health authorities can immediately detect cases (and onward transmission) in their jurisdictions.

So please engage in the extent to which you can. At the current moment, diagnostic testing supported by NIH would somehow come out of funds appropriated for research. That is probably OK. But the next supplemental appropriation might be different and focused on NIH expanding lab testing however they can.

We have had a lot of internal discussions on this so Carl hasn't dropped it.

Feel free to sketch out for us exactly what the RBL/NBLs could do on diagnostic testing (with link to patient identifiers).

Thanks.

Emily

I am cc'ing Hugh on this for his awareness.

---

**From:** LeDuc, James W. <(b) (6)>  
**Sent:** Monday, April 20, 2020 7:24 PM  
**To:** Erbeling, Emily (NIH/NIAID) [E] <(b) (6)>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] <(b) (6)>  
**Subject:** NBL/RBL testing network

Hi Emily

I spoke to Carl Dieffenbach last Wednesday, 15 April when he called about a plan to expand COVID testing across the country and Hugh had suggested he speak to me about including the NBL/RBL network. He was going to follow up with you and Nancy Boyd and get back to me. Have you heard anything on this initiative? It sounded urgent when we spoke, so I'm surprised to not have heard anything more. Happy to chat by phone if you like—my direct office line is (b) (6)

Thanks, Jim

James W. Le Duc, Ph.D.  
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(m) (b) (6)



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**From:** Erbelding, Emily (NIH/NIAID) [E] [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=E976EBF7B14142FBB3C5C294EFB334FE-ERBELDINGEJ]  
**Sent:** 4/20/2020 11:40:55 PM  
**To:** James Leduc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=89e5cd6106194c4d919065f18dd0cbea-jwleduc.utm]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
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**To:** Erbelding, Emily (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
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Thanks, Jim

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University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)



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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 4/24/2020 3:29:26 PM  
**To:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]  
**CC:** Gregory Sempowski [(b) (6)] Zackowitz, Gary (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8e46ab3f44d24a93b7907a328ab7c23e-zackowig]  
**Subject:** FW: NBL/RBL testing network  
**Attachments:** 2020.04.16.20067835v1.full.pdf

Hi Nancy,

I spoke to Greg and Tom Denny yesterday at Duke about using the RBL network to assist with testing. There is general interest and clearly a willingness to assist, but we are not clear as to how best to contribute. I wonder if you and Gary could forward to the network the note below from Emily, focusing on the highlighted area and see what kind of response we get from everyone. I am assuming that her comment about link to patient identifiers means either being CLIA certified or having a work around where the lab is screening and forwarding positives to a partner CLIA approved lab for confirmation. I copied you on an earlier note to Emily regarding the CLIA and EUA challenges but have not had a reply.

Also note the attached paper suggesting saliva rather than NP swabs as a specimen for testing.

Let me know if you have heard anything more from Emily or her team on this.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

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**From:** Erbelding, Emily (NIH/NIAID) [E] <[(b) (6)]>  
**Sent:** Monday, April 20, 2020 6:41 PM  
**To:** LeDuc, James W. <[(b) (6)]>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] [(b) (6)] Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Subject:** RE: NBL/RBL testing network

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Thanks, Jim

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# Saliva is more sensitive for SARS-CoV-2 detection in COVID-19 patients than nasopharyngeal swabs

Anne L. Wyllie<sup>1\*</sup>, John Fournier<sup>2</sup>, Arnau Casanovas-Massana<sup>1</sup>, Melissa Campbell<sup>2</sup>, Maria Tokuyama<sup>3</sup>, Pavithra Vijayakumar<sup>4</sup>, Bertie Geng<sup>4</sup>, M. Catherine Muenker<sup>1</sup>, Adam J. Moore<sup>1</sup>, Chantal B.F. Vogels<sup>1</sup>, Mary E. Petrone<sup>1</sup>, Isabel M. Ott<sup>5</sup>, Peiwen Lu<sup>3</sup>, Arvind Venkataraman<sup>3</sup>, Alice Lu-Culligan<sup>3</sup>, Jonathan Klein<sup>3</sup>, Rebecca Earnest<sup>1</sup>, Michael Simonov<sup>6</sup>, Rupak Datta<sup>2</sup>, Ryan Handoko<sup>2</sup>, Nida Naushad<sup>2</sup>, Lorenzo R. Sewanan<sup>2</sup>, Jordan Valdez<sup>2</sup>, Elizabeth B. White<sup>1</sup>, Sarah Lapidus<sup>1</sup>, Chaney C. Kalinich<sup>1</sup>, Xiaodong Jiang<sup>3</sup>, Daniel J. Kim<sup>3</sup>, Eriko Kudo<sup>3</sup>, Melissa Linehan<sup>3</sup>, Tianyang Mao<sup>3</sup>, Miyu Moriyama<sup>3</sup>, Ji Eun Oh<sup>3</sup>, Annsea Park<sup>3</sup>, Julio Silva<sup>3</sup>, Eric Song<sup>3</sup>, Takehiro Takahashi<sup>3</sup>, Manabu Taura<sup>3</sup>, Orr-El Weizman<sup>3</sup>, Patrick Wong<sup>3</sup>, Yexin Yang<sup>3</sup>, Santos Bermejo<sup>7</sup>, Camila Odio<sup>8</sup>, Saad B. Omer<sup>1,2,9,10</sup>, Charles S. Dela Cruz<sup>7</sup>, Shelli Farhadian<sup>2</sup>, Richard A. Martinello<sup>2,7,11</sup>, Akiko Iwasaki<sup>3,12</sup>, Nathan D. Grubaugh<sup>1#\*</sup>, Albert I. Ko<sup>1#\*</sup>

<sup>1</sup> Department of Epidemiology of Microbial Diseases, Yale School of Public Health, New Haven, CT 06510, USA

<sup>2</sup> Department of Medicine, Section of Infectious Diseases, Yale School of Medicine, New Haven, CT, 06510, USA

<sup>3</sup> Department of Immunobiology, Yale School of Medicine, New Haven, CT, 06510, USA

<sup>4</sup> Department of Obstetrics, Gynecology, and Reproductive Sciences, Yale School of Medicine, New Haven, CT, 06510, USA

<sup>5</sup> Department of Ecology and Evolutionary Biology, Yale University, New Haven, CT 06520, USA

<sup>6</sup> Program of Applied Translational Research, Yale School of Medicine, New Haven, CT, 06510, USA

<sup>7</sup> Department of Internal Medicine, Section of Pulmonary, Critical Care, and Sleep Medicine, Yale School of Medicine, New Haven, CT, 06510, USA

<sup>8</sup> Department of Medicine, Northeast Medical Group, Yale-New Haven Health, New Haven, CT 06510, USA

<sup>9</sup> Yale Institute of Global Health, New Haven, CT 06510, USA

<sup>10</sup> Yale School of Nursing, New Haven, CT 06510, USA

<sup>11</sup> Department of Infection Prevention, Yale-New Haven Health, New Haven, CT 06520

<sup>12</sup> Howard Hughes Medical Institute, New Haven, CT 06510, USA

# Joint senior authors

\* Correspondence: (b) (6) (ALW); (b) (6) (NDG); (b) (6) (AIK)

**Key words:** SARS-CoV-2, COVID-19, saliva, diagnostics

## Abstract

Rapid and accurate SARS-CoV-2 diagnostic testing is essential for controlling the ongoing COVID-19 pandemic. The current gold standard for COVID-19 diagnosis is real-time RT-PCR detection of SARS-CoV-2 from nasopharyngeal swabs. Low sensitivity, exposure risks to healthcare workers, and global shortages of swabs and personal protective equipment, however, necessitate the validation of new diagnostic approaches. Saliva is a promising candidate for SARS-CoV-2 diagnostics because (1) collection is minimally invasive and can reliably be self-administered and (2) saliva has exhibited comparable sensitivity to nasopharyngeal swabs in detection of other respiratory pathogens, including endemic human coronaviruses, in previous studies. To validate the use of saliva for SARS-CoV-2 detection, we tested nasopharyngeal and saliva samples from confirmed COVID-19 patients and self-collected samples from healthcare workers on COVID-19 wards. When we compared SARS-CoV-2 detection from patient-matched nasopharyngeal and saliva samples, we found that saliva yielded greater detection sensitivity and



consistency throughout the course of infection. Furthermore, we report less variability in self-sample collection of saliva. Taken together, our findings demonstrate that saliva is a viable and more sensitive alternative to nasopharyngeal swabs and could enable at-home self-administered sample collection for accurate large-scale SARS-CoV-2 testing.

## Introduction

Efforts to control SARS-CoV-2, the novel coronavirus causing COVID-19 pandemic, depend on accurate and rapid diagnostic testing. These tests must be (1) sensitive to mild and asymptomatic infections to promote effective self isolation and reduce transmission within high risk groups<sup>1</sup>; (2) consistent to reliably monitor disease progression and aid clinical decisions<sup>2</sup>; and (3) scalable to inform local and national public health policies, such as when social distancing measures can be safely relaxed. However, current SARS-CoV-2 testing strategies often fail to meet these criteria, in part because of their reliance on nasopharyngeal swabs as the widely recommended sample type for real-time RT-PCR. Although nasopharyngeal swabs are commonly used in respiratory virus diagnostics, they show relatively poor sensitivity for SARS-CoV-2 detection in early infection and are inconsistent during serial testing<sup>2-6</sup>. Moreover, collecting nasopharyngeal swabs causes discomfort to patients due to the procedure's invasiveness, limiting compliance for repeat testing, and presents a considerable risk to healthcare workers, because it can induce patients to sneeze or cough, expelling virus particles<sup>7</sup>. The procedure is also not conducive to large-scale testing, because there are widespread shortages of swabs and personal protective equipment for healthcare workers<sup>8</sup>, and self-collection of nasopharyngeal swabs is difficult and less sensitive for virus detection<sup>9</sup>. These challenges will be further exacerbated as the COVID-19 pandemic intensifies in low income countries. Given the limitations, a more reliable and less resource-intensive sample collection method, ideally one that accommodates self-collection in the home, is urgently needed.

Saliva sampling is an appealing alternative to nasopharyngeal swab, since collecting saliva is non-invasive and easy to self-administer. An analysis of nasopharyngeal and saliva concordance for RT-PCR detection of respiratory pathogens, including two seasonal human coronaviruses, suggests comparable diagnostic sensitivity between the two sample types<sup>10,11</sup>. Preliminary findings indicate that (1) SARS-CoV-2 can be detected from the saliva of COVID-19 patients<sup>12</sup> and (2) self-collected saliva samples have comparable SARS-CoV-2 detection sensitivity to nasopharyngeal swabs collected by healthcare workers from mild and subclinical COVID-19 cases<sup>13</sup>. Critically, however, no rigorous evaluation of the sensitivity of SARS-CoV-2 detection in saliva with respect to nasopharyngeal swabs has been conducted from inpatients during the course of COVID-19 infection.

In this study, we evaluated SARS-CoV-2 detection in paired nasopharyngeal swabs and saliva samples collected from COVID-19 inpatients and asymptomatic healthcare workers at moderate-to-high risk of COVID-19 exposure. Our results indicate that using saliva for SARS-CoV-2 detection is more sensitive and consistent than using nasopharyngeal swabs. Overall, we demonstrate that saliva should be considered as a reliable sample type to alleviate COVID-19 testing demands.



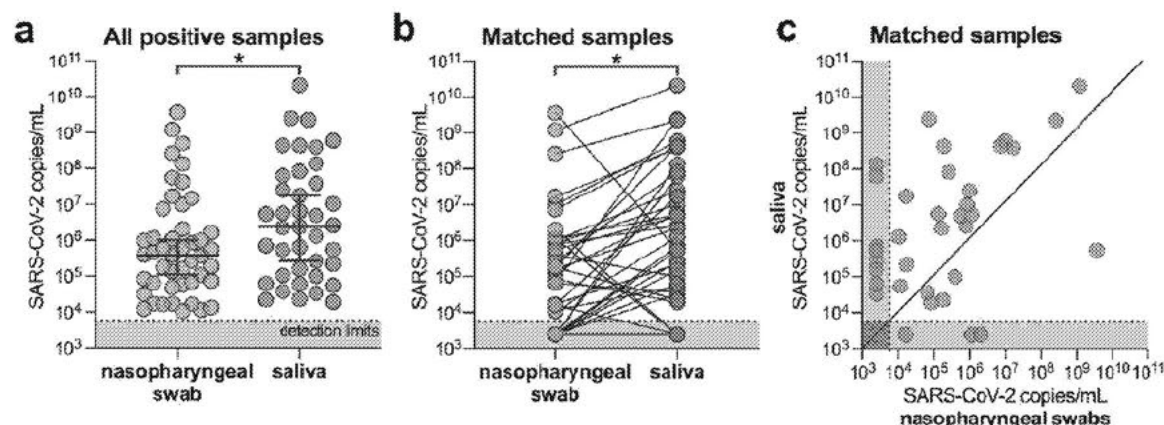
## Results

### Higher SARS-CoV-2 titers detected from saliva than nasopharyngeal swabs from inpatients

To determine if saliva performs as well as the U.S. CDC recommendation of using nasopharyngeal swabs for SARS-CoV-2 diagnostics, we collected clinical samples from 44 COVID-19 inpatient study participants (**Table 1**). This cohort represents a range of COVID-19 patients with severe disease, with 19 (43%) requiring intensive care, 10 (23%) requiring mechanical ventilation, and 2 (5%) deceased as of April 5th, 2020. Using the U.S. CDC SARS-CoV-2 RT-PCR assay, we tested 121 self-collected saliva or healthcare worker-administered nasopharyngeal swabs from this cohort. We found strong concordance between the U.S. CDC “N1” and “N2” primer-probe sets (**Extended Data Fig. 1**), and thus calculated virus titers (virus copies/mL) using only the “N1” set. From all positive samples tested ( $n = 46$  nasopharyngeal, 37 saliva), we found that the geometric mean virus titers from saliva were about 5× higher than nasopharyngeal swabs ( $p < 0.05$ , Mann-Whitney test; **Fig. 1a**). When limiting our analysis to only patient-matched nasopharyngeal and saliva samples ( $n = 38$  for each sample type), we found that SARS-CoV-2 titers from saliva were significantly higher than nasopharyngeal swabs ( $p = 0.0001$ , Wilcoxon test; **Fig. 1b**). Moreover, we detected SARS-CoV-2 from the saliva but not the nasopharyngeal swabs from eight matching samples (21%), while we only detected SARS-CoV-2 from nasopharyngeal swabs and not saliva from three matched samples (8%; **Fig. 1c**). Overall, we found higher SARS-CoV-2 titers from saliva than nasopharyngeal swabs from hospital inpatients.

**Table 1. COVID-19 inpatient cohort characteristics**

	All study participants ( $n = 44$ )	Study participants with paired nasopharyngeal and saliva samples ( $n = 29$ )
Gender, male	23 (52%)	16 (55%)
Age range, years	23-92 (mean = 61)	23-91 (mean = 59)
ICU on admission, $n$	6 (14%)	4 (14%)
ICU during hospital stay, $n$	19 (43%)	12 (41%)
Mechanical ventilation, $n$	10 (23%)	6 (21%)
Deceased (April 5 <sup>th</sup> ), $n$	2 (5%)	1 (4%)
Total samples collected, $n$	121	76

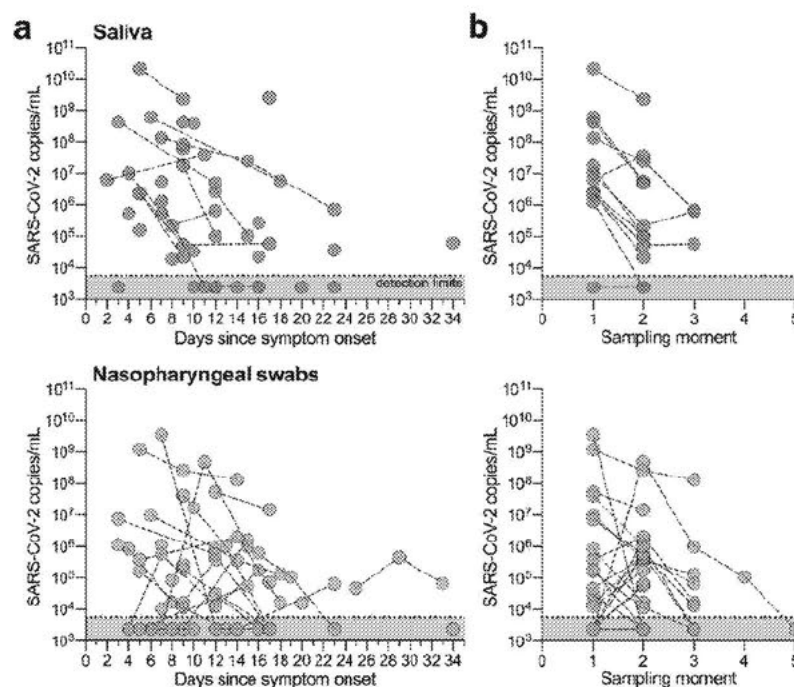


**Figure 1. SARS-CoV-2 titers are higher in the saliva than nasopharyngeal swabs from hospital inpatients.** (a) All positive nasopharyngeal swabs ( $n = 46$ ) and saliva samples ( $n = 39$ ) were compared by a Mann-Whitney test ( $p < 0.05$ ). Bars represent the median and 95% CI. Our assay detection limits for SARS-CoV-2 using the US CDC “N1” assay is at cycle threshold 38, which corresponds to 5,610 virus copies/mL of sample (shown as dotted line and grey area). (b) Patient matched samples ( $n = 38$ ), represented by the connecting lines, were compared by a Wilcoxon test ( $p < 0.05$ ). (c) Patient matched samples ( $n = 38$ ) are also represented on a scatter plot. All of the data used to generate this figure, including the raw cycle thresholds, can be found in **Supplementary Data 1. Extended Data Fig. 1** shows the correlation between US CDC assay “N1” and “N2” results.

### Less temporal SARS-CoV-2 variability when testing saliva from inpatients

As temporal SARS-CoV-2 diagnostic testing from nasopharyngeal swabs is reported to be variable<sup>2,3</sup>, we tested longitudinal nasopharyngeal and saliva samples from inpatients to determine which sample type provided more consistent results. From 22 participants with multiple nasopharyngeal swabs and 12 participants with multiple saliva samples, we found that SARS-CoV-2 titers generally decreased in both sample types following the reported date of symptom onset (**Fig. 2a**). Our nasopharyngeal swab results are consistent with previous reports of variable SARS-CoV-2 titers and results<sup>2,3</sup>: we found 5 instances where a participant’s nasopharyngeal swab was negative for SARS-CoV-2 followed by a positive result during the next collection (5/33 repeats, 33%; **Fig. 2b**). In longitudinal saliva collections from 12 patients, however, there were no instances in which a sample tested negative and was later followed by a positive result. As true negative test results are important for clinicians to track patient improvements and for decisions regarding discharges, our data suggests that saliva is a more consistent sample type than nasopharyngeal swabs for monitoring temporal changes in SARS-CoV-2 titers.





**Figure 2: SARS-CoV-2 detection is less variable between repeat sample collections with saliva.**

(a) Longitudinal SARS-CoV-2 titers from saliva or nasopharyngeal swabs are shown as days since symptom onset. Each circle represents a separate sample, which are connected to additional samples from the same patient by a dashed line. Our assay detection limits for SARS-CoV-2 using the US CDC “N1” assay is at cycle threshold 38, which corresponds to 5,610 virus copies/mL of sample (shown as dotted line and grey area). (b) The data are also shown by sampling moment (sequential collection time) to highlight the differences in virus titers between collection points. All of the data used to generate this figure, including the raw cycle thresholds, can be found in **Supplementary Data 1**.

### More consistent self-sampling from healthcare workers using saliva

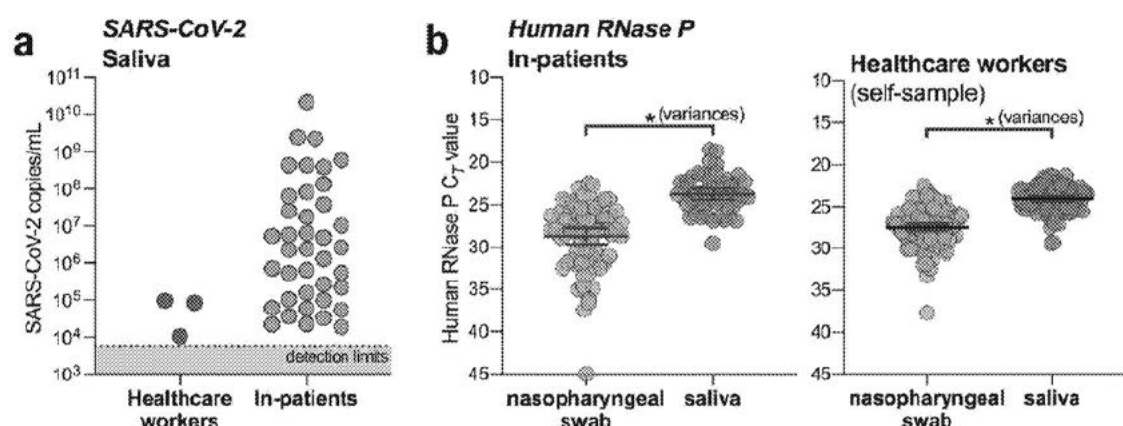
Validating saliva for the detection of subclinical SARS-CoV-2 infections could prove transformative for both remote patient diagnostics and healthcare worker surveillance. To investigate this, we enrolled 98 asymptomatic healthcare workers into our study and collected saliva and/or nasopharyngeal swabs on average every 2.9 days (range = 1-8 days, **Table 2**). To date, we have detected SARS-CoV-2 in saliva from two healthcare workers who were negative by nasopharyngeal swabs using both the US CDC “N1” and “N2” tests and did not report any symptoms. The saliva from one of these individuals again tested positive alongside a matching negative nasopharyngeal swab upon repeat testing 2 days later. Virus titers from asymptomatic healthcare workers’ saliva are lower than what we typically detect from symptomatic inpatients (**Fig. 3a**), which likely supports the lack of symptoms.

Our limited data supports that saliva may be more sensitive for detecting asymptomatic or pre-symptomatic infections; however, a larger sample size is needed to confirm. As nasopharyngeal swab sampling inconsistency may be one of the potential issues for false negatives (**Fig. 2**), monitoring an internal control for proper sample collection, human RNase P, may provide an alternative evaluation technique. While human RNase P detection was

better from saliva in both the inpatient and healthcare worker cohorts (**Fig. 3b**), this alone may not indicate better virus detection. More importantly, we found that human RNase P detection was more variable from nasopharyngeal swabs collected from inpatients ( $p = 0.0001$ , F test for variances) and self-collected from healthcare workers ( $p = 0.0002$ ; **Fig. 3b**). Our results suggest that saliva may also be an appropriate, and perhaps more sensitive, alternative to nasopharyngeal swabs for screening asymptomatic or pre-symptomatic SARS-CoV-2 infections.

**Table 2. Healthcare worker cohort**

	All study participants (n=98)	Participants with matching samples (n=33)
Gender, male	16 (16%)	5 (15%)
Age range, years (average)	22-67 (36)	22-61 (36)
Total samples collected, n	244	64



**Figure 3. Saliva is an alternative for SARS-CoV-2 screening from healthcare workers and asymptomatic cases.** (a) SARS-CoV-2 titers measured from the saliva of healthcare workers and inpatients. Our assay detection limits for SARS-CoV-2 using the US CDC “N1” assay is at cycle threshold 38, which corresponds to 5,610 virus copies/mL of sample (shown as dotted line and grey area). (b) RT-PCR cycle thresholds (Ct) values for human RNase P, and internal control for sample collection, from either inpatients (left panel) or health care workers (right panel) were compared by variances using the F test ( $p = 0.0001$  for inpatients;  $p = 0.0002$  for healthcare workers). All of the data used to generate this figure, including the raw cycle thresholds, can be found in **Supplementary Data 1**.

## Discussion

Our study demonstrates that saliva is a viable and preferable alternative to nasopharyngeal swabs for SARS-CoV-2 detection. We found that the sensitivity of SARS-CoV-2 detection



from saliva is comparable, if not superior to nasopharyngeal swabs in early hospitalization and is more consistent during extended hospitalization and recovery. Moreover, the detection of SARS-CoV-2 from the saliva of two asymptomatic healthcare workers despite negative matched nasopharyngeal swabs suggests that saliva may also be a viable alternative for identifying mild or subclinical infections. With further validation, widespread implementation of saliva sampling could be transformative for public health efforts: saliva self-collection negates the need for direct healthcare worker-patient interaction, a source of several major testing bottlenecks and overall nosocomial infection risk<sup>14-16</sup>, and alleviates supply demands on swabs and personal protective equipment.

As SARS-CoV-2 viral loads differ between mild and severe cases<sup>17</sup>, a limitation of our study is the primary focus on COVID-19 inpatients, many with severe disease. While more data are required to more rigorously compare the efficacy of saliva in the hospital setting to earlier in the course of infection, findings from two recent studies support its potential for detecting SARS-CoV-2 from both asymptomatic individuals and outpatients<sup>13,18</sup>. As infectious virus has been detected from the saliva of COVID-19 patients<sup>12</sup>, ascertaining the relationship between virus genome copies and infectious virus particles in the saliva of pre-symptomatic individuals<sup>19</sup> will play a key role in understanding the dynamics of asymptomatic transmission<sup>1,20</sup>.

Stemming from the promising results for SARS-CoV-2 detection in asymptomatic individuals<sup>13</sup>, a saliva SARS-CoV-2 detection assay has already gained approval through the U.S. Food and Drug Administration emergency use authorization<sup>18</sup>. To meet the growing testing demands, however, our findings support the need for immediate validation and implementation of saliva for SARS-CoV-2 diagnostics in certified clinical laboratories.

## Methods

### *Ethics*

All study participants were enrolled and sampled in accordance to the Yale University HIC-approved protocol #2000027690. Demographics, clinical data and samples were only collected after the study participant had acknowledged that they had understood the study protocol and signed the informed consent. All participant information and samples were collected in association with study identifiers.

### *Participant enrollment*

#### Inpatients

Patients admitted to Yale New Haven Hospital (a 1541-bed tertiary care medical center in New Haven, CT, USA), who tested positive for SARS-CoV-2 by nasopharyngeal and/or oropharyngeal swab (CDC approved assay) were invited to enroll in the research study. Exclusion criteria were age under 18 years, non-English speaking and clinical, radiological or laboratory evidence for a non-infectious cause of fever or respiratory symptoms or a microbiologically-confirmed infectious source (e.g. gastrointestinal, urinary, cardiovascular) other than respiratory tract for symptoms and no suspicion for COVID-19 infection.

### Healthcare workers

Asymptomatic healthcare workers (e.g., without fever or respiratory symptoms) with occupational exposure to patients with COVID-19 were invited to enroll in the study. Study participation enabled active surveillance to ensure early detection following exposure and to further protect other healthcare workers and patients.

### **Sample collection**

#### Inpatients

Nasopharyngeal and saliva samples were obtained every three days throughout their clinical course. Nasopharyngeal samples were taken by registered nurses using the BD universal viral transport (UVT) system. The flexible, mini-tip swab was passed through the patient's nostril until the posterior nasopharynx was reached, left in place for several seconds to absorb secretions then slowly removed while rotating. The swab was placed in the sterile viral transport media (total volume 3 mL) and sealed securely. Saliva samples were self-collected by the patient. Upon waking, patients were asked to avoid food, water and brushing of teeth until the sample was collected. Patients were asked to repeatedly spit into a sterile urine cup until roughly a third full of liquid (excluding bubbles), before securely closing it. All samples were stored at room temperature and transported to the research lab at the Yale School of Public Health within 5 hours of sample collection.

#### Healthcare workers

Healthcare workers were asked to collect a self-administered nasopharyngeal swab and a saliva sample every three days for a period of 2 weeks. Samples were stored at +4°C until being transported to the research lab.

### **SARS-CoV-2 detection**

On arrival at the research lab, total nucleic acid was extracted from 300 µl of viral transport media from the nasopharyngeal swab or 300 µl of whole saliva using the MagMAX Viral/Pathogen Nucleic Acid Isolation kit (ThermoFisher Scientific) following the manufacturer's protocol and eluted into 75 µl of elution buffer. For SARS-CoV-2 RNA detection, 5 µl of RNA template was tested as previously described<sup>21,22</sup>, using the US CDC real-time RT-PCR primer/probe sets for 2019-nCoV\_N1 and 2019-nCoV\_N2 and the human RNase P (RP) as an extraction control. Samples were classified as positive for SARS-CoV-2 when both N1 and N2 primer-probe sets were detected <38 C<sub>T</sub>. Virus copies were quantified using a 10-fold dilution standard curve of RNA transcripts that we previously generated<sup>21</sup>. As results from N1 and N2 were comparable (**Extended Data Fig. 1**), all virus copies are shown as calculated using the N1 primer-probe set.

### **Statistical analysis**

Statistical analyses were conducted in GraphPad Prism 8.0.0 as described in the Results.

### **Acknowledgments**

We gratefully acknowledge the study participants for their time and commitment to the study. We thank all members of the clinical team at Yale-New Haven Hospital for their

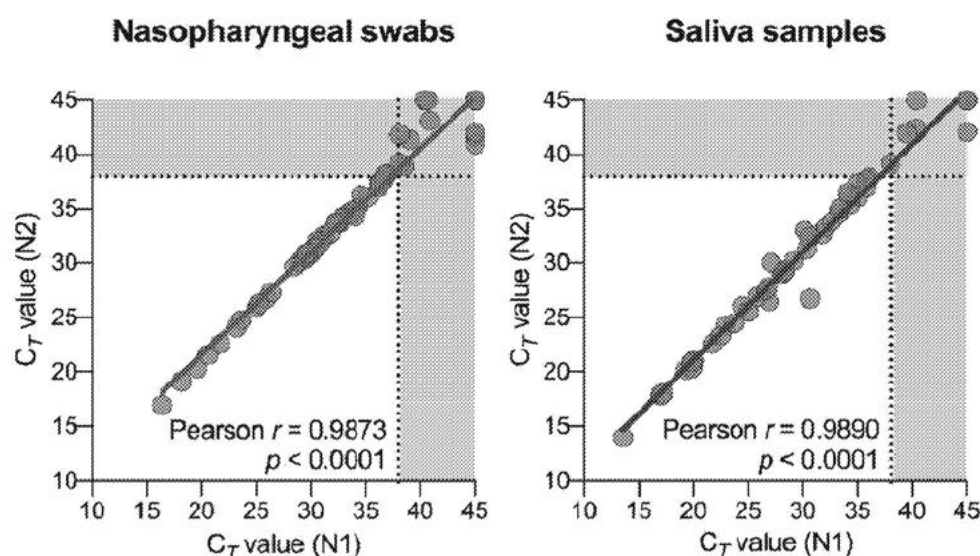


dedication and work which made this study possible. We also thank S. Taylor and P. Jack for technical discussions.

## Funding

The study was partially funded by the Yale Institute for Global Health. The corresponding authors had full access to all data in the study and had final responsibility for the decision to submit for publication.

## Extended data



**Extended Data Fig. 1. Concordance between SARS-CoV-2 detection using US CDC “N1” and “N2” primer and probe sets.** Ct = RT-PCR cycle threshold. Dotted line and grey areas indicate the limits of detection.

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**From:** LeDuc, James W. [REDACTED] (b) (6)  
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**Subject:** quoted in Science article just posted

Sorry if this causes problems. I spoke to him about 2 weeks ago.

<https://www.sciencemag.org/news/2020/04/nih-s-axing-bat-coronavirus-grant-horrible-precedent-and-might-break-rules-critics-say>

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**From:** Baric, Ralph S [(b) (6)]  
**Sent:** 5/29/2020 2:21:40 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Cohen, Myron [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2141b9e28c1a421fb3c1c4f75dd4c457-myron\_cohen]; Corey MD, Larry [(b) (6)]; Mascola, John (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7f78b40a596b4ca4a2850a429d1ae3f2-jmascola]  
**Subject:** RE: letter of intent

Hi Hugh, this is perfect! Thanks, ralph

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**From:** Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Sent:** Friday, May 29, 2020 8:43 AM  
**To:** Baric, Ralph S <[(b) (6)]>  
**Cc:** Cohen, Myron S <[(b) (6)]> Corey MD, Larry <[(b) (6)]> Mascola, John (NIH/VRC) [E] <[(b) (6)]>  
**Subject:** RE: letter of intent

Is this sufficient?

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**From:** Baric, Ralph S [REDACTED] (b) (6)  
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**Subject:** RE: OWS, BSL 3 and UNC

Hi Emily, It will be important to include Penny on the email chain as well. Toni can help with my schedule. I look forward to talking. Ralph

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**From:** Cohen, Myron S <[REDACTED] (b) (6)>  
**Sent:** Thursday, June 4, 2020 10:35 AM  
**To:** Erbelding, Emily (NIH/NIAID) [E] <[REDACTED] (b) (6)> Baric, Ralph S <[REDACTED] (b) (6)> Heise, Mark T <[REDACTED] (b) (6)> Damania, Blossom A <[REDACTED] (b) (6)> Magnuson, Terry R <[REDACTED] (b) (6)>  
**Cc:** Dieffenbach, Carl (NIH/NIAID) [E] <[REDACTED] (b) (6)> Herrod, Lisa (NIH/NIAID) [C] <lisa.[REDACTED] (b) (6)> Harper, Jill (NIH/NIAID) [E] <[REDACTED] (b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED] (b) (6)> Linde, Emily (NIH/NIAID) [E] <[REDACTED] (b) (6)> Criffield, Robin R. <[REDACTED] (b) (6)> Baric, Toni C <[REDACTED] (b) (6)>  
**Subject:** RE: OWS, BSL 3 and UNC

Sure. Ill ask Ralph to take the lead.

M

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**From:** Erbelding, Emily (NIH/NIAID) [E] [REDACTED] (b) (6)  
**Sent:** Thursday, June 4, 2020 10:16 AM  
**To:** Cohen, Myron S [REDACTED] (b) (6) Baric, Ralph S <[REDACTED] (b) (6)> Heise, Mark T [REDACTED] (b) (6) Damania, Blossom A [REDACTED] (b) (6) Magnuson, Terry R [REDACTED] (b) (6)  
**Cc:** Dieffenbach, Carl (NIH/NIAID) [E] <[REDACTED] (b) (6)> Herrod, Lisa (NIH/NIAID) [C] [REDACTED] (b) (6) Harper, Jill (NIH/NIAID) [E] <[REDACTED] (b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] [REDACTED] (b) (6) Linde, Emily (NIH/NIAID) [E] [REDACTED] (b) (6)  
**Subject:** RE: OWS, BSL 3 and UNC

Mike, Ralph,  
We'd like to schedule a call to talk through this.

Can you send availability to Lisa Herrod cc'd here?

Thanks.

Emily

Emily Erbeling, M.D., M.P.H.

Director, Division of Microbiology and Infectious Diseases

NIAID/NIH

5601 Fishers Lane

Rockville, MD 20852

Tel: (b) (6)

---

**From:** Cohen, Myron S (b) (6)

**Sent:** Saturday, May 30, 2020 2:46 PM

**To:** Erbeling, Emily (NIH/NIAID) [E] (b) (6); Dieffenbach, Carl (NIH/NIAID) [E]

<(b) (6) Corey, Lawrence <(b) (6) Koup, Richard (NIH/VRC) [E]

<(b) (6) Mascola, John (NIH/VRC) [E] (b) (6); Baric, Ralph (b) (6)

Heise, Mark T (b) (6) Damania, Blossom A (b) (6) Magnuson,

Terry R <(b) (6) Kathleen Neuzil (b) (6); Marovich, Mary (NIH/NIAID) [E]

(b) (6)>

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**I am hoping there is a mechanism by which UNC and Dr. Baric might apply for a supplement for renovations and equipment required for expansion of BSL 3 space.**

I believe UNC could prepare such a supplement request in very short order.

Thank you for consideration of this inquiry.

Warmest Regards,

Mike

Myron S. Cohen, MD

Yeagan-Bate Professor of Medicine, Microbiology and Epidemiology

Associate Vice Chancellor for Medical Affairs and Global Health

Director, Institute for Global Health and Infectious Diseases

**UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL**

130 Mason Farm Road, Suite 2115, CB 7030 | Chapel Hill, NC 27599-7030

<http://globalhealth.unc.edu> | <https://www.med.unc.edu/infdis>



---

**From:** Erbeling, Emily (NIH/NIAID) [E] [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=E976EBF7B14142FBB3C5C294EFB334FE-ERBELDINGEJ]  
**Sent:** 6/4/2020 2:16:27 PM  
**To:** Cohen, Myron [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2141b9e28c1a421fb3c1c4f75dd4c457-myron\_cohen]; Baric, Ralph [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=48e35ab1d3044465a7790ee4ded5bc32-rbaric.emai]; Heise, Mark T [REDACTED (b) (6) Damania, Blossom A [REDACTED (b) (6) Magnuson, Terry R [REDACTED (b) (6)  
**CC:** Dieffenbach, Carl (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=94acc37973d346fa98dfe16cd1bf7013-cdieffenba]; Herrod, Lisa (NIH/NIAID) [C] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=bc389f66a58e4de2a46aff026bc06344-herrodlc]; Harper, Jill (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0bfd6dfb8e48482fb49a5f72abfcbac8-jharper]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Linde, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2fd661421cd499b8f7fad6a196f6b02-lindee]  
**Subject:** RE: OWS, BSL 3 and UNC

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Emily

Emily Erbeling, M.D., M.P.H.  
Director, Division of Microbiology and Infectious Diseases  
NIAID/NIH  
5601 Fishers Lane  
Rockville, MD 20852  
Tel: [REDACTED (b) (6)]

---

**From:** Cohen, Myron S <[REDACTED (b) (6)]>  
**Sent:** Saturday, May 30, 2020 2:46 PM  
**To:** Erbeling, Emily (NIH/NIAID) [E] <[REDACTED (b) (6)]> Dieffenbach, Carl (NIH/NIAID) [E] <[REDACTED (b) (6)]> Corey, Lawrence <[REDACTED (b) (6)]> Koup, Richard (NIH/VRC) [E] <[REDACTED (b) (6)]> Mascola, John (NIH/VRC) [E] <[REDACTED (b) (6)]> Baric, Ralph <[REDACTED (b) (6)]> Heise, Mark T <[REDACTED (b) (6)]> Damania, Blossom A <[REDACTED (b) (6)]> Magnuson, Terry R <[REDACTED (b) (6)]> Kathleen Neuzil <[REDACTED (b) (6)]> Marovich, Mary (NIH/NIAID) [E] <[REDACTED (b) (6)]>  
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Thank you for consideration of this inquiry.

Warmest Regards,

Mike

Myron S. Cohen, MD  
Yeaman-Gate Professor of Medicine, Microbiology and Epidemiology  
Associate Vice Chancellor for Medical Affairs and Global Health  
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**UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL**  
130 Mason Farm Road, Suite 2115, CB 7030 | Chapel Hill, NC 27599-7030  
<http://globalhealth.unc.edu> | <https://www.med.unc.edu/infdis>

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 6/4/2020 6:17:02 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** FW: Whyno 2020 reference from my EndNote library  
**Attachments:** Shyno-2020-Horse named for Dr. Anthony Fauci f.pdf

smile

---

**From:** Ksiazek, Thomas G. <[REDACTED]> (b) (6)  
**Sent:** Thursday, June 04, 2020 12:57 PM  
**To:** Ksiazek, Thomas G. <[REDACTED]> (b) (6)  
**Subject:** Whyno 2020 reference from my EndNote library

Whyno S. (2020, 20200603). **Horse named for Dr. Anthony Fauci finishes second in debut.** AP  
Retrieved 0604, 2020,  
<https://apnews.com/5437e6db6e3be483fcbcabf417c34790>

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## Horse named for Dr. Anthony Fauci finishes second in debut

By [STEPHEN WHYNO](#) yesterday







A racehorse named for Dr. Anthony Fauci reached the finish line at a safe enough distance from others that would have made his namesake proud.

Fauci the 2-year-old colt finished a distant second to a horse named Prisoner and was well ahead of third-place Indoctrinate in his much-anticipated debut Wednesday at Belmont Park. In a sport known for topical names, Fauci is the first of a series of horses inspired by the coronavirus pandemic and the latest tribute to the respected director of the National Institute of Allergy and Infectious Diseases.

Social Distancing, Self Isolation, Flatten the Curve, Herd Immunity and No Spectators have also been registered with the Jockey Club.



Co-owner Phillip Antonacci picked the name Fauci in mid-March after the 79-year-old started doing daily coronavirus briefings from the White House. The Antonacci family, like Fauci, is Italian-American and from Brooklyn.

“We wanted to honor the service that he’s given to the whole world: beside COVID, fighting all the other infectious his whole life,” Antonacci said. “Throughout the whole thing, he seemed like a voice that knew what was going on and, without trying to be too political, kind of calmed things and provided real data behind what was going on.”

Antonacci hoped to name a filly after Dr. Deborah Birx. In the end, though, Antonacci said he didn’t have horse good enough to name after the coordinator of the White House’s virus task force.

This colt who debuted Wednesday was named Fauci in part because his owners thought he’d be a special horse. Trainer Wesley Ward has seen that since the then-unnamed horse got to his barn in September.

“He’s a beautiful colt, done everything right on the track in the mornings, got a beautiful mind on him to where he’s not fractious or anxious and seems very, very intelligent,” Ward said. “He’s just a real easygoing guy. Not much bothers him.”

Antonacci has sensed a lot of hype surrounding the horse because of his name. Since the global pandemic began, Dr. Fauci’s likeness has been used for a plush doll, a bobblehead and a donut, and he has a namesake beer.

And now a thoroughbred.

“He’s a really, really good horse,” Ward said. “Especially with the name that’s been assigned to him, you know that he’s got to live up to the name.”

Ward said depending on how Fauci comes out of his first race, he could be headed to Royal Ascot in England for the Coventry Stakes in mid-June.

ADVERTISEMENT



Fauci’s debut coincided with the first live horse racing in New York since March and amid protests nationwide following death of George Floyd in Minnesota. Jockeys stood for a moment of silence to pay respects for those who died of COVID-19 and in tribute to medical professionals, then took a knee in the paddock prior to the first race as a show of solidarity with protesters in the wake of Floyd’s death.

“There’s a lot going on in the world right now and we wanted to show respect to all causes,

and to all people, and to show that we here at (the New York Racing Association) support everybody,” jockey Reylu Gutierrez said. “Horse racing, in general, supports all ethnicities. Horse racing is a worldwide sport and it doesn’t matter what color you are, what religion you are, or what ethnicity you are. What matters in horse racing is that we are one.”



---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 6/24/2020 10:41:19 PM  
**To:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Miers, Sarah (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=edb14b99d9ec49e695cd1ae80dd504d7-smiers]; Erbelding, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbeldingj]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Holubar, Connie J. [REDACTED] (b) (6)  
**Subject:** FW: Preparing for the Next Pandemic - Some Comments to HELP cmte  
**Attachments:** UTMB Letter to Senate HELP Committee.pdf

Please see attached letter submitted this afternoon to the Senate HELP committee with comments on the white paper just released.

Thanks, Jim

---

**From:** Holubar, Connie J. <[REDACTED]> (b) (6)  
**Sent:** Wednesday, June 24, 2020 5:29 PM  
**To:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Subject:** FW: Preparing for the Next Pandemic - Some Comments

For your files and to forward to Nancy and Sarah.

---

**From:** Holubar, Connie J.  
**Sent:** Wednesday, June 24, 2020 5:28 PM  
**To:** [PANDEMICPREPAREDNESS@HELP.SENATE.GOV](mailto:PANDEMICPREPAREDNESS@HELP.SENATE.GOV)  
**Subject:** Preparing for the Next Pandemic - Some Comments

The Honorable Lamar Alexander  
Chairman  
U.S. Senate Committee on Health, Education, Labor and Pensions  
United States Senate  
Washington D.C. 20510

Dear Mr. Chairman,

On behalf of Dr. James Le Duc, Director of the Galveston National Laboratory at the University of Texas Medical Branch, we respectfully submit the attached letter with some comments on your recent white paper: Preparing for the Next Pandemic.

We hope that these comments from Dr. Le Duc will be helpful as you attend to the important work of ensuring that the U.S. takes decisive steps to prepare for the next public health threat.

Kind regards,

**Connie Jean Holubar, MS, MBA**  
Director of Operations  
Galveston National Laboratory

The University of Texas Medical Branch  
301 University Blvd., Galveston, TX 77555-0128  
P (b) (6) E (b) (6)



## **Comments on “Preparing for the Next Pandemic” draft of 9 June 2020**

June 23, 2020

Dear members of the Senate HELP Committee,

Thank you for preparing such a timely white paper addressing the future needs of the nation to prepare for pandemics of infectious diseases and for the opportunity to provide comments as you finalize your report and recommendations. You have done an excellent job in capturing the threat that pandemics represent to the health and welfare of our nation, and as is obvious from the current challenges we face with COVID-19, the need for continued action is urgent.

The section, “Summary of Past Federal Government Efforts to Prepare for a Pandemic” nicely highlights many important accomplishments; however, it fails to mention the significant investments that have been made by the National Institutes of Health to create a network of biocontainment laboratories located on academic centers across the country. The funding for these investments originated in the appropriations made in 2003 and 2005 as indicated below:

- 2003 appropriations, Public Law 108-7: “Provided further, that up to \$375,000,000 shall be for extramural facilities construction grants to enhance the Nation’s capability to do research on biological and other agents.”
- 2005 appropriations, Public Law 108-447: “Provided further, that up to \$150,000,000 shall be for extramural facilities construction grants to enhance the Nation’s capability to do research on biological and other agents.”

Nearly \$1 billion was used to create two national laboratories able to handle all infectious diseases, including those caused by especially dangerous pathogens like Ebola virus that require maximum biological safety level 4 (BSL4) biocontainment and 12 regional biocontainment laboratories able to safely provide research at BSL3 levels of biocontainment. These laboratories are listed below:

### **National Biocontainment Laboratories (BSL4 laboratories)**

- Galveston National Laboratory, University of Texas Medical Branch, Galveston, TX
- National Emerging Infectious Diseases Laboratory, Boston University, Boston, MA

### **Regional Biocontainment Laboratories (BSL3 laboratories)**

- Colorado State University, Fort Collins, CO
- Duke University, Durham, NC
- George Mason University, Fairfax, VA



- Rutgers University, New Brunswick, NJ
- Tufts University, Boston, MA
- Tulane University, New Orleans, LA
- University of Alabama, Birmingham, AL
- University of Chicago, Chicago, IL
- University of Louisville, Louisville, KY
- University of Missouri, Columbia, MO
- University of Pittsburgh, Pittsburgh, PA
- University of Tennessee, Memphis, TN

The NBL-RBL network laboratories have repeatedly proven their value in responding to emerging infectious diseases over the past decade of their operation. Examples include pandemic influenza A H1N1 of 2009, Ebola in West Africa, the Zika epidemic and most recently the massive response to COVID-19, among many others. Going forward, these laboratories are very well positioned to implement many of the action items listed in recommendation 1, Accelerate Research and Development (specifically recommendations 1.2, 1.3 and 1.4).

It is important to note, however, that NIAID has only been able to provide operational funding for the two national laboratories to cover only the BSL4 portions of the labs. That has left funding for the 12 Regional BSL3 labs and for the BSL3 portions of the two national labs to the host institutions, which is a significant challenge and something that should be reviewed as part of future preparations. A recent study conducted for NIAID noted that these BSL3 laboratories require approximately \$2 - \$4 Million each for annual operations costs. Notably, the current pandemic threat, COVID-19, is a BSL3 pathogen, and while the laboratory network has responded across the board with literally hundreds of basic and translational research projects for diagnostics, therapeutics and vaccine development, the time is now to revisit providing a funding mechanism to ensure their continued readiness to respond to public health threats.

As the report is finalized, we hope that the valuable investments already made in the creation of the national and regional biocontainment laboratories will continue to play an essential role as we prepare the nation for the threat of future pandemics. For additional information on each of these laboratories, please visit this page on the NIAID website:

<https://www.niaid.nih.gov/research/biocontainment-research-facilities>

Thank you for your consideration of our comments.

(b) (6)

James W. Le Duc, PhD  
 Director, Galveston National Laboratory  
 Professor, Department of Microbiology and Immunology  
 John Sealy Distinguished Chair in Tropical and Emerging Virology

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 8/7/2020 5:08:01 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** RE: HEALS bill

Good point. Will do.

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Sent:** Friday, August 07, 2020 12:02 PM  
**To:** LeDuc, James W. <[(b) (6)]>  
**Subject:** RE: HEALS bill

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Will get back to you, but in the meantime can they keep in mind our intramural labs as well - RML and Ft. Detrick plus the BSL3 here in Bethesda.

Hugh

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** Friday, August 7, 2020 12:59 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Cc:** Sheer, Lauren E. [(b) (6)] Holubar, Connie J. [(b) (6)]  
**Subject:** HEALS bill

Hi Hugh,

I hope you had a nice break sailing in Maine. Our University of Texas System legislative affairs lead, Lauren Sheer, is continuing to follow up on the original language in the HEALS bill and attempting to educate our Texas delegation about the omission of NBLs in the current language and offer possible wording to modify it to include all 12 RBLs and the 2 NBLs. (original language and proposed modifications pasted below.) She asked about a point of contact in NIH with whom she might coordinate efforts—or at least keep informed of her work. Is there someone from NIAID you could recommend?

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS  
13 DISEASES  
14 For an additional amount for “National Institute of

15 Allergy and Infectious Diseases”, \$480,555,000, to remain available until September 30, 2024, to prevent, prepare  
for, and respond to coronavirus, domestically or  
18 internationally: Provided, That \$55,000,000 shall be for  
19 Regional Biocontainment Laboratories: Provided further,  
20 That funding provided in the previous proviso shall be divided evenly among the eleven laboratories: Provided  
further, That such amount is designated by the Congress as  
23 being for an emergency requirement pursuant to section  
24 251(b)(2)(A)(i) of the Balanced Budget and Emergency  
25 Deficit Control Act of 1985.

Suggested possible edits:

(b) (4)



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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 8/7/2020 4:58:35 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Sheer, Lauren E. [REDACTED] (b) (6) Holubar, Connie J. [REDACTED] (b) (6)  
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Thanks, Jim

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University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)

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(b) (4)

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 7/30/2020 6:57:21 PM  
**To:** Miers, Sarah (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=edb14b99d9ec49e695cd1ae80dd504d7-smiers]; Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Holubar, Connie J. [(b) (6)] Sheer, Lauren E. [(b) (6)]  
**Subject:** FW: The current language  
**Attachments:** HEALS Act NIAID National Labs.docx

Sarah, Nancy and Hugh,

We had a conference call yesterday with a lead staffer from Senator Cornyn's office, Jeffrey Last, during which we discussed the draft language currently in the HEALS Act now under consideration in Congress. As you probably know, there is specific mention of funding for the regional biocontainment labs mentioned in the allocation for NIAID (attached). We pointed out that there are in fact 12 regional labs and that the national labs are not funded for BSL3 operations and we suggested that to correct the language, it could be modified slightly to include all 12 regional biocontainment labs and to include the 2 national lab's BSL3 capabilities. [(b) (4)]  
[REDACTED]. The dialogue is captured in part in the email string below.

I just wanted to keep you informed of our efforts. Hopefully this support will remain in the legislation that eventually passes.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

---

**From:** Sheer, Lauren E. <[(b) (6)]>  
**Sent:** Wednesday, July 29, 2020 1:58 PM  
**To:** Holubar, Connie J. <[(b) (6)]> Last, Jeffrey (Cornyn) <[(b) (6)]>  
**Cc:** Matthews, Douglas W. <[(b) (6)]> LeDuc, James W. <[(b) (6)]>  
**Subject:** RE: The current language

Hi Jeff,

Thank you again for your time this afternoon and your work on this issue. UTMB greatly appreciates everything Senator Cornyn and the office has done to assist our institution during this pandemic.

Per our discussion, I have attached the proposed changes that would include the National Labs. Those edits are also show below. Please feel free to reach out if you have any questions or concerns.

"shall be for National and Regional Biocontainment Laboratories: Provided further, that funding provided in the previous proviso shall be divided among the fourteen laboratories...."

**The RBLs are:**

Colorado State University  
Duke University  
George Mason University  
Rutgers University  
Tufts University  
Tulane University  
University of Alabama  
University of Chicago  
University of Louisville  
University of Missouri  
University of Pittsburgh  
University of Tennessee

**NBLs are:**

Boston University  
University of Texas Medical Branch

Thank you,

Lauren

Lauren Sheer  
VP, Legislative Affairs  
The University of Texas Medical Branch

(b) (6) office

(b) (6) cell

(b) (6)

---

**From:** Holubar, Connie J. <(b) (6)>

**Sent:** Wednesday, July 29, 2020 1:06 PM

**To:** Last, Jeffrey (Cornyn) (b) (6)

**Cc:** Sheer, Lauren E. <(b) (6)> Matthews, Douglas W. <(b) (6)> LeDuc, James W.

(b) (6)

**Subject:** The current language

NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS  
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19 Regional Biocontainment Laboratories: Provided further,  
20 That funding provided in the previous proviso shall be divided evenly among the (b) (4) laboratories: Provided  
further, That such amount is designated by the Congress as  
23 being for an emergency requirement pursuant to section  
24 251(b)(2)(A)(i) of the Balanced Budget and Emergency  
25 Deficit Control Act of 1985.





12 NATIONAL INSTITUTE OF ALLERGY AND INFECTIOUS

13 DISEASES

14 For an additional amount for “National Institute of

15 Allergy and Infectious Diseases”, \$480,555,000, to re-

16 main available until September 30, 2024, to prevent, pre-

17 pare for, and respond to coronavirus, domestically or

18 internationally: Provided, That (b) (4) shall be for

19 National and Regional Biocontainment Laboratories: Provided further,

20 That funding provided in the previous proviso shall be di-

21 (b) (4) laboratories: Provided fur-

22 ther, That such amount is designated by the Congress as

23 being for an emergency requirement pursuant to section

24 251(b)(2)(A)(i) of the Balanced Budget and Emergency

25 Deficit Control Act of 1985.

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 5/5/2017 6:38:45 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=auchincloss]  
**CC:** Holubar, Connie J. [REDACTED] (b) (6); Boyd, Nancy (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=NBoyd]; Hudgings, Carole (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=hudgings]  
**Subject:** Thanks for joining us!

Hi Hugh,

Thanks so much for taking time from your busy schedule to join us at the GNL for the annual RBL-NBL meeting. I'm especially pleased that you were here to participate in the presentation of the STPI report and to join in the discussion of next steps. Your presence sent an important message to all the network labs that NIAID recognizes the value of their facilities and appreciates the challenges that all the labs are facing in this era of uncertainty. I hope that this is just the first step in an ongoing discussion to optimize the use of this incredible resource as we jointly address the emerging diseases and bioterrorism threats.

With best wishes,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)



---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 2/16/2018 7:54:30 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Niesel, David W. [(b) (6)] Salmon, Logan (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4ae7ea9127804178b120f83862484359-salmonlm]; Harper, Jill (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0bfd6dfb8e48482fb49a5f72abfcba8-jharper]  
**Subject:** RE: In town

Perfect, thanks. Please invite anyone you feel can contribute to the discussion.

Yes, I will see you on 6 March as well, but it looks like that day is fully booked and I need to head home that evening.

Thanks again,

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] [mailto: (b) (6)]  
**Sent:** Friday, February 16, 2018 1:40 PM  
**To:** LeDuc, James W. < (b) (6)>  
**Cc:** Niesel, David W. < (b) (6)> Salmon, Logan (NIH/NIAID) [E] < (b) (6)> Harper, Jill (NIH/NIAID) [E] < (b) (6)>  
**Subject:** RE: In town

Sure thing. I was going to sit in on some of NSABB meeting on the 13th but I've been summoned for jury duty. I believe Tony will attend for a portion. I'd be happy to see you on Wednesday and I think it would be useful to have Jill Harper join us. Logan Salmon, copied on this message, can set up a time for us.

I think I'll also see you on March 6 but only for about 20 minutes.

Hugh

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** Friday, February 16, 2018 1:44 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] < (b) (6)>  
**Cc:** Niesel, David W. < (b) (6)>  
**Subject:** In town

Hi Hugh,

I am tentatively scheduled to attend a NSABB meeting at NIH on Tuesday, 13 March. I'm thinking of staying on through Wednesday evening to attend the Research!America awards dinner (Roger Glass is among the honorees) and I am wondering if you might have some time on the 14<sup>th</sup> morning or early afternoon to meet for a few minutes and discuss the STPI report on the operations costs of the BSL4 labs and how we might plan for continued GNL support. I'll work on an agenda if it looks like you might have time to meet.

I look forward to seeing you,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)

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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 2/16/2018 6:44:09 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Niesel, David W. [REDACTED] (b) (6)  
**Subject:** In town

Hi Hugh,

I am tentatively scheduled to attend a NSABB meeting at NIH on Tuesday, 13 March. I'm thinking of staying on through Wednesday evening to attend the Research!America awards dinner (Roger Glass is among the honorees) and I am wondering if you might have some time on the 14<sup>th</sup> morning or early afternoon to meet for a few minutes and discuss the STPI report on the operations costs of the BSL4 labs and how we might plan for continued GNL support. I'll work on an agenda if it looks like you might have time to meet.

I look forward to seeing you,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 4/21/2017 5:17:14 PM  
**To:** Kurilla, Michael (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=mkurilla]; Hudgings, Carole (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=hudgings]; Auchincloss, Hugh (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=auchinclossh]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/O=NIH/OU=NIHEXCHANGE/cn=NIAID/cn=NBoyd]; Holubar, Connie J. [REDACTED] (b) (6)  
**Subject:** RE: RBL-NBL meeting 1-2May, Galveston

Thanks Mike. Fingers crossed that the government remains "open."

---

**From:** Kurilla, Michael (NIH/NIAID) [E] [mailto:[REDACTED]] (b) (6)  
**Sent:** Friday, April 21, 2017 12:08 PM  
**To:** LeDuc, James W. <[REDACTED] (b) (6)> Hudgings, Carole (NIH/NIAID) [E] <[REDACTED] (b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] <[REDACTED] (b) (6)> Holubar, Connie J. <[REDACTED] (b) (6)>  
**Subject:** RE: RBL-NBL meeting 1-2May, Galveston

Jim,

I'll be arriving in Galveston around 5PM Sunday and returning Wednesday AM.

Minor caveat: this assumes the USG is actually open for business and that the timing (if it goes down to the wire) still permits actually "ticketing" to occur as opposed to just "booking."

**Director, Office of BioDefense, Research Resources, and Translational Research**  
**Associate Director for BioDefense Product Development**  
**DMID, NIAID, NIH, DHHS**  
5601 Fishers Lane 8G61  
Rockville, MD 20852  
[REDACTED] (b) (6)

*Accept that some days you are the pigeon and some days you are the statue.*  
- Scott Adams

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** Friday, April 21, 2017 12:51 PM  
**To:** Hudgings, Carole (NIH/NIAID) [E] <[REDACTED] (b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED] (b) (6)>; Kurilla, Michael (NIH/NIAID) [E] <[REDACTED] (b) (6)>  
**Cc:** Boyd, Nancy (NIH/NIAID) [E] <[REDACTED] (b) (6)> Holubar, Connie J. <[REDACTED] (b) (6)>  
**Subject:** RBL-NBL meeting 1-2May, Galveston

Hi,

We are looking forward to welcoming you to Galveston for what is shaping up to be a very exciting meeting of the RBL-NBL network. I'm trying to make maximum use of your limited time on campus and would like to explore if it might be possible for you to meet with some of our NIH-sponsored investigators while you are here. Could you please send us your proposed arrival and departure times so that we can work around your schedule.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director



Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610

(t) [REDACTED] (b) (6)

(f) 409-266-6810

(m) [REDACTED] (b) (6)

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 3/23/2018 2:57:08 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Niesel, David W. [(b) (6)]  
**Subject:** GNL 10 year anniversary

Hi Hugh,

First, thank you for taking time to meet with Dave and me during our recent visit to DC. We were pleased to have the opportunity to talk about future challenges and we left encouraged that you all appreciate the issues we face. I am confident that we will be able to work together to resolve any future problems.

On Veterans Day, November 11, 2008, we held a formal ceremony to dedicate the GNL. Although it seems like just yesterday, we are rapidly approaching our 10 year anniversary and we are starting discussions as to how best to celebrate this important milestone. When we opened, Tony had agreed to speak, but unfortunately when the time arrived he was ill and Mike Kurilla stepped in for him. (Tony later made a special visit down which was much appreciated.) My purpose in writing now is just to give you a heads up that this is on the horizon and to welcome your suggestions as to how we might best celebrate the occasion. This may also be a topic for discussion at the RBL-NBL meeting in Boston. We are forming a planning committee and will be working on a plan very soon.

Thanks again for your continued support,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 4/17/2018 11:37:19 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Re: Veterans Day

Hi Hugh

Thanks for checking on Tony's availability. I'm sorry he can't make it but I understand completely. He's giving the closing talk at our joint training with FDA next week so he's already doing us a big favor.

I'm actually in DC now and will meet with Nancy tomorrow on the supplement and other issues. We really appreciate your support on this!

We had fun with our grandkids but it was exhausting. Little boys [REDACTED] (b) (6) going full speed all the time. Even though there were two of us we were clearly no match for them.

Thanks again for making the trip to Boston. I know that folks appreciate your personal involvement.

Best wishes

Jim

Sent from my iPhone

On Apr 17, 2018, at 2:39 PM, Auchincloss, Hugh (NIH/NIAID) [E] [REDACTED] (b) (6) wrote:

Dear Jim, I hope you had a good visit with your grandchildren.

I'm afraid I can't deliver Tony to you in UTMB on Veterans Day. His fall schedule is already becoming insane.

I am almost certain, however, that I can deliver you some "end of year" help for your facility. Work with Nancy Boyd to put a request together.

Nice to see you in Boston,

Hugh

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 4/20/2018 2:33:54 PM  
**To:** Fauci, Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]  
**CC:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Great job!

Tony, Very nice job on the House biodefense hearing earlier this week, and a special thanks for the "shout-out" to UTMB. There were cheers across the entire UT System!

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]



**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 4/27/2018 5:46:21 PM  
**To:** Feldmann, Heinrich (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7f4bacd16b7d4c22803a843ca5c33312-feldmannh]; Allgood, Amanda (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=f1c3f99d2f0248729b5da3cddb6fb4be-prattam]; Kurilla, Michael (NIH/NCATS) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=dc4e85061e3943b9b8ad3f426727861f-mkurilla]; Mascola, John (NIH/VRC) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7f78b40a596b4ca4a2850a429d1ae3f2-jmascola]; Holland, Steven (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=98d92acd58924e5bbc1eb32ff473475c-sholland]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Tuma, Bonnie (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9b466b3bd7094248ad0922ae2f4773f4-tumabon]; King, Renee (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2ecc16cd791e4844891f4e6978b01288-kingor]; [REDACTED] (b) (6)  
**CC:** Savage, Dana (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d9c48bf7e2d941eba82c0dbcd469ae7c-dsavage]; Day, Vanessa (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b4bcbf9767174265a78746914e09c5ef-dayv]; Faile, Laura (NIH/NIAID) [C] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d96a92c490be4151b5c719963212e907-failel]  
**Subject:** RE: Update on Director, IRF/DCR/NIAID Search and Request for Scheduling POC

I had exactly the same impression and I fully agree with Heinz' suggestion [REDACTED] (b) (5)

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)

---

**From:** Feldmann, Heinrich (NIH/NIAID) [E] [REDACTED] (b) (6)  
**Sent:** Friday, April 27, 2018 12:42 PM  
**To:** Allgood, Amanda (NIH/NIAID) [E] [REDACTED] (b) (6); Kurilla, Michael (NIH/NCATS) [E] [REDACTED] (b) (6); Mascola, John (NIH/VRC) [E] <[REDACTED] (b) (6)>; Holland, Steven (NIH/NIAID) [E] [REDACTED] (b) (6); Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED] (b) (6)>; LeDuc, James W. [REDACTED] (b) (6); Tuma, Bonnie (NIH/OD) [E] <[REDACTED] (b) (6)>; King, Renee (NIH/OD) [E] [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6)  
**Cc:** Savage, Dana (NIH/NIAID) [E] <[REDACTED] (b) (6)>; Day, Vanessa (NIH/NIAID) [E] <[REDACTED] (b) (6)>; Faile, Laura (NIH/NIAID) [C] <[REDACTED] (b) (6)>  
**Subject:** RE: Update on Director, IRF/DCR/NIAID Search and Request for Scheduling POC

This is likely too late and not my business, (b) (5)

---

**From:** Allgood, Amanda (NIH/NIAID) [E]

**Sent:** Thursday, April 26, 2018 6:46 AM

**To:** Kurilla, Michael (NIH/NCATS) [E] (b) (6); Mascola, John (NIH/VRC) [E] (b) (6)

Holland, Steven (NIH/NIAID) [E] (b) (6); Auchincloss, Hugh (NIH/NIAID) [E]

(b) (6); Feldmann, Heinrich (NIH/NIAID) [E] (b) (6) James Leduc

(b) (6) Tuma, Bonnie (NIH/OD) [E] (b) (6); King, Renee (NIH/OD) [E]

(b) (6) (b) (6)

**Cc:** Savage, Dana (NIH/NIAID) [E] (b) (6); Day, Vanessa (NIH/NIAID) [E] (b) (6) Faile,

Laura (NIH/NIAID) [C] (b) (6); Allgood, Amanda (NIH/NIAID) [E] (b) (6)

**Subject:** Update on Director, IRF/DCR/NIAID Search and Request for Scheduling POC

Dear Search Committee Member,

On behalf of Dr. Lane, thank you again for assisting with the selection process for the Director, Integrated Research Facility, Division of Clinical Research, NIAID and for your support of DCR/NIAID. The search process involves initially recruiting for the position as a Title 5 GS-15; if highly qualified candidates are not identified, then the position will be advertised as a Title 42 appointment.

The position is currently being advertised on a variety of scientific, diversity, and general outreach sites. For your reference, a copy of the ad is attached. The Title 5 GS vacancy announcement will open April 29, 2018 and close May 8, 2018. Therefore, we would like to schedule a one hour meeting in late-May/early-June for the committee to meet and review the applications. Would you please provide us with a point of contact to coordinate your availability?

The Executive Secretary team is available to answer any questions you may have about the process. Please let us know what we can do to assist.

Looking forward to working with you.

Best regards,

*Amanda Allgood*

Senior Program Specialist

NIAID/DCR/PPAB

Integrated Research Facility

Fort Detrick

8200 Research Plaza, Room 1A121D

Frederick, MD 21702

Phone: (b) (6)

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 6/27/2018 7:09:27 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]  
**Subject:** Thanks and update  
**Attachments:** UC7-Intro Slides\_NIAID Site Visit 2018.pptx

Hi Hugh,

We had our annual site visit yesterday with Nancy Boyd, Kim Taylor and Gary Zackowitz and during their visit they indicated that "the check was in the mail" for the supplement to fund the building automation upgrade. I want to thank you and Tony again for your generous support of our program! We really appreciate all the hard work that you have done and continue to do to keep us going.

During my introductory comments I used the attached slides that I thought you might enjoy seeing. As we approach the 10 year anniversary of the GNL, we tried to gather some information to measure how successful we have been at fulfilling the vision of a biocontainment "national laboratory". The map of the USA shows the states where our BSL4 investigators have shared authorship with folks in each state; so far we've partners with institutions/investigators from 43 states. Hopefully this kind of national engagement is what was originally envisioned when the lab was constructed. (We're actively seeking collaborators in West Virginia, Vermont, Connecticut, Rhode Island, Delaware, Alaska and Hawaii!)

The world map shows our international partnerships, with shared authorship of publications from scientists in 64 different countries. So our reach is beyond our nation's borders and we are having a global impact.

The fourth slide has summary statistics quantifying our external partners and institutions and the referencing of our findings in policy development, patents and by other publications.

We are quite proud of the progress that we have made in standing up the GNL and making it an active contributor to attaining NIAID's mission, and again, we thank you for your continuing support. Together we're having an impact!

Best wishes,

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)

# Galveston National Lab 10 Years of Success

**2018 NIAID Site Visit**

**June 26, 2018**



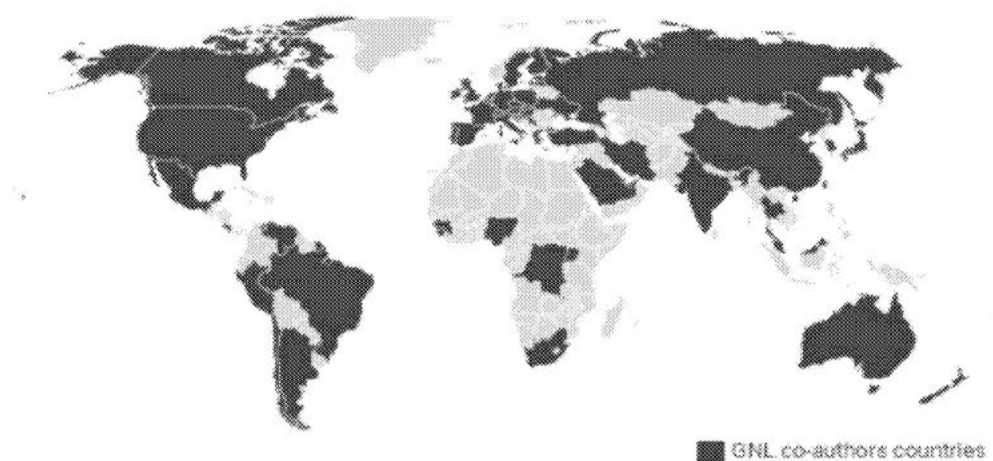
# The First 10 Years



Size of symbol corresponds with # of publications from that state

**GNL Global Co-Authors**

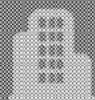
BSL4 co-investigators from 64 countries from around the world since 2008



The  
First  
10  
Years



### Ten Researchers



352 External Institutions



300+ patents  
referencing GNL  
researchers' papers



700 External Persons



2500+ publications



~ 80 Policy Source references

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 4/21/2017 4:51:23 PM  
**To:** Hudgings, Carole (NIH/NIAID) [E] [/O=NIH/OU=NIH/EXCHANGE/cn=NIAID/cn=hudgings]; Auchincloss, Hugh (NIH/NIAID) [E] [/O=NIH/OU=NIH/EXCHANGE/cn=NIAID/cn=auchincloss]; Kurilla, Michael (NIH/NIAID) [E] [/O=NIH/OU=NIH/EXCHANGE/cn=NIAID/cn=mkurilla]  
**CC:** Boyd, Nancy (NIH/NIAID) [E] [/O=NIH/OU=NIH/EXCHANGE/cn=NIAID/cn=NBoyd]; Holubar, Connie J. [REDACTED] (b) (6)  
**Subject:** RBL-NBL meeting 1-2May, Galveston

Hi,

We are looking forward to welcoming you to Galveston for what is shaping up to be a very exciting meeting of the RBL-NBL network. I'm trying to make maximum use of your limited time on campus and would like to explore if it might be possible for you to meet with some of our NIH-sponsored investigators while you are here. Could you please send us your proposed arrival and departure times so that we can work around your schedule.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)



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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 9/14/2018 7:59:02 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Holubar, Connie J. [REDACTED] (b) (6); Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Erbelding, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbeldingej]; Taylor, Kimberly (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=40d07049615c454a99400a11c3a9c652-taylorkl]; Zackowitz, Gary (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8e46ab3f44d24a93b7907a328ab7c23e-zackowig]  
**Subject:** GNL 10 yr anniversary

Hi Hugh,

As we discussed earlier, the GNL will be celebrating 10 years of operation in November and to recognize the milestone we are hosting a gathering for our local Galveston partners and our own UTMB community. Our plans are for a luncheon for community VIPs, followed by a presentation on our accomplishments and talk in our large auditorium. We have invited Ian Crozier as our guest speaker and we anticipate a large turn-out. We will be inviting Emily Erbelding and our program officers, Nancy Boyd, Kim Taylor and Gary Zackowitz to represent NIAID in person.

I wonder if we could get a brief note of congratulations from Tony to recognize the important partnership that has been built between NIAID and the GNL/UTMB? We will have a program that will be given to all attendees and we are thinking that it would be nice to prominently display a "Message from Dr Fauci."

Would you mind asking him if he would be willing to write a brief paragraph for this? I'm happy to ask him directly if you prefer. We would need it by mid-October to ensure that it is included in the program.

Thanks very much!

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 9/18/2018 3:33:06 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** RE: GNL 10 yr anniversary

Thanks very much! Let me know if we can help. The event is scheduled for Thursday, 15 November.

Hope all is well with you,

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Sent:** Tuesday, September 18, 2018 9:57 AM  
**To:** LeDuc, James W. <[REDACTED]> (b) (6); Folkers, Greg (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Cc:** Holubar, Connie J. <[REDACTED]> (b) (6); Boyd, Nancy (NIH/NIAID) [E] <[REDACTED]> (b) (6); Erbelding, Emily (NIH/NIAID) [E] <[REDACTED]> (b) (6); Taylor, Kimberly (NIH/NIAID) [E] <[REDACTED]> (b) (6); Zackowitz, Gary (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Subject:** RE: GNL 10 yr anniversary

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Absolutely Jim. Tony would be happy to do this.

Hugh

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**From:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Sent:** Friday, September 14, 2018 3:59 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Cc:** Holubar, Connie J. <[REDACTED]> (b) (6); Boyd, Nancy (NIH/NIAID) [E] <[REDACTED]> (b) (6); Erbelding, Emily (NIH/NIAID) [E] <[REDACTED]> (b) (6); Taylor, Kimberly (NIH/NIAID) [E] <[REDACTED]> (b) (6); Zackowitz, Gary (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 11/5/2018 5:17:35 PM  
**To:** Fauci, Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]  
**CC:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Erbelding, Emily (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=e976ebf7b14142fbb3c5c294efb334fe-erbeldingj]; Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]  
**Subject:** Economic Impact study of GNL  
**Attachments:** Perryman GNL Impact 10 30 2018.pdf; Perryman revised GNL Summary 10-30-18.pdf

Tony and colleagues,

We recently commissioned an economic impact study on the GNL in preparation for our 10 year anniversary. Attached is a 1-page graphic of their findings and also the full report. The study was done by the Perryman Group, which had done a similar study in 2003, before construction began. The Perryman Group is well known and respected in Texas for this kind of work. The findings from the current study indicate that we are well ahead of predictions in terms of dollars and jobs. The return on the investment by NIH and Texas is substantial and I hope this information will be of value to you in future dealings with Congress.

Thanks,

Jim

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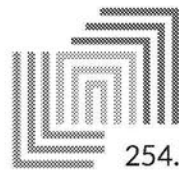


# THE GALVESTON NATIONAL LABORATORY:

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*Economic Benefits of the First 10 Years*

October 2018



THE

**PERRYMAN GROUP**

254.751.9595 • [info@perrymangroup.com](mailto:info@perrymangroup.com) • [www.perrymangroup.com](http://www.perrymangroup.com)

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## Introduction

The Galveston National Laboratory (GNL) at the University of Texas Medical Branch (UTMB) is an anchor laboratory of the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health. As a component of the Biodefense Laboratory Network, GNL is involved in crucial research to better understand, prevent, and treat dangerous pathogens. In addition to the importance of GNL's work in the areas of human health and national security, GNL also generates significant economic benefits on a global scale.

The Perryman Group was recently asked to examine the economic benefits of GNL impact over the first 10 years of its operations. Three primary sources of economic stimulus were analyzed. First, ongoing operations of the facility generate business activity through providing quality jobs and purchasing necessary goods and services. The lab has been responsible for more than 3,000 job-years to date among scholars working directly at UTMB. Second, research initiatives also lead to economic gains through commercialization of discoveries and other spinoff effects. Third, even beyond these benefits of research, there are societal gains due to improvements in treatment and prevention of disease due to GNL findings as well as additional economic development which is stimulated due to the initiatives of a national laboratory.

The economic stimulus provided by GNL leads to ripple effects through the economy, with a broad spectrum of industries positively affected by activity at the facility.

### *Summary of Key Results*

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A brief summary of key results is provided on the following page.



## Economic Benefits Associated with Galveston National Laboratory Research Activity First 10 Years of Operations

The Galveston National Laboratory (GNL) at the University of Texas Medical Branch is an anchor lab of the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health. As part of the Biodefense Laboratory Network, GNL is involved in crucial research to better understand, prevent, and treat dangerous pathogens.

In addition to the importance of GNL's work in the areas of human health and national security, GNL also generates significant economic benefits. The Perryman Group estimated the economic impact of the first 10 years of operations. Benefits of research activity, effects of commercialization, and social improvement were also considered based on typical patterns for medical research given the critical nature of infectious disease prevention and treatment; gains may be significantly understated. For more detail, see the associated report.

### Cumulative Economic Benefits of Operating Galveston National Laboratory from 2008-2018

Effects in each individual geographic area are inclusive of prior results

City of Galveston	Galveston County	Houston Metro Area	State of Texas	United States of America
<b>+\$356.2 million</b> gross product	<b>+\$407.9 million</b> gross product	<b>+\$445.2 million</b> gross product	<b>+\$479.8 million</b> gross product	<b>+\$519.6 million</b> gross product
<b>+\$263.4 million</b> personal income	<b>+\$292.0 million</b> personal income	<b>+\$313.7 million</b> personal income	<b>+\$333.0 million</b> personal income	<b>+\$355.4 million</b> personal income
<b>+5,880</b> job-years	<b>+6,291</b> job-years	<b>+6,543</b> job-years	<b>+6,882</b> job-years	<b>+7,246</b> job-years



### The Perryman Group

[www.perryman.com](http://www.perryman.com) | [info@perryman.com](mailto:info@perryman.com) | 214.651.9500

The Perryman Group is a focused team of analysts who know how to address any economic information task and present findings effectively. Our in-house professionals bring expertise in economics, finance, statistics, mathematics, and online, valuation, systems analysis, engineering, technical communications, and marketing. Dr. Ray Perryman, President and CEO, has 40 years of experience in developing systems and presenting problems and opportunities effectively.

### Definition of Terms

**Gross Product:** The total value of all goods and services produced in a region during a given period of time.

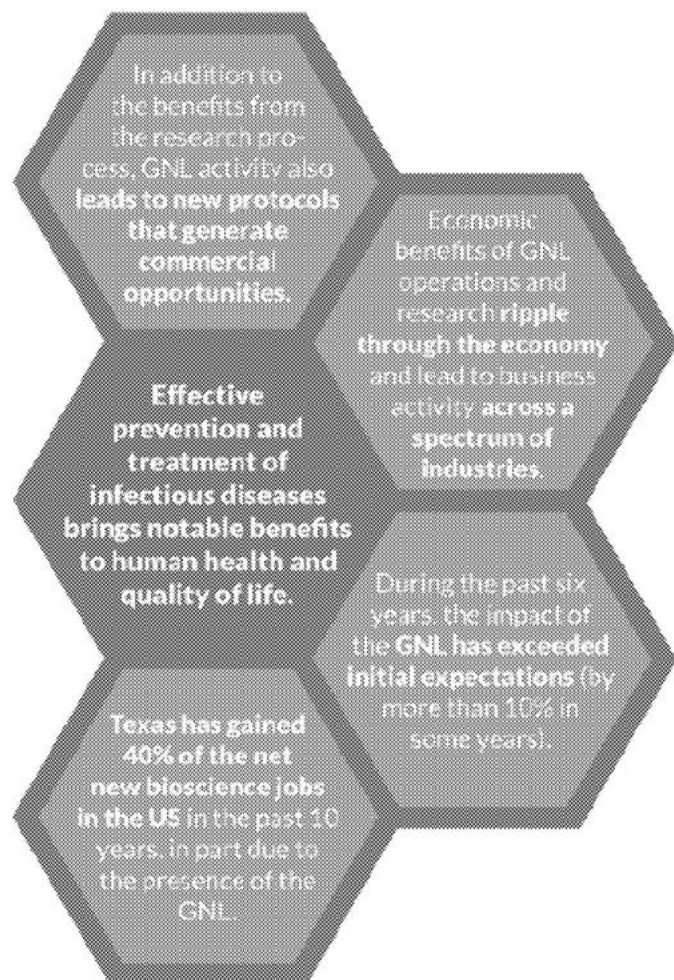
**Personal Income:** The total income, according to household, of the income-earner residents.

**Job-years:** The total annual hours person working and job for one year.



## Economic Benefits of Galveston National Laboratory

The presence of a major national laboratory facility can lead to benefits in a number of ways. Over the past 10 years, Texas has gained approximately 40% of all bioscience jobs added in the United States. While there are many factors contributing to this outcome, the presence of the GNL is certainly a positive factor because it has enabled a variety of research projects to proceed.



group) being provided in the Appendices.

In addition, The Perryman Group reviewed the overall performance of the GNL compared to expectations prior to the facility's construction and implementation and found that GNL has exceeded initial expectations by a significant margin each of the past six years since it has reached maturity, with the performance in some years more than 10% above original projections.<sup>1</sup>

As noted, The Perryman Group analyzed economic benefits of GNL operations, research, commercialization of research, and economic and social returns. Results for each of these major channels of economic stimulus are presented in the following sections, with additional detail (including results by industry

<sup>1</sup> "The Impact of the National Biocontainment Laboratory and Related Initiatives at The University of Texas Medical Branch (UTMB) on Business Activity in Texas", The Perryman Group, November 2003.

Descriptions of measures of economic activity and methods used are briefly outlined on the following page and explained in further detail in the Appendix to this report.

## Measuring Economic Impacts

Any economic stimulus, whether positive or negative, generates multiplier effects throughout the economy. In this instance, ongoing operations and research at the Galveston National Laboratory leads to multiplier effects rippling through the economy. In addition, research leads to additional benefits, such as commercialization of discoveries and improved health and quality of life.

The Perryman Group's input-output assessment system (the US Multi-Regional Impact Assessment System, which is described in further detail in the Appendices to this report) was developed by the firm about 35 years ago and has been consistently maintained and updated since that time. The model has been used in hundreds of analyses for clients ranging from major corporations to government agencies. The impact system uses a variety of data (from surveys, industry information, and other sources) to describe the various goods and services (known as resources or inputs) required to produce another good/service. This process allows for estimation of the total economic impact (including multiplier effects) of excessive the terminal and related facilities. The models used in the current analysis reflect the specific industrial composition and characteristics of the economy of the US, Texas, the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area, and Galveston County. Results were localized to the City of Galveston using gravity modeling and other techniques.

Total economic effects are quantified for key measures of business activity:

- **Total expenditures** (or total spending) measure the dollars changing hands as a result of the economic stimulus.
- **Gross product** (or output) is production of goods and services that will come about in each area as a result of the activity. This measure is parallel to the gross domestic product numbers commonly reported by various media outlets and is a subset of total expenditures.
- **Personal income** is dollars that end up in the hands of people in the area; the vast majority of this aggregate derives from the earnings of employees, but payments such as interest and rents are also included.
- **Job gains** are expressed as person-year of employment for a multi-year, cumulative effects or permanent jobs for effects which would be ongoing.

Monetary values were quantified on a constant (2018) basis to eliminate the effects of inflation. See the Appendices for additional information regarding the methods and assumptions used in this analysis.



## *Operations and Research Activity*

Operations and research activity of GNL have generated a significant stimulus to the local, state, and national economies. The Perryman Group estimates that for Galveston County, about **6,291 job-years** of employment (one person working for one year) and **\$407.9 million** in gross product have been added over the past 10 years when multiplier effects are considered. Benefits are concentrated in the City of Galveston and spill over into other parts of the state and nation. (Note that results for each successively larger geographic area include results from the smaller ones, and that person-year is one person working for one year.)

### **Cumulative Economic Benefits of Galveston National Laboratory Operations and Research Activity: 2008-2018**

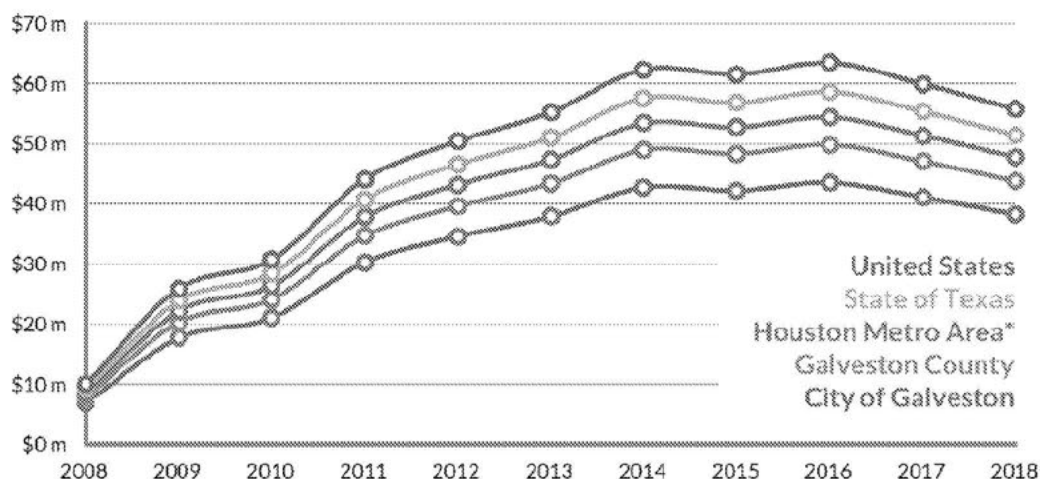
City of Galveston	Galveston County	Houston Metro Area	State of Texas	United States of America
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The Perryman Group also measured the overall economic benefits for each year of operations. Total benefits are linked to researchers at the facility by year, and show a strong upward trend in early years as the operations ramped up to maturity. The facility has generated at least 600 person-years of employment in the City of Galveston each year for the past five (when multiplier effects are considered), with even higher totals when looking at larger geographic areas (inclusive of the City of Galveston). Annual results for gross product and employment are presented in the following graphs.



**Annual\* Gross Product Benefits over 10-year History of Galveston National Laboratory Operations**

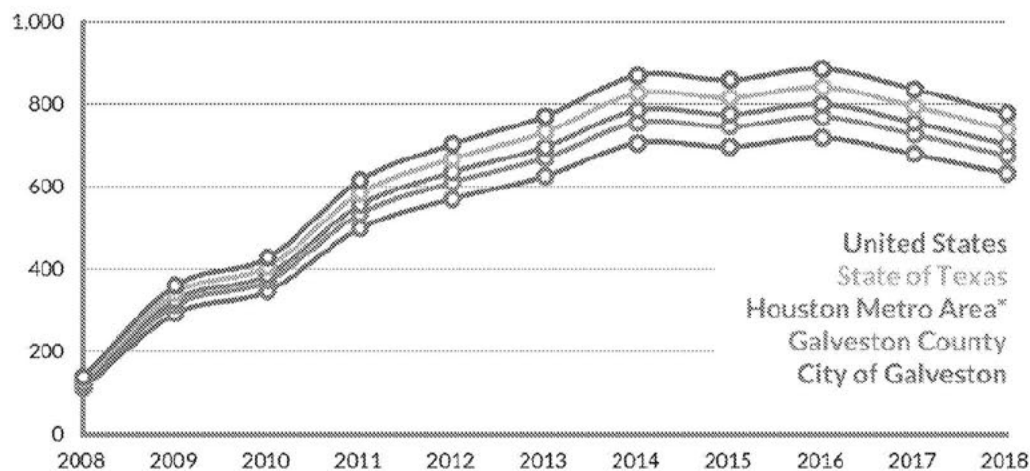
Units: Millions of 2017 US dollars



\*Includes operations and research activity and associated multiplier effects. Houston Metro Area is the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties).  
Source: The Perryman Group, USMIRAS

**Annual\* Employment Benefits over 10-year History of Galveston National Laboratory Operations**

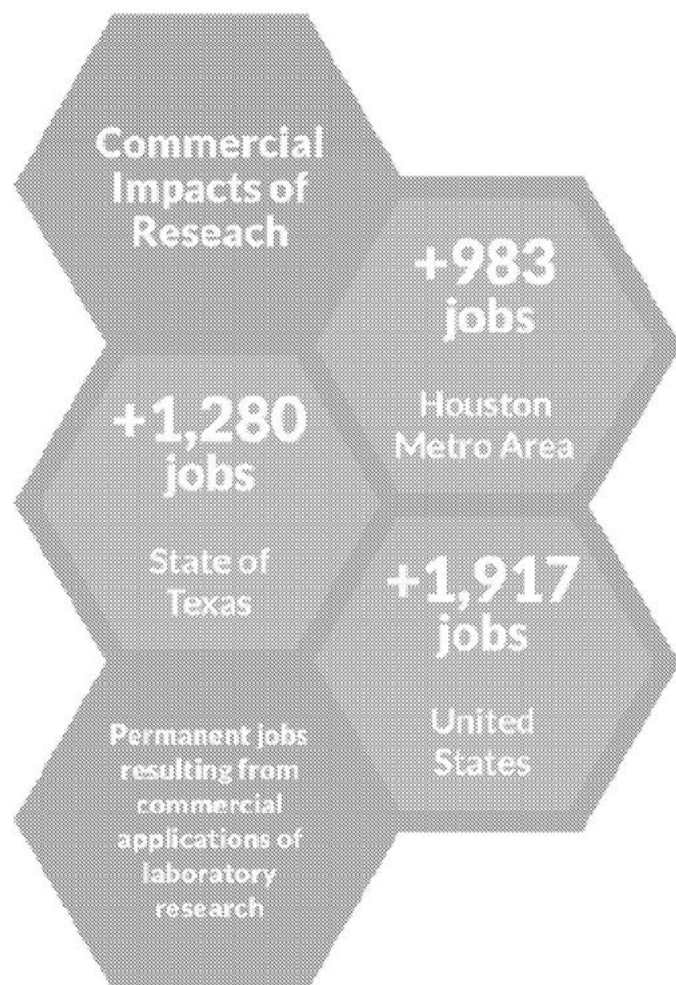
Units: Job-years (the equivalent of one person working one job for one year)



\*Includes operations and research activity and associated multiplier effects. Houston Metro Area is the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area (Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller Counties).  
Source: The Perryman Group, USMIRAS

## *Commercialization of Research*

Benefits of research activity include commercialization of discoveries and the spinoff of findings into new firms. The Perryman Group estimated likely commercialization impacts based on typical patterns for medical research. Total



economic benefits (including multiplier effects) are estimated to include **983** jobs in the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area, **1,280** jobs in Texas (including the Houston area), and **1,917** jobs across the nation. When measured by annual gross product, the economic benefits (including multiplier effects) of commercial impacts of research include an estimated \$123.2 million in the Houston-The Woodlands-Sugar Land MSA, \$154.1 million in Texas, and \$232.6 million in the United States. Notable additions to personal income and spending throughout the economy are also generated, as described in the Appendices to this report.

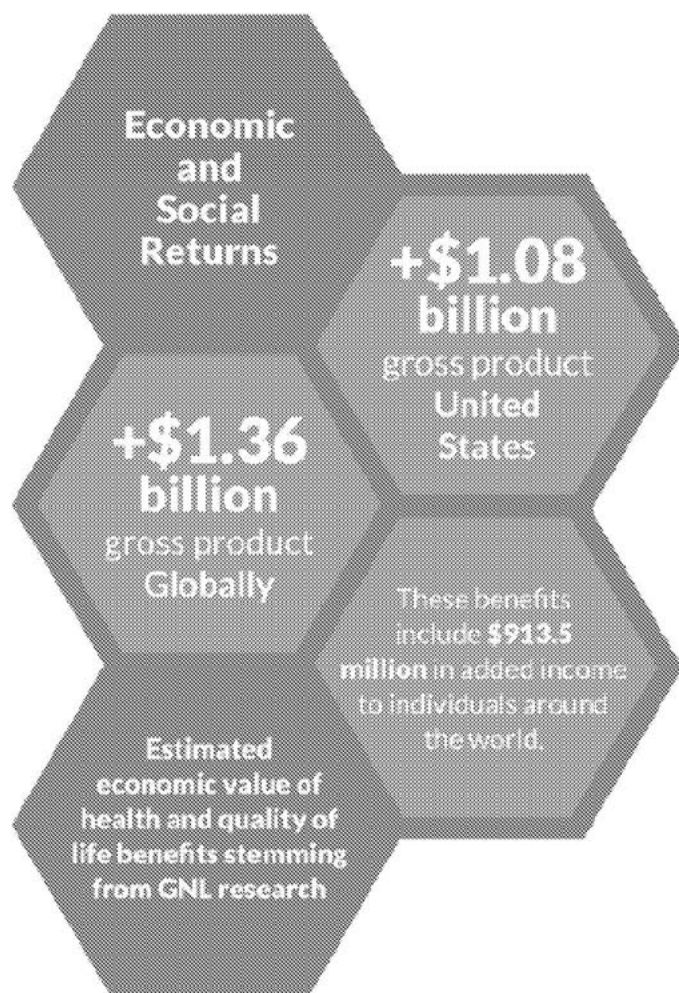


## *Economic and Social Returns*

Research at GNL also improves prevention and treatment protocols as well as enhancing the development of related industries in the biosciences. As noted, Texas has captured 40% of the net new biosciences jobs in the United States

over the past decade. Social improvements associated with better treatment prevention outcomes were also considered.

The Perryman Group estimates the that economic and social returns of GNL activity include an estimated 8,416 jobs in the United States and \$1.08 billion in annual gross product, with even higher results on a global scale. Note that these benefits and those for commercialization are based on typical patterns for basic medical research. Given the critical nature of infectious disease prevention and treatment, gains may be significantly understated.



## Conclusion

The Galveston National Laboratory is an important aspect of prevention and treatment of disease. In addition to potential improvement in human health and well-being and national security associated with GNL operations and research, the facility's operations also generate substantial economic benefits to the Galveston area and beyond.

The presence of GNL also contributes to the development of a range of bioscience industries and better positions Texas to be at the forefront of new activity. In addition, it is unique in the synergy which is possible with the vast resources of the rest of the University of Texas Medical Branch operations, research, and education. In its first 10 years of operations, The GNL has played a notable role in the prevention and treatment of infectious diseases, exceeded expectations in its level of activity, generated notable economic and social benefits, and become an integral part of the Texas bioscience complex.



## Appendix A: Methods Used

### *US Multi-Regional Impact Assessment System*

The basic modeling technique employed in this study is known as dynamic input-output analysis. This input-output segment of the methodology essentially uses extensive survey data, industry information, and a variety of corroborative source materials to create a matrix describing the various goods and services (known as resources or inputs) required to produce one unit (a dollar's worth) of output for a given sector. Once the base information is compiled, it can be mathematically simulated to generate evaluations of the magnitude of successive rounds of activity involved in the overall production process.

There are two essential steps in conducting an input-output analysis once the system is operational. The first major endeavor is to accurately define the levels of direct activity to be evaluated. In this case, research scholars supported at UTMB, and external research funding levels were provided by Galveston National Laboratory. Commercialization of research estimates were based on typical patterns from funded basic research as provided by the Association of University Technology Managers<sup>2</sup> localized to the relevant geographic area and adjusted for the specifics of GNL. Societal and economic benefits were estimated based on a global and national scale were determined based on detailed academic studies related to the relevant returns to investments in basic medical research.<sup>3</sup>

The second major phase of the analysis is the simulation of the input-output system to measure overall economic effects of the direct excess costs of the current situation. The present study was conducted within the context of the US Multi-Regional Impact Assessment System (USMRIAS) which was developed and is maintained by The Perryman Group. This model has been used in hundreds of diverse applications across the country and has an excellent reputation for accuracy and credibility; it has also been peer reviewed on multiple occasions. The

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<sup>2</sup> Association of University Technology Managers®, AUTM U.S. Licensing Activity Survey: FY2016, editors Shawn Hawkins, Yiorgos Kostoulas, Alice Li, Nichole R. Mercier, Matthew A. Mroz, Olivia Novac, Ragan Robertson, Nate Ruey, Ashley J. Stevens, April Turley and Karen White, with research assistance by Chrys Gwellem.

<sup>3</sup> See, in particular, Hall Bronwyn, Jacques Mairesse, and Pierre Mohnen; *Measuring the Returns to R&D*; chapter prepared for the *Handbook of the Economics of Innovation*, editors B.H.Hall and N. Rosenberg. December 2009. Frontier Economics, Rates of return to investment in science and innovation, report prepared for the Department for Business Innovation and Skills, July 2014.

systems used in the current simulations reflect the unique industrial structures of Galveston County, the Houston-The Woodlands-Sugar Land Metropolitan Statistical Area, Texas, and the United States, with an extension to capture social benefits on a global scale. Results were localized to the City of Galveston using techniques such as gravity modeling.

The USMRIAS is somewhat similar in format to the Input-Output Model of the United States which is maintained by the US Department of Commerce. The model developed by TPG, however, incorporates several important enhancements and refinements. Specifically, the expanded system includes (1) comprehensive 500-sector coverage for any county, multi-county, or urban region; (2) calculation of both total expenditures and value-added by industry and region; (3) direct estimation of expenditures for multiple basic input choices (expenditures, output, income, or employment); (4) extensive parameter localization; (5) price adjustments for real and nominal assessments by sectors and areas; (6) measurement of the induced impacts associated with payrolls and consumer spending; (7) embedded modules to estimate multi-sectoral direct spending effects; (8) estimation of retail spending activity by consumers; and (9) comprehensive linkage and integration capabilities with a wide variety of econometric, real estate, occupational, and fiscal impact models.

The impact assessment (input-output) process essentially estimates the amounts of all types of goods and services required to produce one unit (a dollar's worth) of a specific type of output. For purposes of illustrating the nature of the system, it is useful to think of inputs and outputs in dollar (rather than physical) terms. As an example, the construction of a new building will require specific dollar amounts of lumber, glass, concrete, hand tools, architectural services, interior design services, paint, plumbing, and numerous other elements. Each of these suppliers must, in turn, purchase additional dollar amounts of inputs. This process continues through multiple rounds of production, thus generating subsequent increments to business activity. The initial process of building the facility is known as the *direct effect*. The ensuing transactions in the output chain constitute the *indirect effect*.

Another pattern that arises in response to any direct economic activity comes from the payroll dollars received by employees at each stage of the production cycle. As workers are compensated, they use some of their income for taxes, savings, and purchases from external markets. A substantial portion, however, is spent locally on food, clothing, health care services, utilities, housing, recreation, and other items. Typical purchasing patterns in the relevant areas are obtained from the Center for Community and Economic Research *Cost of Living Index*, a privately compiled inter-regional measure which has been widely used for several



decades, and the *Consumer Expenditure Survey* of the US Department of Labor. These initial outlays by area residents generate further secondary activity as local providers acquire inputs to meet this consumer demand. These consumer spending impacts are known as the *induced effect*. The USMRIAS is designed to provide realistic, yet conservative, estimates of these phenomena.

Sources for information used in this process include the Bureau of the Census, the Bureau of Labor Statistics, the Regional Economic Information System of the US Department of Commerce, and other public and private sources. The pricing data are compiled from the US Department of Labor and the US Department of Commerce. The verification and testing procedures make use of extensive public and private sources.

Impacts were measured in constant 2018 dollars to eliminate the effects of inflation.

The USMRIAS generates estimates of the effect on several measures of business activity. The most comprehensive measure of economic activity used in this study is **Total Expenditures**. This measure incorporates every dollar that changes hands in any transaction. For example, suppose a farmer sells wheat to a miller for \$0.50; the miller then sells flour to a baker for \$0.75; the baker, in turn, sells bread to a customer for \$1.25. The Total Expenditures recorded in this instance would be \$2.50, that is,  $\$0.50 + \$0.75 + \$1.25$ . This measure is quite broad but is useful in that (1) it reflects the overall interplay of all industries in the economy, and (2) some key fiscal variables such as sales taxes are linked to aggregate spending.

A second measure of business activity frequently employed in this analysis is that of **Gross Product**. This indicator represents the regional equivalent of Gross Domestic Product, the most commonly reported statistic regarding national economic performance. In other words, the Gross Product of Texas is the amount of US output that is produced in that state; it is defined as the value of all final goods produced in a given region for a specific period of time. Stated differently, it captures the amount of value-added (gross area product) over intermediate goods and services at each stage of the production process, that is, it eliminates the double counting in the Total Expenditures concept. Using the example above, the Gross Product is \$1.25 (the value of the bread) rather than \$2.50.

Alternatively, it may be viewed as the sum of the value-added by the farmer, \$0.50; the miller, \$0.25 ( $\$0.75 - \$0.50$ ); and the baker, \$0.50 ( $\$1.25 - \$0.75$ ). The total value-added is, therefore, \$1.25, which is equivalent to the final value of the bread. In many industries, the primary component of value-added is the wage and salary payments to employees.

The third gauge of economic activity used in this evaluation is **Personal Income**. As the name implies, Personal Income is simply the income received by individuals, whether in the form of wages, salaries, interest, dividends, proprietors' profits, or other sources. It may thus be viewed as the segment of overall impacts which flows directly to the citizenry.

The fourth measure, **Retail Sales**, represents the component of Total Expenditures which occurs in retail outlets (general merchandise stores, automobile dealers and service stations, building materials stores, food stores, drugstores, restaurants, and so forth). Retail Sales is a commonly used measure of consumer activity.

The final aggregates used are **Permanent Jobs and Person-Years of Employment**, reflect the full-time equivalent jobs generated by an activity. For an economic stimulus expected to endure (such as the ongoing operations of a facility), the Permanent Jobs Measure is used. It should be noted that, unlike the dollar values described above, Permanent Jobs is a "stock" rather than a "flow." In other words, if an area produces \$1 million in output in 2016 and \$1 million in 2017, it is appropriate to say that \$2 million was achieved in the 2016-17 period. If the same area has 100 people working in 2016 and 100 in 2017, it only has 100 Permanent Jobs. When a flow of jobs is measured, such as in a construction project or a cumulative assessment over multiple years, it is appropriate to measure employment in Person-Years (a person working for a year). This concept is distinct from Permanent Jobs, which anticipates that the relevant positions will be maintained on a continuing basis.



## Appendix B: Detailed Sectoral Results

### *Operations and Research Activity*

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City of Galveston

**The Cumulative Impact of Operations and Research Activity Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in the City of Galveston**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$6,841,072	\$1,151,253	\$741,988	11
Mining	\$1,596,195	\$380,196	\$183,583	1
Construction	\$19,459,532	\$10,454,536	\$8,615,180	118
Total Manufacturing	\$20,373,399	\$5,033,795	\$2,793,769	36
Food, Beverage, and Tobacco Manufacturing	\$3,950,216	\$1,024,439	\$523,334	9
Textile and Textile Product Mills	\$0	\$0	\$0	0
Apparel Manufacturing	\$340,170	\$188,002	\$95,269	2
Wood, Furniture, and Related Product Manufacturing	\$44,633	\$15,649	\$11,159	0
Paper Manufacturing	\$6,823	\$3,019	\$1,364	0
Printing and Related Support Activities	\$1,708,911	\$802,037	\$523,506	8
Petroleum, Coal Products, and Chemical Manufacturing	\$10,829,128	\$1,635,031	\$767,741	5
Plastics and Rubber Products Manufacturing	\$17,448	\$7,568	\$4,423	0
Nonmetallic Mineral Product Manufacturing	\$486,937	\$274,963	\$143,807	2
Primary Metal Manufacturing	\$12,743	\$3,405	\$2,537	0
Fabricated Metal Product Manufacturing	\$1,574,101	\$566,783	\$365,913	6
Machinery Manufacturing	\$197,367	\$77,825	\$55,601	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$18,190	\$9,396	\$5,617	0
Transportation Equipment Manufacturing	\$707,641	\$234,808	\$153,206	1
Miscellaneous Manufacturing	\$479,092	\$190,869	\$140,293	1
Transportation and Utilities	\$34,028,335	\$13,577,853	\$7,939,852	88
Information	\$9,822,569	\$6,031,046	\$2,620,695	25
Wholesale Trade	\$7,471,976	\$5,056,763	\$2,915,776	32
Retail Trade (including Restaurants)	\$109,857,287	\$82,104,760	\$47,675,237	1,438
Finance, Insurance, & Real Estate	\$66,093,502	\$18,270,644	\$6,565,657	67
Business Services	\$14,935,178	\$9,012,902	\$7,352,218	88
Health Services	\$26,029,867	\$18,206,112	\$15,393,446	249
Other Services	\$300,037,992	\$186,890,922	\$160,586,403	3,728
<b>TOTAL</b>	<b>\$616,546,903</b>	<b>\$356,170,782</b>	<b>\$263,383,804</b>	<b>5,880</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2008				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$131,927.35	\$22,201.47	\$14,308.95	0
Mining	\$30,781.98	\$7,331.93	\$3,540.33	0
Construction	\$375,269.36	\$201,611.58	\$166,140.34	2
Total Manufacturing	\$392,892.92	\$97,074.74	\$53,876.72	1
Food, Beverage, and Tobacco Manufacturing	\$76,178.35	\$19,755.90	\$10,092.29	0
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$6,560.05	\$3,625.55	\$1,837.23	0
Wood, Furniture, and Related Product Manufacturing	\$860.72	\$301.78	\$215.19	0
Paper Manufacturing	\$131.59	\$58.21	\$26.30	0
Printing and Related Support Activities	\$32,955.67	\$15,466.97	\$10,095.60	0
Petroleum, Coal Products, and Chemical Manufacturing	\$208,835.44	\$31,530.93	\$14,805.58	0
Plastics and Rubber Products Manufacturing	\$336.47	\$145.95	\$85.29	0
Nonmetallic Mineral Product Manufacturing	\$9,390.38	\$5,302.54	\$2,773.26	0
Primary Metal Manufacturing	\$245.74	\$65.66	\$48.92	0
Fabricated Metal Product Manufacturing	\$30,355.91	\$10,930.18	\$7,056.49	0
Machinery Manufacturing	\$3,806.14	\$1,500.83	\$1,072.25	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$350.79	\$181.20	\$108.33	0
Transportation Equipment Manufacturing	\$13,646.57	\$4,528.19	\$2,954.51	0
Miscellaneous Manufacturing	\$9,239.10	\$3,680.84	\$2,705.50	0
Transportation and Utilities	\$656,222.95	\$261,843.51	\$153,116.89	2
Information	\$189,424.34	\$116,306.32	\$50,539.05	0
Wholesale Trade	\$144,094.10	\$97,517.66	\$56,229.59	1
Retail Trade (including Restaurants)	\$2,118,554.22	\$1,583,357.74	\$919,398.03	28
Finance, Insurance, & Real Estate	\$1,274,586.97	\$352,342.13	\$126,616.09	1
Business Services	\$288,018.98	\$173,810.24	\$141,784.61	2
Health Services	\$501,975.65	\$351,097.65	\$296,856.51	5
Other Services	\$5,786,113.69	\$3,604,117.31	\$3,096,845.10	72
<b>TOTAL</b>	<b>\$11,889,862.52</b>	<b>\$6,868,612.28</b>	<b>\$5,079,252.21</b>	<b>113</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2009				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$340,457.69	\$57,294.11	\$36,926.32	1
Mining	\$79,437.37	\$18,921.10	\$9,136.33	0
Construction	\$968,437.06	\$520,287.94	\$428,749.25	6
Total Manufacturing	\$1,013,917.22	\$250,515.46	\$139,036.69	2
Food, Beverage, and Tobacco Manufacturing	\$196,589.30	\$50,982.97	\$26,044.61	0
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$16,929.17	\$9,356.25	\$4,741.23	0
Wood, Furniture, and Related Product Manufacturing	\$2,221.22	\$778.79	\$555.33	0
Paper Manufacturing	\$339.58	\$150.23	\$67.86	0
Printing and Related Support Activities	\$85,046.90	\$39,914.75	\$26,053.16	0
Petroleum, Coal Products, and Chemical Manufacturing	\$538,930.16	\$81,370.14	\$38,207.96	0
Plastics and Rubber Products Manufacturing	\$868.32	\$376.65	\$220.11	0
Nonmetallic Mineral Product Manufacturing	\$24,233.25	\$13,683.98	\$7,156.81	0
Primary Metal Manufacturing	\$634.16	\$169.45	\$126.24	0
Fabricated Metal Product Manufacturing	\$78,337.83	\$28,206.92	\$18,210.29	0
Machinery Manufacturing	\$9,822.29	\$3,873.11	\$2,767.08	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$905.25	\$467.61	\$279.56	0
Transportation Equipment Manufacturing	\$35,216.95	\$11,685.65	\$7,624.54	0
Miscellaneous Manufacturing	\$23,842.85	\$9,498.94	\$6,981.92	0
Transportation and Utilities	\$1,693,478.58	\$675,725.18	\$395,140.36	4
Information	\$488,837.02	\$300,145.35	\$130,423.37	1
Wholesale Trade	\$371,855.73	\$251,658.48	\$145,108.61	2
Retail Trade (including Restaurants)	\$5,467,236.69	\$4,086,084.50	\$2,372,640.08	72
Finance, Insurance, & Real Estate	\$3,289,256.70	\$909,270.02	\$326,751.20	3
Business Services	\$743,274.79	\$448,542.54	\$365,895.78	4
Health Services	\$1,295,421.04	\$906,058.45	\$766,081.32	12
Other Services	\$14,931,906.29	\$9,300,947.91	\$7,991,858.33	186
TOTAL	\$30,683,516.18	\$17,725,451.04	\$13,107,747.65	293
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2010				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$404,293.50	\$68,036.75	\$43,850.01	1
Mining	\$94,331.88	\$22,468.81	\$10,849.39	0
Construction	\$1,150,019.01	\$617,841.93	\$509,139.74	7
Total Manufacturing	\$1,204,026.69	\$297,487.10	\$165,106.07	2
Food, Beverage, and Tobacco Manufacturing	\$233,449.79	\$60,542.28	\$30,927.97	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$20,103.39	\$11,110.55	\$5,630.21	0
Wood, Furniture, and Related Product Manufacturing	\$2,637.70	\$924.82	\$659.45	0
Paper Manufacturing	\$403.25	\$178.40	\$80.59	0
Printing and Related Support Activities	\$100,993.19	\$47,398.77	\$30,938.12	0
Petroleum, Coal Products, and Chemical Manufacturing	\$639,979.56	\$96,627.04	\$45,371.95	0
Plastics and Rubber Products Manufacturing	\$1,031.13	\$447.27	\$261.38	0
Nonmetallic Mineral Product Manufacturing	\$28,776.99	\$16,249.73	\$8,498.71	0
Primary Metal Manufacturing	\$753.06	\$201.22	\$149.91	0
Fabricated Metal Product Manufacturing	\$93,026.18	\$33,495.72	\$21,624.72	0
Machinery Manufacturing	\$11,663.97	\$4,599.31	\$3,285.91	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,074.99	\$555.29	\$331.98	0
Transportation Equipment Manufacturing	\$41,820.12	\$13,876.71	\$9,054.14	0
Miscellaneous Manufacturing	\$28,313.38	\$11,279.99	\$8,291.03	0
Transportation and Utilities	\$2,011,005.81	\$802,423.65	\$469,229.18	5
Information	\$580,493.96	\$356,422.60	\$154,877.75	1
Wholesale Trade	\$441,578.68	\$298,844.44	\$172,316.48	2
Retail Trade (including Restaurants)	\$6,492,343.57	\$4,852,225.35	\$2,817,510.10	85
Finance, Insurance, & Real Estate	\$3,905,992.33	\$1,079,758.15	\$388,017.05	4
Business Services	\$882,638.81	\$532,644.27	\$434,501.24	5
Health Services	\$1,538,312.49	\$1,075,944.41	\$909,721.57	15
Other Services	\$17,731,638.72	\$11,044,875.64	\$9,490,331.77	220
TOTAL	\$36,436,675.46	\$21,048,973.11	\$15,565,450.33	347
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2011				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$580,905.93	\$97,758.07	\$63,005.53	1
Mining	\$135,540.02	\$32,284.13	\$15,588.86	0
Construction	\$1,652,395.73	\$887,741.30	\$731,553.41	10
Total Manufacturing	\$1,729,996.25	\$427,442.00	\$237,231.36	3
Food, Beverage, and Tobacco Manufacturing	\$335,430.49	\$86,989.70	\$44,438.61	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$28,885.39	\$15,964.10	\$8,089.72	0
Wood, Furniture, and Related Product Manufacturing	\$3,789.96	\$1,328.82	\$947.53	0
Paper Manufacturing	\$579.40	\$256.33	\$115.79	0
Printing and Related Support Activities	\$145,111.27	\$68,104.55	\$44,453.20	1
Petroleum, Coal Products, and Chemical Manufacturing	\$919,549.58	\$138,837.80	\$65,192.33	0
Plastics and Rubber Products Manufacturing	\$1,481.57	\$642.66	\$375.57	0
Nonmetallic Mineral Product Manufacturing	\$41,347.98	\$23,348.30	\$12,211.30	0
Primary Metal Manufacturing	\$1,082.03	\$289.13	\$215.39	0
Fabricated Metal Product Manufacturing	\$133,663.93	\$48,128.06	\$31,071.31	0
Machinery Manufacturing	\$16,759.29	\$6,608.49	\$4,721.34	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,544.59	\$797.86	\$477.01	0
Transportation Equipment Manufacturing	\$60,088.91	\$19,938.64	\$13,009.36	0
Miscellaneous Manufacturing	\$40,681.86	\$16,207.57	\$11,912.91	0
Transportation and Utilities	\$2,889,497.83	\$1,152,956.09	\$674,208.24	7
Information	\$834,078.16	\$512,123.00	\$222,534.87	2
Wholesale Trade	\$634,478.85	\$429,392.28	\$247,591.57	3
Retail Trade (including Restaurants)	\$9,328,472.60	\$6,971,881.68	\$4,048,317.14	122
Finance, Insurance, & Real Estate	\$5,612,294.25	\$1,551,441.97	\$557,519.24	6
Business Services	\$1,268,212.60	\$765,325.71	\$624,309.67	7
Health Services	\$2,210,312.16	\$1,545,962.23	\$1,307,126.25	21
Other Services	\$25,477,565.11	\$15,869,742.36	\$13,636,108.28	317
TOTAL	\$52,353,749.48	\$30,244,050.84	\$22,365,094.42	499
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2012				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$663,892.49	\$111,723.51	\$72,006.32	1
Mining	\$154,902.88	\$36,896.15	\$17,815.84	0
Construction	\$1,888,452.27	\$1,014,561.48	\$836,061.05	11
Total Manufacturing	\$1,977,138.57	\$488,505.14	\$271,121.55	3
Food, Beverage, and Tobacco Manufacturing	\$383,349.13	\$99,416.80	\$50,786.98	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$33,011.88	\$18,244.69	\$9,245.40	0
Wood, Furniture, and Related Product Manufacturing	\$4,331.39	\$1,518.65	\$1,082.89	0
Paper Manufacturing	\$662.17	\$292.95	\$132.33	0
Printing and Related Support Activities	\$165,841.45	\$77,833.77	\$50,803.65	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,050,913.81	\$158,671.77	\$74,505.52	1
Plastics and Rubber Products Manufacturing	\$1,693.22	\$734.47	\$429.22	0
Nonmetallic Mineral Product Manufacturing	\$47,254.84	\$26,683.77	\$13,955.77	0
Primary Metal Manufacturing	\$1,236.60	\$330.43	\$246.16	0
Fabricated Metal Product Manufacturing	\$152,758.77	\$55,003.49	\$35,510.07	1
Machinery Manufacturing	\$19,153.47	\$7,552.56	\$5,395.81	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,765.24	\$911.84	\$545.15	0
Transportation Equipment Manufacturing	\$68,673.04	\$22,787.01	\$14,867.84	0
Miscellaneous Manufacturing	\$46,493.55	\$18,522.94	\$13,614.75	0
Transportation and Utilities	\$3,302,283.23	\$1,317,664.11	\$770,523.70	9
Information	\$953,232.18	\$585,283.43	\$254,325.56	2
Wholesale Trade	\$725,118.68	\$490,734.04	\$282,961.79	3
Retail Trade (including Restaurants)	\$10,661,111.55	\$7,967,864.78	\$4,626,648.16	140
Finance, Insurance, & Real Estate	\$6,414,050.57	\$1,773,076.53	\$637,164.84	6
Business Services	\$1,449,385.83	\$874,657.96	\$713,496.77	9
Health Services	\$2,526,071.04	\$1,766,813.98	\$1,493,858.57	24
Other Services	\$29,117,217.27	\$18,136,848.42	\$15,584,123.75	362
TOTAL	\$59,832,856.55	\$34,564,629.53	\$25,560,107.91	571
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2013				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$727,728.31	\$122,466.16	\$78,930.01	1
Mining	\$169,797.38	\$40,443.86	\$19,528.90	0
Construction	\$2,070,034.21	\$1,112,115.47	\$916,451.53	13
Total Manufacturing	\$2,167,248.05	\$535,476.79	\$297,190.93	4
Food, Beverage, and Tobacco Manufacturing	\$420,209.63	\$108,976.11	\$55,670.35	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$36,186.10	\$19,998.99	\$10,134.38	0
Wood, Furniture, and Related Product Manufacturing	\$4,747.87	\$1,664.67	\$1,187.01	0
Paper Manufacturing	\$725.84	\$321.11	\$145.06	0
Printing and Related Support Activities	\$181,787.75	\$85,317.79	\$55,688.62	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,151,963.21	\$173,928.67	\$81,669.51	1
Plastics and Rubber Products Manufacturing	\$1,856.03	\$805.09	\$470.49	0
Nonmetallic Mineral Product Manufacturing	\$51,798.57	\$29,249.52	\$15,297.67	0
Primary Metal Manufacturing	\$1,355.51	\$362.20	\$269.83	0
Fabricated Metal Product Manufacturing	\$167,447.12	\$60,292.29	\$38,924.50	1
Machinery Manufacturing	\$20,995.15	\$8,278.76	\$5,914.64	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,934.98	\$999.52	\$597.57	0
Transportation Equipment Manufacturing	\$75,276.22	\$24,978.07	\$16,297.45	0
Miscellaneous Manufacturing	\$50,964.09	\$20,303.99	\$14,923.86	0
Transportation and Utilities	\$3,619,810.46	\$1,444,362.58	\$844,612.52	9
Information	\$1,044,889.12	\$641,560.68	\$278,779.95	3
Wholesale Trade	\$794,841.63	\$537,920.00	\$310,169.66	3
Retail Trade (including Restaurants)	\$11,686,218.43	\$8,734,005.62	\$5,071,518.17	153
Finance, Insurance, & Real Estate	\$7,030,786.20	\$1,943,564.66	\$698,430.69	7
Business Services	\$1,588,749.86	\$958,759.69	\$782,102.22	9
Health Services	\$2,768,962.48	\$1,936,699.94	\$1,637,498.82	26
Other Services	\$31,916,949.70	\$19,880,776.15	\$17,082,597.19	397
TOTAL	\$65,586,015.83	\$37,888,151.60	\$28,017,810.59	625
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2014				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$821,354.17	\$138,222.04	\$89,084.75	1
Mining	\$191,642.66	\$45,647.16	\$22,041.39	0
Construction	\$2,336,354.41	\$1,255,194.66	\$1,034,357.58	14
Total Manufacturing	\$2,446,075.28	\$604,368.54	\$335,426.03	4
Food, Beverage, and Tobacco Manufacturing	\$474,271.68	\$122,996.42	\$62,832.61	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$40,841.62	\$22,571.96	\$11,438.21	0
Wood, Furniture, and Related Product Manufacturing	\$5,358.70	\$1,878.84	\$1,339.73	0
Paper Manufacturing	\$819.23	\$362.43	\$163.72	0
Printing and Related Support Activities	\$205,175.65	\$96,294.34	\$62,853.24	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,300,169.00	\$196,305.46	\$92,176.70	1
Plastics and Rubber Products Manufacturing	\$2,094.81	\$908.67	\$531.02	0
Nonmetallic Mineral Product Manufacturing	\$58,462.72	\$33,012.61	\$17,265.79	0
Primary Metal Manufacturing	\$1,529.90	\$408.80	\$304.55	0
Fabricated Metal Product Manufacturing	\$188,990.02	\$68,049.19	\$43,932.33	1
Machinery Manufacturing	\$23,696.28	\$9,343.87	\$6,675.59	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,183.92	\$1,128.11	\$674.45	0
Transportation Equipment Manufacturing	\$84,960.88	\$28,191.63	\$18,394.19	0
Miscellaneous Manufacturing	\$57,520.87	\$22,916.20	\$16,843.89	0
Transportation and Utilities	\$4,085,517.07	\$1,630,187.00	\$953,276.12	11
Information	\$1,179,319.30	\$724,100.65	\$314,646.37	3
Wholesale Trade	\$897,101.96	\$607,126.08	\$350,074.53	4
Retail Trade (including Restaurants)	\$13,189,708.52	\$9,857,678.86	\$5,723,994.19	173
Finance, Insurance, & Real Estate	\$7,935,331.79	\$2,193,613.92	\$788,287.27	8
Business Services	\$1,793,150.42	\$1,082,108.89	\$882,723.56	11
Health Services	\$3,125,203.27	\$2,185,866.02	\$1,848,171.18	30
Other Services	\$36,023,223.93	\$22,438,536.82	\$19,280,358.23	448
TOTAL	\$74,023,982.78	\$42,762,650.63	\$31,622,441.20	706
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2015				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$810,714.87	\$136,431.59	\$87,930.80	1
Mining	\$189,160.24	\$45,055.88	\$21,755.88	0
Construction	\$2,306,090.75	\$1,238,935.66	\$1,020,959.16	14
Total Manufacturing	\$2,414,390.37	\$596,539.93	\$331,081.13	4
Food, Beverage, and Tobacco Manufacturing	\$468,128.27	\$121,403.21	\$62,018.72	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$40,312.58	\$22,279.57	\$11,290.05	0
Wood, Furniture, and Related Product Manufacturing	\$5,289.29	\$1,854.50	\$1,322.37	0
Paper Manufacturing	\$808.61	\$357.73	\$161.60	0
Printing and Related Support Activities	\$202,517.93	\$95,047.01	\$62,039.08	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,283,327.44	\$193,762.64	\$90,982.70	1
Plastics and Rubber Products Manufacturing	\$2,067.68	\$896.90	\$524.14	0
Nonmetallic Mineral Product Manufacturing	\$57,705.43	\$32,584.99	\$17,042.14	0
Primary Metal Manufacturing	\$1,510.08	\$403.51	\$300.60	0
Fabricated Metal Product Manufacturing	\$186,541.96	\$67,167.73	\$43,363.26	1
Machinery Manufacturing	\$23,389.33	\$9,222.83	\$6,589.12	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,155.63	\$1,113.50	\$665.71	0
Transportation Equipment Manufacturing	\$83,860.35	\$27,826.45	\$18,155.93	0
Miscellaneous Manufacturing	\$56,775.78	\$22,619.35	\$16,625.70	0
Transportation and Utilities	\$4,032,595.87	\$1,609,070.59	\$940,927.98	10
Information	\$1,164,043.14	\$714,721.11	\$310,570.64	3
Wholesale Trade	\$885,481.47	\$599,261.75	\$345,539.88	4
Retail Trade (including Restaurants)	\$13,018,857.37	\$9,729,988.72	\$5,649,849.19	170
Finance, Insurance, & Real Estate	\$7,832,542.52	\$2,165,199.23	\$778,076.30	8
Business Services	\$1,769,923.09	\$1,068,091.93	\$871,289.32	10
Health Services	\$3,084,721.36	\$2,157,551.69	\$1,824,231.14	29
Other Services	\$35,556,601.86	\$22,147,882.20	\$19,030,612.66	442
TOTAL	\$73,065,122.90	\$42,208,730.29	\$31,212,824.08	697
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2016				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$836,249.20	\$140,728.65	\$90,700.27	1
Mining	\$195,118.05	\$46,474.96	\$22,441.10	0
Construction	\$2,378,723.53	\$1,277,957.25	\$1,053,115.36	14
Total Manufacturing	\$2,490,434.16	\$615,328.59	\$341,508.88	4
Food, Beverage, and Tobacco Manufacturing	\$482,872.47	\$125,226.93	\$63,972.07	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$41,582.27	\$22,981.29	\$11,645.64	0
Wood, Furniture, and Related Product Manufacturing	\$5,455.88	\$1,912.91	\$1,364.02	0
Paper Manufacturing	\$834.08	\$369.00	\$166.69	0
Printing and Related Support Activities	\$208,896.45	\$98,040.61	\$63,993.06	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,323,747.20	\$199,865.40	\$93,848.30	1
Plastics and Rubber Products Manufacturing	\$2,132.80	\$925.15	\$540.65	0
Nonmetallic Mineral Product Manufacturing	\$59,522.92	\$33,611.29	\$17,578.90	0
Primary Metal Manufacturing	\$1,557.65	\$416.22	\$310.07	0
Fabricated Metal Product Manufacturing	\$192,417.30	\$69,283.25	\$44,729.03	1
Machinery Manufacturing	\$24,126.01	\$9,513.32	\$6,796.65	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,223.52	\$1,148.57	\$686.68	0
Transportation Equipment Manufacturing	\$86,501.62	\$28,702.87	\$18,727.77	0
Miscellaneous Manufacturing	\$58,563.99	\$23,331.78	\$17,149.35	0
Transportation and Utilities	\$4,159,606.76	\$1,659,749.98	\$970,563.51	11
Information	\$1,200,705.92	\$737,232.01	\$320,352.39	3
Wholesale Trade	\$913,370.65	\$618,136.14	\$356,423.03	4
Retail Trade (including Restaurants)	\$13,428,900.12	\$10,036,445.06	\$5,827,797.20	176
Finance, Insurance, & Real Estate	\$8,079,236.77	\$2,233,394.48	\$802,582.64	8
Business Services	\$1,825,668.69	\$1,101,732.62	\$898,731.50	11
Health Services	\$3,181,877.94	\$2,225,506.07	\$1,881,687.24	30
Other Services	\$36,676,494.83	\$22,845,453.29	\$19,630,002.03	456
TOTAL	\$75,366,386.62	\$43,538,139.12	\$32,195,905.16	719
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2017				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$789,436.26	\$132,850.71	\$85,622.90	1
Mining	\$184,195.41	\$43,873.31	\$21,184.86	0
Construction	\$2,245,563.43	\$1,206,417.66	\$994,162.33	14
Total Manufacturing	\$2,351,020.55	\$580,882.71	\$322,391.34	4
Food, Beverage, and Tobacco Manufacturing	\$455,841.44	\$118,216.77	\$60,390.93	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$39,254.51	\$21,694.81	\$10,993.72	0
Wood, Furniture, and Related Product Manufacturing	\$5,150.46	\$1,805.83	\$1,287.67	0
Paper Manufacturing	\$787.39	\$348.34	\$157.36	0
Printing and Related Support Activities	\$197,202.50	\$92,552.34	\$60,410.76	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,249,644.30	\$188,677.01	\$88,594.70	1
Plastics and Rubber Products Manufacturing	\$2,013.41	\$873.36	\$510.38	0
Nonmetallic Mineral Product Manufacturing	\$56,190.85	\$31,729.74	\$16,594.84	0
Primary Metal Manufacturing	\$1,470.45	\$392.92	\$292.71	0
Fabricated Metal Product Manufacturing	\$181,645.85	\$65,404.80	\$42,225.12	1
Machinery Manufacturing	\$22,775.44	\$8,980.76	\$6,416.18	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,099.05	\$1,084.27	\$648.24	0
Transportation Equipment Manufacturing	\$81,659.29	\$27,096.10	\$17,679.39	0
Miscellaneous Manufacturing	\$55,285.60	\$22,025.67	\$16,189.33	0
Transportation and Utilities	\$3,926,753.46	\$1,566,837.77	\$916,231.71	10
Information	\$1,133,490.83	\$695,962.03	\$302,419.18	3
Wholesale Trade	\$862,240.48	\$583,533.10	\$336,470.59	4
Retail Trade (including Restaurants)	\$12,677,155.08	\$9,474,608.44	\$5,501,559.19	166
Finance, Insurance, & Real Estate	\$7,626,963.97	\$2,108,369.85	\$757,654.35	8
Business Services	\$1,723,468.41	\$1,040,058.02	\$848,420.83	10
Health Services	\$3,003,757.55	\$2,100,923.04	\$1,776,351.06	29
Other Services	\$34,623,357.72	\$21,566,572.96	\$18,531,121.51	430
TOTAL	\$71,147,403.14	\$41,100,889.60	\$30,393,589.86	679
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the City of Galveston: 2018				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$734,111.89	\$123,540.42	\$79,622.38	1
Mining	\$171,286.83	\$40,798.63	\$19,700.21	0
Construction	\$2,088,192.41	\$1,121,870.87	\$924,490.58	13
Total Manufacturing	\$2,186,259.00	\$540,173.95	\$299,797.87	4
Food, Beverage, and Tobacco Manufacturing	\$423,895.68	\$109,932.04	\$56,158.68	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$36,503.52	\$20,174.42	\$10,223.27	0
Wood, Furniture, and Related Product Manufacturing	\$4,789.51	\$1,679.27	\$1,197.43	0
Paper Manufacturing	\$732.21	\$323.93	\$146.33	0
Printing and Related Support Activities	\$183,382.38	\$86,066.19	\$56,177.12	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,162,068.15	\$175,454.36	\$82,385.91	1
Plastics and Rubber Products Manufacturing	\$1,872.31	\$812.15	\$474.62	0
Nonmetallic Mineral Product Manufacturing	\$52,252.95	\$29,506.09	\$15,431.86	0
Primary Metal Manufacturing	\$1,367.40	\$365.38	\$272.20	0
Fabricated Metal Product Manufacturing	\$168,915.95	\$60,821.17	\$39,265.95	1
Machinery Manufacturing	\$21,179.32	\$8,351.38	\$5,966.53	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,951.95	\$1,008.29	\$602.81	0
Transportation Equipment Manufacturing	\$75,936.54	\$25,197.18	\$16,440.41	0
Miscellaneous Manufacturing	\$51,411.14	\$20,482.09	\$15,054.77	0
Transportation and Utilities	\$3,651,563.19	\$1,457,032.42	\$852,021.40	9
Information	\$1,054,054.81	\$647,188.41	\$281,225.38	3
Wholesale Trade	\$801,813.93	\$542,638.60	\$312,890.44	3
Retail Trade (including Restaurants)	\$11,788,729.11	\$8,810,619.71	\$5,116,005.17	154
Finance, Insurance, & Real Estate	\$7,092,459.76	\$1,960,613.48	\$704,557.28	7
Business Services	\$1,602,686.26	\$967,169.86	\$788,962.77	9
Health Services	\$2,793,251.63	\$1,953,688.54	\$1,651,862.84	27
Other Services	\$32,196,922.94	\$20,055,168.92	\$17,232,444.53	400
TOTAL	\$66,161,331.76	\$38,220,503.81	\$28,263,580.86	631
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

## Galveston County



The Cumulative Impact of Research Activity Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in Galveston County				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$6,977,221	\$2,176,397	\$1,402,698	21
Mining	\$3,017,540	\$718,745	\$347,056	2
Construction	\$22,882,930	\$12,293,739	\$10,130,797	139
Total Manufacturing	\$53,840,158	\$13,302,656	\$7,383,007	95
Food, Beverage, and Tobacco Manufacturing	\$10,439,115	\$2,707,254	\$1,382,998	23
Textile and Textile Product Mills	\$0	\$0	\$0	0
Apparel Manufacturing	\$898,958	\$496,828	\$251,765	6
Wood, Furniture, and Related Product Manufacturing	\$117,950	\$41,355	\$29,489	0
Paper Manufacturing	\$18,032	\$7,977	\$3,604	0
Printing and Related Support Activities	\$4,516,087	\$2,119,519	\$1,383,452	22
Petroleum, Coal Products, and Chemical Manufacturing	\$28,617,804	\$4,320,847	\$2,028,886	14
Plastics and Rubber Products Manufacturing	\$46,109	\$20,001	\$11,688	0
Nonmetallic Mineral Product Manufacturing	\$1,286,813	\$726,635	\$380,034	6
Primary Metal Manufacturing	\$33,674	\$8,998	\$6,703	0
Fabricated Metal Product Manufacturing	\$4,159,828	\$1,497,820	\$966,987	15
Machinery Manufacturing	\$521,575	\$205,666	\$146,935	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$48,070	\$24,831	\$14,845	0
Transportation Equipment Manufacturing	\$1,870,060	\$620,521	\$404,872	4
Miscellaneous Manufacturing	\$1,266,082	\$504,405	\$370,748	4
Transportation and Utilities	\$60,940,507	\$24,316,242	\$14,219,285	157
Information	\$10,417,656	\$6,396,732	\$2,779,231	26
Wholesale Trade	\$13,381,378	\$9,056,032	\$5,221,792	58
Retail Trade (including Restaurants)	\$115,639,250	\$86,426,064	\$50,184,460	1,514
Finance, Insurance, & Real Estate	\$118,365,224	\$32,720,447	\$11,758,273	120
Business Services	\$18,619,875	\$11,236,499	\$9,166,104	109
Health Services	\$27,399,860	\$19,164,328	\$16,203,628	262
Other Services	\$305,204,829	\$190,125,080	\$163,192,352	3,789
<b>TOTAL</b>	<b>\$756,686,428</b>	<b>\$407,932,960</b>	<b>\$291,988,681</b>	<b>6,291</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2008				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$134,552.94	\$41,970.95	\$27,050.47	0
Mining	\$58,192.05	\$13,860.70	\$6,692.84	0
Construction	\$441,288.23	\$237,079.88	\$195,368.40	3
Total Manufacturing	\$1,038,286.09	\$256,536.44	\$142,378.36	2
Food, Beverage, and Tobacco Manufacturing	\$201,314.20	\$52,208.32	\$26,670.57	0
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$17,336.05	\$9,581.12	\$4,855.18	0
Wood, Furniture, and Related Product Manufacturing	\$2,274.61	\$797.51	\$568.67	0
Paper Manufacturing	\$347.74	\$153.84	\$69.49	0
Printing and Related Support Activities	\$87,090.95	\$40,874.08	\$26,679.33	0
Petroleum, Coal Products, and Chemical Manufacturing	\$551,883.01	\$83,325.82	\$39,126.26	0
Plastics and Rubber Products Manufacturing	\$889.19	\$385.70	\$225.40	0
Nonmetallic Mineral Product Manufacturing	\$24,815.68	\$14,012.87	\$7,328.81	0
Primary Metal Manufacturing	\$649.40	\$173.53	\$129.27	0
Fabricated Metal Product Manufacturing	\$80,220.63	\$28,884.86	\$18,647.97	0
Machinery Manufacturing	\$10,058.36	\$3,966.19	\$2,833.59	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$927.01	\$478.85	\$286.28	0
Transportation Equipment Manufacturing	\$36,063.36	\$11,966.51	\$7,807.79	0
Miscellaneous Manufacturing	\$24,415.90	\$9,727.24	\$7,149.73	0
Transportation and Utilities	\$1,175,213.52	\$468,929.09	\$274,213.27	3
Information	\$200,900.37	\$123,358.44	\$53,596.37	1
Wholesale Trade	\$258,054.57	\$174,641.98	\$100,700.18	1
Retail Trade (including Restaurants)	\$2,230,057.07	\$1,666,692.36	\$967,787.40	29
Finance, Insurance, & Real Estate	\$2,282,626.41	\$631,000.85	\$226,753.64	2
Business Services	\$359,076.91	\$216,691.42	\$176,764.67	2
Health Services	\$528,395.43	\$369,576.47	\$312,480.54	5
Other Services	\$5,885,754.09	\$3,666,486.77	\$3,147,099.78	73
<b>TOTAL</b>	<b>\$14,592,397.67</b>	<b>\$7,866,825.35</b>	<b>\$5,630,885.91</b>	<b>121</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2009				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$347,233.39	\$108,312.12	\$69,807.67	1
Mining	\$150,173.04	\$35,769.56	\$17,271.85	0
Construction	\$1,138,808.32	\$611,819.05	\$504,176.51	7
Total Manufacturing	\$2,679,447.96	\$662,029.52	\$367,428.01	5
Food, Beverage, and Tobacco Manufacturing	\$519,520.52	\$134,731.14	\$68,827.28	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$44,738.19	\$24,725.48	\$12,529.50	0
Wood, Furniture, and Related Product Manufacturing	\$5,869.96	\$2,058.10	\$1,467.55	0
Paper Manufacturing	\$897.39	\$397.01	\$179.34	0
Printing and Related Support Activities	\$224,750.84	\$105,481.50	\$68,849.88	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,424,214.22	\$215,034.37	\$100,971.00	1
Plastics and Rubber Products Manufacturing	\$2,294.67	\$995.36	\$581.68	0
Nonmetallic Mineral Product Manufacturing	\$64,040.47	\$36,162.25	\$18,913.07	0
Primary Metal Manufacturing	\$1,675.86	\$447.81	\$333.60	0
Fabricated Metal Product Manufacturing	\$207,020.99	\$74,541.56	\$48,123.79	1
Machinery Manufacturing	\$25,957.07	\$10,235.34	\$7,312.49	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,392.28	\$1,235.74	\$738.80	0
Transportation Equipment Manufacturing	\$93,066.74	\$30,881.30	\$20,149.13	0
Miscellaneous Manufacturing	\$63,008.76	\$25,102.56	\$18,450.91	0
Transportation and Utilities	\$3,032,809.07	\$1,210,139.59	\$707,647.14	8
Information	\$518,452.58	\$318,344.37	\$138,313.20	1
Wholesale Trade	\$665,947.27	\$450,688.97	\$259,871.44	3
Retail Trade (including Restaurants)	\$5,754,985.99	\$4,301,141.58	\$2,497,515.87	75
Finance, Insurance, & Real Estate	\$5,890,648.81	\$1,628,389.28	\$585,170.68	6
Business Services	\$926,650.08	\$559,203.67	\$456,166.90	5
Health Services	\$1,363,601.10	\$953,745.74	\$806,401.39	13
Other Services	\$15,189,042.82	\$9,461,901.35	\$8,121,547.83	189
<b>TOTAL</b>	<b>\$37,657,800.44</b>	<b>\$20,301,484.78</b>	<b>\$14,531,318.49</b>	<b>313</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2010				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$412,339.66	\$128,620.64	\$82,896.61	1
Mining	\$178,330.48	\$42,476.35	\$20,510.32	0
Construction	\$1,352,334.89	\$726,535.12	\$598,709.61	8
Total Manufacturing	\$3,181,844.46	\$786,160.05	\$436,320.77	6
Food, Beverage, and Tobacco Manufacturing	\$616,930.61	\$159,993.23	\$81,732.40	1
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$53,126.60	\$29,361.51	\$14,878.78	0
Wood, Furniture, and Related Product Manufacturing	\$6,970.58	\$2,443.99	\$1,742.71	0
Paper Manufacturing	\$1,065.65	\$471.44	\$212.96	0
Printing and Related Support Activities	\$266,891.62	\$125,259.28	\$81,759.23	1
Petroleum, Coal Products, and Chemical Manufacturing	\$1,691,254.38	\$255,353.32	\$119,903.06	1
Plastics and Rubber Products Manufacturing	\$2,724.92	\$1,182.00	\$690.75	0
Nonmetallic Mineral Product Manufacturing	\$76,048.06	\$42,942.67	\$22,459.27	0
Primary Metal Manufacturing	\$1,990.09	\$531.77	\$396.15	0
Fabricated Metal Product Manufacturing	\$245,837.42	\$88,518.11	\$57,147.00	1
Machinery Manufacturing	\$30,824.02	\$12,154.46	\$8,683.58	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$2,840.83	\$1,467.44	\$877.32	0
Transportation Equipment Manufacturing	\$110,516.76	\$36,671.55	\$23,927.09	0
Miscellaneous Manufacturing	\$74,822.91	\$29,809.29	\$21,910.46	0
Transportation and Utilities	\$3,601,460.78	\$1,437,040.76	\$840,330.98	9
Information	\$615,662.43	\$378,033.94	\$164,246.93	2
Wholesale Trade	\$790,812.39	\$535,193.15	\$308,597.33	3
Retail Trade (including Restaurants)	\$6,834,045.86	\$5,107,605.63	\$2,965,800.10	89
Finance, Insurance, & Real Estate	\$6,995,145.46	\$1,933,712.27	\$694,890.18	7
Business Services	\$1,100,396.97	\$664,054.35	\$541,698.19	6
Health Services	\$1,619,276.31	\$1,132,573.07	\$957,601.65	15
Other Services	\$18,036,988.35	\$11,236,007.85	\$9,644,338.05	224
<b>TOTAL</b>	<b>\$44,718,638.03</b>	<b>\$24,108,013.18</b>	<b>\$17,255,940.70</b>	<b>372</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2011				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$592,466.98	\$184,807.56	\$119,109.33	2
Mining	\$256,232.75	\$61,031.81	\$29,470.09	0
Construction	\$1,943,091.70	\$1,043,916.25	\$860,251.18	12
Total Manufacturing	\$4,571,808.09	\$1,129,587.87	\$626,924.05	8
Food, Beverage, and Tobacco Manufacturing	\$886,431.88	\$229,885.01	\$117,436.55	2
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$76,334.54	\$42,187.85	\$21,378.46	1
Wood, Furniture, and Related Product Manufacturing	\$10,015.62	\$3,511.62	\$2,504.00	0
Paper Manufacturing	\$1,531.16	\$677.39	\$306.00	0
Printing and Related Support Activities	\$383,481.11	\$179,977.80	\$117,475.10	2
Petroleum, Coal Products, and Chemical Manufacturing	\$2,430,065.51	\$366,902.40	\$172,281.77	1
Plastics and Rubber Products Manufacturing	\$3,915.29	\$1,698.34	\$992.50	0
Nonmetallic Mineral Product Manufacturing	\$109,269.05	\$61,701.84	\$32,270.43	0
Primary Metal Manufacturing	\$2,859.44	\$764.07	\$569.21	0
Fabricated Metal Product Manufacturing	\$353,229.56	\$127,186.54	\$82,111.21	1
Machinery Manufacturing	\$44,289.25	\$17,464.05	\$12,476.93	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$4,081.83	\$2,108.48	\$1,260.57	0
Transportation Equipment Manufacturing	\$158,795.13	\$52,691.23	\$34,379.45	0
Miscellaneous Manufacturing	\$107,508.70	\$42,831.25	\$31,481.87	0
Transportation and Utilities	\$5,174,730.48	\$2,064,800.67	\$1,207,422.93	13
Information	\$884,609.71	\$543,175.08	\$235,996.90	2
Wholesale Trade	\$1,136,272.54	\$768,988.06	\$443,405.64	5
Retail Trade (including Restaurants)	\$9,819,444.85	\$7,338,822.82	\$4,261,386.46	129
Finance, Insurance, & Real Estate	\$10,050,919.52	\$2,778,439.21	\$998,447.47	10
Business Services	\$1,581,096.70	\$954,141.25	\$778,334.77	9
Health Services	\$2,326,644.38	\$1,627,328.67	\$1,375,922.37	22
Other Services	\$25,916,304.31	\$16,144,369.17	\$13,857,390.98	322
TOTAL	\$64,253,622.01	\$34,639,408.41	\$24,794,062.17	534
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2012				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$677,105.12	\$211,208.64	\$136,124.95	2
Mining	\$292,837.43	\$69,750.64	\$33,680.10	0
Construction	\$2,220,676.23	\$1,193,047.14	\$983,144.20	14
Total Manufacturing	\$5,224,923.53	\$1,290,957.56	\$716,484.63	9
Food, Beverage, and Tobacco Manufacturing	\$1,013,065.01	\$262,725.73	\$134,213.21	2
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$87,239.48	\$48,214.68	\$24,432.53	1
Wood, Furniture, and Related Product Manufacturing	\$11,446.42	\$4,013.29	\$2,861.72	0
Paper Manufacturing	\$1,749.90	\$774.16	\$349.71	0
Printing and Related Support Activities	\$438,264.13	\$205,688.92	\$134,257.26	2
Petroleum, Coal Products, and Chemical Manufacturing	\$2,777,217.72	\$419,317.03	\$196,893.45	1
Plastics and Rubber Products Manufacturing	\$4,474.61	\$1,940.96	\$1,134.28	0
Nonmetallic Mineral Product Manufacturing	\$124,878.92	\$70,516.38	\$36,880.49	1
Primary Metal Manufacturing	\$3,267.94	\$873.22	\$650.52	0
Fabricated Metal Product Manufacturing	\$403,690.93	\$145,356.05	\$93,841.38	1
Machinery Manufacturing	\$50,616.29	\$19,958.91	\$14,259.35	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$4,664.95	\$2,409.70	\$1,440.65	0
Transportation Equipment Manufacturing	\$181,480.15	\$60,218.54	\$39,290.80	0
Miscellaneous Manufacturing	\$122,867.09	\$48,950.00	\$35,979.28	0
Transportation and Utilities	\$5,913,977.70	\$2,359,772.19	\$1,379,911.92	15
Information	\$1,010,982.52	\$620,771.52	\$269,710.75	3
Wholesale Trade	\$1,298,597.18	\$878,843.50	\$506,749.30	6
Retail Trade (including Restaurants)	\$11,222,222.68	\$8,387,226.08	\$4,870,155.95	147
Finance, Insurance, & Real Estate	\$11,486,765.17	\$3,175,359.09	\$1,141,082.82	12
Business Services	\$1,806,967.66	\$1,090,447.15	\$889,525.45	11
Health Services	\$2,659,022.14	\$1,859,804.19	\$1,572,482.71	25
Other Services	\$29,618,633.50	\$18,450,707.63	\$15,837,018.27	368
<b>TOTAL</b>	<b>\$73,432,710.86</b>	<b>\$39,587,895.33</b>	<b>\$28,336,071.05</b>	<b>611</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2013				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$742,211.38	\$231,517.16	\$149,213.89	2
Mining	\$320,994.87	\$76,457.43	\$36,918.57	0
Construction	\$2,434,202.79	\$1,307,763.21	\$1,077,677.30	15
Total Manufacturing	\$5,727,320.02	\$1,415,088.10	\$785,377.38	10
Food, Beverage, and Tobacco Manufacturing	\$1,110,475.11	\$287,987.81	\$147,118.32	2
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$95,627.89	\$52,850.71	\$26,781.81	1
Wood, Furniture, and Related Product Manufacturing	\$12,547.04	\$4,399.18	\$3,136.88	0
Paper Manufacturing	\$1,918.16	\$848.60	\$383.33	0
Printing and Related Support Activities	\$480,404.91	\$225,466.70	\$147,166.61	2
Petroleum, Coal Products, and Chemical Manufacturing	\$3,044,257.89	\$459,635.97	\$215,825.52	2
Plastics and Rubber Products Manufacturing	\$4,904.86	\$2,127.59	\$1,243.35	0
Nonmetallic Mineral Product Manufacturing	\$136,886.51	\$77,296.80	\$40,426.69	1
Primary Metal Manufacturing	\$3,582.16	\$957.19	\$713.07	0
Fabricated Metal Product Manufacturing	\$442,507.36	\$159,332.59	\$102,864.59	2
Machinery Manufacturing	\$55,483.24	\$21,878.03	\$15,630.45	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,113.50	\$2,641.40	\$1,579.18	0
Transportation Equipment Manufacturing	\$198,930.17	\$66,008.79	\$43,068.76	0
Miscellaneous Manufacturing	\$134,681.23	\$53,656.73	\$39,438.83	0
Transportation and Utilities	\$6,482,629.40	\$2,586,673.36	\$1,512,595.76	17
Information	\$1,108,192.38	\$680,461.09	\$295,644.47	3
Wholesale Trade	\$1,423,462.30	\$963,347.68	\$555,475.20	6
Retail Trade (including Restaurants)	\$12,301,282.55	\$9,193,690.13	\$5,338,440.18	161
Finance, Insurance, & Real Estate	\$12,591,261.82	\$3,480,682.08	\$1,250,802.32	13
Business Services	\$1,980,714.55	\$1,195,297.83	\$975,056.74	12
Health Services	\$2,914,697.35	\$2,038,631.52	\$1,723,682.97	28
Other Services	\$32,466,579.02	\$20,224,814.13	\$17,359,808.49	403
TOTAL	\$80,493,548.45	\$43,394,423.73	\$31,060,693.26	669
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2014				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$837,700.57	\$261,302.99	\$168,411.00	2
Mining	\$362,292.46	\$86,294.06	\$41,668.33	0
Construction	\$2,747,375.08	\$1,476,013.45	\$1,216,325.84	17
Total Manufacturing	\$6,464,168.21	\$1,597,146.21	\$886,420.08	11
Food, Beverage, and Tobacco Manufacturing	\$1,253,343.25	\$325,038.88	\$166,045.82	3
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$107,930.89	\$59,650.22	\$30,227.42	1
Wood, Furniture, and Related Product Manufacturing	\$14,161.28	\$4,965.15	\$3,540.46	0
Paper Manufacturing	\$2,164.94	\$957.78	\$432.65	0
Printing and Related Support Activities	\$542,211.39	\$254,474.11	\$166,100.33	3
Petroleum, Coal Products, and Chemical Manufacturing	\$3,435,916.79	\$518,770.43	\$243,592.54	2
Plastics and Rubber Products Manufacturing	\$5,535.90	\$2,401.32	\$1,403.31	0
Nonmetallic Mineral Product Manufacturing	\$154,497.64	\$87,241.42	\$45,627.78	1
Primary Metal Manufacturing	\$4,043.02	\$1,080.33	\$804.81	0
Fabricated Metal Product Manufacturing	\$499,438.14	\$179,831.52	\$116,098.63	2
Machinery Manufacturing	\$62,621.43	\$24,692.75	\$17,641.38	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,771.38	\$2,981.23	\$1,782.35	0
Transportation Equipment Manufacturing	\$224,523.52	\$74,501.15	\$48,609.77	0
Miscellaneous Manufacturing	\$152,008.64	\$60,559.93	\$44,512.83	0
Transportation and Utilities	\$7,316,651.89	\$2,919,461.75	\$1,707,198.72	19
Information	\$1,250,766.84	\$768,005.80	\$333,680.60	3
Wholesale Trade	\$1,606,597.80	\$1,087,287.15	\$626,939.84	7
Retail Trade (including Restaurants)	\$13,883,903.70	\$10,376,504.07	\$6,025,257.05	182
Finance, Insurance, & Real Estate	\$14,211,190.24	\$3,928,489.13	\$1,411,724.26	14
Business Services	\$2,235,543.32	\$1,349,078.84	\$1,100,502.64	13
Health Services	\$3,289,687.65	\$2,300,911.60	\$1,945,443.35	31
Other Services	\$36,643,565.80	\$22,826,837.00	\$19,593,234.14	455
<b>TOTAL</b>	<b>\$90,849,443.57</b>	<b>\$48,977,332.04</b>	<b>\$35,056,805.85</b>	<b>755</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2015				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$826,849.52	\$257,918.24	\$166,229.51	2
Mining	\$357,599.55	\$85,176.26	\$41,128.58	0
Construction	\$2,711,787.32	\$1,456,894.10	\$1,200,570.32	16
Total Manufacturing	\$6,380,435.46	\$1,576,457.79	\$874,937.96	11
Food, Beverage, and Tobacco Manufacturing	\$1,237,108.23	\$320,828.53	\$163,894.97	3
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$106,532.82	\$58,877.55	\$29,835.87	1
Wood, Furniture, and Related Product Manufacturing	\$13,977.84	\$4,900.84	\$3,494.60	0
Paper Manufacturing	\$2,136.90	\$945.37	\$427.05	0
Printing and Related Support Activities	\$535,187.93	\$251,177.81	\$163,948.77	3
Petroleum, Coal Products, and Chemical Manufacturing	\$3,391,410.10	\$512,050.60	\$240,437.20	2
Plastics and Rubber Products Manufacturing	\$5,464.19	\$2,370.21	\$1,385.13	0
Nonmetallic Mineral Product Manufacturing	\$152,496.37	\$86,111.35	\$45,036.75	1
Primary Metal Manufacturing	\$3,990.65	\$1,066.34	\$794.39	0
Fabricated Metal Product Manufacturing	\$492,968.73	\$177,502.10	\$114,594.76	2
Machinery Manufacturing	\$61,810.27	\$24,372.90	\$17,412.87	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,696.62	\$2,942.61	\$1,759.26	0
Transportation Equipment Manufacturing	\$221,615.18	\$73,536.11	\$47,980.11	0
Miscellaneous Manufacturing	\$150,039.62	\$59,775.48	\$43,936.24	0
Transportation and Utilities	\$7,221,876.61	\$2,881,644.89	\$1,685,084.75	19
Information	\$1,234,565.20	\$758,057.53	\$329,358.32	3
Wholesale Trade	\$1,585,786.95	\$1,073,203.12	\$618,818.86	7
Retail Trade (including Restaurants)	\$13,704,060.39	\$10,242,093.39	\$5,947,209.68	179
Finance, Insurance, & Real Estate	\$14,027,107.47	\$3,877,601.97	\$1,393,437.68	14
Business Services	\$2,206,585.51	\$1,331,603.73	\$1,086,247.42	13
Health Services	\$3,247,075.12	\$2,271,107.04	\$1,920,243.31	31
Other Services	\$36,168,908.21	\$22,531,152.58	\$19,339,435.77	449
<b>TOTAL</b>	<b>\$89,672,637.31</b>	<b>\$48,342,910.64</b>	<b>\$34,602,702.14</b>	<b>746</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2016				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$852,892.03	\$266,041.65	\$171,465.08	3
Mining	\$368,862.53	\$87,858.97	\$42,423.97	0
Construction	\$2,797,197.95	\$1,502,780.53	\$1,238,383.56	17
Total Manufacturing	\$6,581,394.06	\$1,626,110.01	\$902,495.06	12
Food, Beverage, and Tobacco Manufacturing	\$1,276,072.27	\$330,933.37	\$169,057.02	3
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$109,888.19	\$60,731.96	\$30,775.58	1
Wood, Furniture, and Related Product Manufacturing	\$14,418.09	\$5,055.20	\$3,604.66	0
Paper Manufacturing	\$2,204.20	\$975.14	\$440.50	0
Printing and Related Support Activities	\$552,044.24	\$259,088.93	\$169,112.51	3
Petroleum, Coal Products, and Chemical Manufacturing	\$3,498,226.17	\$528,178.18	\$248,010.02	2
Plastics and Rubber Products Manufacturing	\$5,636.29	\$2,444.86	\$1,428.76	0
Nonmetallic Mineral Product Manufacturing	\$157,299.41	\$88,823.52	\$46,455.23	1
Primary Metal Manufacturing	\$4,116.34	\$1,099.92	\$819.41	0
Fabricated Metal Product Manufacturing	\$508,495.30	\$183,092.72	\$118,204.05	2
Machinery Manufacturing	\$63,757.05	\$25,140.55	\$17,961.30	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,876.04	\$3,035.29	\$1,814.67	0
Transportation Equipment Manufacturing	\$228,595.19	\$75,852.20	\$49,491.29	0
Miscellaneous Manufacturing	\$154,765.28	\$61,658.17	\$45,320.06	0
Transportation and Utilities	\$7,449,337.29	\$2,972,405.36	\$1,738,158.28	19
Information	\$1,273,449.14	\$781,933.36	\$339,731.81	3
Wholesale Trade	\$1,635,732.99	\$1,107,004.79	\$638,309.22	7
Retail Trade (including Restaurants)	\$14,135,684.34	\$10,564,679.01	\$6,134,523.37	185
Finance, Insurance, & Real Estate	\$14,468,906.13	\$3,999,731.16	\$1,437,325.48	15
Business Services	\$2,276,084.26	\$1,373,544.00	\$1,120,459.94	13
Health Services	\$3,349,345.20	\$2,342,637.97	\$1,980,723.41	32
Other Services	\$37,308,086.42	\$23,240,795.19	\$19,948,551.86	463
<b>TOTAL</b>	<b>\$92,496,972.34</b>	<b>\$49,865,522.00</b>	<b>\$35,692,551.03</b>	<b>769</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2017				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$805,147.43	\$251,148.73	\$161,866.53	2
Mining	\$348,213.74	\$82,940.66	\$40,049.09	0
Construction	\$2,640,611.80	\$1,418,655.41	\$1,169,059.29	16
Total Manufacturing	\$6,212,969.97	\$1,535,080.95	\$851,973.71	11
Food, Beverage, and Tobacco Manufacturing	\$1,204,638.20	\$312,407.83	\$159,593.27	3
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$103,736.69	\$57,332.20	\$29,052.78	1
Wood, Furniture, and Related Product Manufacturing	\$13,610.97	\$4,772.21	\$3,402.88	0
Paper Manufacturing	\$2,080.81	\$920.56	\$415.84	0
Printing and Related Support Activities	\$521,141.00	\$244,585.22	\$159,645.65	3
Petroleum, Coal Products, and Chemical Manufacturing	\$3,302,396.71	\$498,610.95	\$234,126.51	2
Plastics and Rubber Products Manufacturing	\$5,320.77	\$2,308.00	\$1,348.78	0
Nonmetallic Mineral Product Manufacturing	\$148,493.84	\$83,851.21	\$43,854.68	1
Primary Metal Manufacturing	\$3,885.91	\$1,038.35	\$773.54	0
Fabricated Metal Product Manufacturing	\$480,029.92	\$172,843.25	\$111,587.03	2
Machinery Manufacturing	\$60,187.96	\$23,733.19	\$16,955.83	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,547.10	\$2,865.37	\$1,713.08	0
Transportation Equipment Manufacturing	\$215,798.51	\$71,606.02	\$46,720.79	0
Miscellaneous Manufacturing	\$146,101.57	\$58,206.57	\$42,783.05	0
Transportation and Utilities	\$7,032,326.04	\$2,806,011.16	\$1,640,856.80	18
Information	\$1,202,161.91	\$738,161.01	\$320,713.74	3
Wholesale Trade	\$1,544,165.24	\$1,045,035.06	\$602,576.90	7
Retail Trade (including Restaurants)	\$13,344,373.77	\$9,973,272.04	\$5,791,114.93	175
Finance, Insurance, & Real Estate	\$13,658,941.92	\$3,775,827.64	\$1,356,864.51	14
Business Services	\$2,148,669.88	\$1,296,653.50	\$1,057,736.99	13
Health Services	\$3,161,850.05	\$2,211,497.93	\$1,869,843.22	30
Other Services	\$35,219,593.03	\$21,939,783.75	\$18,831,839.03	437
<b>TOTAL</b>	<b>\$87,319,024.78</b>	<b>\$47,074,067.84</b>	<b>\$33,694,494.74</b>	<b>726</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Galveston County: 2018				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$748,722.01	\$233,548.01	\$150,522.78	2
Mining	\$323,810.62	\$77,128.11	\$37,242.42	0
Construction	\$2,455,555.45	\$1,319,234.82	\$1,087,130.61	15
Total Manufacturing	\$5,777,559.67	\$1,427,501.15	\$792,266.65	10
Food, Beverage, and Tobacco Manufacturing	\$1,120,216.12	\$290,514.02	\$148,408.83	2
Textile and Textile Product Mills	\$0.00	\$0.00	\$0.00	0
Apparel Manufacturing	\$96,466.73	\$53,314.31	\$27,016.73	1
Wood, Furniture, and Related Product Manufacturing	\$12,657.10	\$4,437.77	\$3,164.40	0
Paper Manufacturing	\$1,934.99	\$856.04	\$386.70	0
Printing and Related Support Activities	\$484,618.99	\$227,444.48	\$148,457.55	2
Petroleum, Coal Products, and Chemical Manufacturing	\$3,070,961.90	\$463,667.87	\$217,718.72	2
Plastics and Rubber Products Manufacturing	\$4,947.89	\$2,146.25	\$1,254.25	0
Nonmetallic Mineral Product Manufacturing	\$138,087.26	\$77,974.85	\$40,781.31	1
Primary Metal Manufacturing	\$3,613.58	\$965.58	\$719.33	0
Fabricated Metal Product Manufacturing	\$446,389.01	\$160,730.25	\$103,766.91	2
Machinery Manufacturing	\$55,969.93	\$22,069.95	\$15,767.56	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$5,158.36	\$2,664.57	\$1,593.03	0
Transportation Equipment Manufacturing	\$200,675.17	\$66,587.81	\$43,446.56	0
Miscellaneous Manufacturing	\$135,862.65	\$54,127.40	\$39,784.78	0
Transportation and Utilities	\$6,539,494.57	\$2,609,363.48	\$1,525,864.14	17
Information	\$1,117,913.37	\$686,430.05	\$298,237.85	3
Wholesale Trade	\$1,435,948.81	\$971,798.10	\$560,347.79	6
Retail Trade (including Restaurants)	\$12,409,188.54	\$9,274,336.54	\$5,385,268.60	162
Finance, Insurance, & Real Estate	\$12,701,711.49	\$3,511,214.38	\$1,261,774.28	13
Business Services	\$1,998,089.24	\$1,205,782.90	\$983,609.87	12
Health Services	\$2,940,264.87	\$2,056,514.25	\$1,738,802.99	28
Other Services	\$32,751,373.58	\$20,402,224.78	\$17,512,087.51	407
<b>TOTAL</b>	<b>\$81,199,632.21</b>	<b>\$43,775,076.57</b>	<b>\$31,333,155.48</b>	<b>675</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



## Houston-The Woodlands-Sugar Land Metropolitan Statistical Area



The Cumulative Impact of Research Activity Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Area				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$6,977,221	\$2,176,397	\$1,402,698	21
Mining	\$11,129,652	\$2,542,343	\$1,287,269	6
Construction	\$23,094,020	\$12,401,918	\$10,219,953	141
Total Manufacturing	\$75,685,793	\$21,095,454	\$11,909,685	164
Food, Beverage, and Tobacco Manufacturing	\$18,946,601	\$4,913,115	\$2,509,863	40
Textile and Textile Product Mills	\$52,129	\$10,770	\$9,124	0
Apparel Manufacturing	\$1,146,812	\$633,814	\$321,164	8
Wood, Furniture, and Related Product Manufacturing	\$735,882	\$258,066	\$183,986	3
Paper Manufacturing	\$2,231,916	\$987,485	\$446,427	7
Printing and Related Support Activities	\$6,689,382	\$3,141,379	\$2,050,451	34
Petroleum, Coal Products, and Chemical Manufacturing	\$28,896,581	\$4,363,073	\$2,048,715	14
Plastics and Rubber Products Manufacturing	\$3,005,653	\$1,303,128	\$761,800	14
Nonmetallic Mineral Product Manufacturing	\$1,525,969	\$861,546	\$450,593	6
Primary Metal Manufacturing	\$877,472	\$234,583	\$174,611	2
Fabricated Metal Product Manufacturing	\$4,203,173	\$1,513,380	\$977,049	15
Machinery Manufacturing	\$2,594,983	\$1,023,461	\$731,172	7
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$676,267	\$349,557	\$208,972	1
Transportation Equipment Manufacturing	\$1,870,060	\$620,521	\$404,872	4
Miscellaneous Manufacturing	\$2,232,911	\$881,575	\$630,886	8
Transportation and Utilities	\$73,149,390	\$28,199,237	\$16,296,657	175
Information	\$14,305,817	\$8,788,621	\$3,800,412	35
Wholesale Trade	\$24,171,136	\$16,358,136	\$9,432,236	105
Retail Trade (including Restaurants)	\$115,639,250	\$86,426,064	\$50,184,460	1,514
Finance, Insurance, & Real Estate	\$134,042,986	\$37,201,553	\$12,938,020	130
Business Services	\$33,180,524	\$20,439,049	\$16,673,019	198
Health Services	\$27,399,860	\$19,164,328	\$16,203,628	262
Other Services	\$305,578,194	\$190,357,328	\$163,373,039	3,793
<b>TOTAL</b>	<b>\$844,353,841</b>	<b>\$445,150,428</b>	<b>\$313,721,075</b>	<b>6,543</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Area: 2008				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$134,552.94	\$41,970.95	\$27,050.47	0
Mining	\$214,630.92	\$49,028.08	\$24,824.46	0
Construction	\$445,359.02	\$239,166.06	\$197,087.75	3
Total Manufacturing	\$1,459,570.49	\$406,817.46	\$229,673.56	3
Food, Beverage, and Tobacco Manufacturing	\$365,377.69	\$94,747.48	\$48,401.72	1
Textile and Textile Product Mills	\$1,005.30	\$207.69	\$175.96	0
Apparel Manufacturing	\$22,115.81	\$12,222.85	\$6,193.53	0
Wood, Furniture, and Related Product Manufacturing	\$14,191.20	\$4,976.70	\$3,548.09	0
Paper Manufacturing	\$43,041.61	\$19,043.26	\$8,609.17	0
Printing and Related Support Activities	\$129,002.09	\$60,580.24	\$39,542.14	1
Petroleum, Coal Products, and Chemical Manufacturing	\$557,259.11	\$84,140.14	\$39,508.65	0
Plastics and Rubber Products Manufacturing	\$57,962.83	\$25,130.32	\$14,691.02	0
Nonmetallic Mineral Product Manufacturing	\$29,427.72	\$16,614.57	\$8,689.51	0
Primary Metal Manufacturing	\$16,921.69	\$4,523.84	\$3,367.30	0
Fabricated Metal Product Manufacturing	\$81,056.53	\$29,184.93	\$18,842.00	0
Machinery Manufacturing	\$50,043.23	\$19,737.04	\$14,100.37	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$13,041.54	\$6,741.07	\$4,029.95	0
Transportation Equipment Manufacturing	\$36,063.36	\$11,966.51	\$7,807.79	0
Miscellaneous Manufacturing	\$43,060.80	\$17,000.82	\$12,166.38	0
Transportation and Utilities	\$1,410,656.97	\$543,811.11	\$314,274.57	3
Information	\$275,882.00	\$169,485.08	\$73,289.44	1
Wholesale Trade	\$466,130.77	\$315,460.16	\$181,896.94	2
Retail Trade (including Restaurants)	\$2,230,057.07	\$1,666,692.36	\$967,787.40	29
Finance, Insurance, & Real Estate	\$2,584,965.82	\$717,417.20	\$249,504.58	2
Business Services	\$639,873.25	\$394,158.95	\$321,532.56	4
Health Services	\$528,395.43	\$369,576.47	\$312,480.54	5
Other Services	\$5,892,954.28	\$3,670,965.59	\$3,150,584.26	73
TOTAL	\$16,283,028.96	\$8,584,549.46	\$6,049,986.52	126
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Area: 2009				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$347,233.39	\$108,312.12	\$69,807.67	1
Mining	\$553,886.26	\$126,524.08	\$64,063.13	0
Construction	\$1,149,313.61	\$617,202.75	\$508,613.54	7
Total Manufacturing	\$3,766,633.53	\$1,049,851.51	\$592,705.95	8
Food, Beverage, and Tobacco Manufacturing	\$942,910.16	\$244,509.63	\$124,907.66	2
Textile and Textile Product Mills	\$2,594.31	\$535.98	\$454.09	0
Apparel Manufacturing	\$57,073.06	\$31,542.83	\$15,983.29	0
Wood, Furniture, and Related Product Manufacturing	\$36,622.45	\$12,843.10	\$9,156.36	0
Paper Manufacturing	\$111,075.11	\$49,143.89	\$22,217.21	0
Printing and Related Support Activities	\$332,908.61	\$156,336.11	\$102,044.23	2
Petroleum, Coal Products, and Chemical Manufacturing	\$1,438,088.02	\$217,135.85	\$101,957.80	1
Plastics and Rubber Products Manufacturing	\$149,581.50	\$64,852.43	\$37,912.30	1
Nonmetallic Mineral Product Manufacturing	\$75,942.49	\$42,876.32	\$22,424.54	0
Primary Metal Manufacturing	\$43,668.89	\$11,674.41	\$8,689.81	0
Fabricated Metal Product Manufacturing	\$209,178.15	\$75,315.95	\$48,624.52	1
Machinery Manufacturing	\$129,143.81	\$50,934.29	\$36,388.04	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$33,655.58	\$17,396.32	\$10,399.86	0
Transportation Equipment Manufacturing	\$93,066.74	\$30,881.30	\$20,149.13	0
Miscellaneous Manufacturing	\$111,124.65	\$43,873.10	\$31,397.12	0
Transportation and Utilities	\$3,640,405.09	\$1,403,383.50	\$811,031.14	9
Information	\$711,953.54	\$437,380.85	\$189,134.03	2
Wholesale Trade	\$1,202,918.11	\$814,090.73	\$469,411.45	5
Retail Trade (including Restaurants)	\$5,754,985.99	\$4,301,141.58	\$2,497,515.87	75
Finance, Insurance, & Real Estate	\$6,670,879.54	\$1,851,399.23	\$643,882.79	6
Business Services	\$1,651,285.79	\$1,017,184.37	\$829,761.46	10
Health Services	\$1,363,601.10	\$953,745.74	\$806,401.39	13
Other Services	\$15,207,623.95	\$9,473,459.58	\$8,130,540.02	189
<b>TOTAL</b>	<b>\$42,020,719.91</b>	<b>\$22,153,676.03</b>	<b>\$15,612,868.44</b>	<b>326</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2010**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$412,339.66	\$128,620.64	\$82,896.61	1
Mining	\$657,739.93	\$150,247.34	\$76,074.97	0
Construction	\$1,364,809.91	\$732,928.26	\$603,978.57	8
<b>Total Manufacturing</b>	<b>\$4,472,877.32</b>	<b>\$1,246,698.67</b>	<b>\$703,838.31</b>	<b>10</b>
Food, Beverage, and Tobacco Manufacturing	\$1,119,705.81	\$290,355.19	\$148,327.84	2
Textile and Textile Product Mills	\$3,080.75	\$636.48	\$539.23	0
Apparel Manufacturing	\$67,774.26	\$37,457.11	\$18,980.16	0
Wood, Furniture, and Related Product Manufacturing	\$43,489.16	\$15,251.18	\$10,873.18	0
Paper Manufacturing	\$131,901.70	\$58,358.37	\$26,382.93	0
Printing and Related Support Activities	\$395,328.97	\$185,649.13	\$121,177.53	2
Petroleum, Coal Products, and Chemical Manufacturing	\$1,707,729.52	\$257,848.82	\$121,074.89	1
Plastics and Rubber Products Manufacturing	\$177,628.03	\$77,012.26	\$45,020.86	1
Nonmetallic Mineral Product Manufacturing	\$90,181.71	\$50,915.63	\$26,629.14	0
Primary Metal Manufacturing	\$51,856.81	\$13,863.37	\$10,319.15	0
Fabricated Metal Product Manufacturing	\$248,399.05	\$89,437.69	\$57,741.61	1
Machinery Manufacturing	\$153,358.27	\$60,484.47	\$43,210.80	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$39,966.00	\$20,658.13	\$12,349.84	0
Transportation Equipment Manufacturing	\$110,516.76	\$36,671.55	\$23,927.09	0
Miscellaneous Manufacturing	\$131,960.52	\$52,099.30	\$37,284.07	0
<b>Transportation and Utilities</b>	<b>\$4,322,981.04</b>	<b>\$1,666,517.90</b>	<b>\$963,099.48</b>	<b>10</b>
<b>Information</b>	<b>\$845,444.83</b>	<b>\$519,389.75</b>	<b>\$224,596.66</b>	<b>2</b>
<b>Wholesale Trade</b>	<b>\$1,428,465.25</b>	<b>\$966,732.75</b>	<b>\$557,426.09</b>	<b>6</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$6,834,045.86</b>	<b>\$5,107,605.63</b>	<b>\$2,965,800.10</b>	<b>89</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$7,921,669.46</b>	<b>\$2,198,536.58</b>	<b>\$764,610.81</b>	<b>8</b>
<b>Business Services</b>	<b>\$1,960,901.88</b>	<b>\$1,207,906.44</b>	<b>\$985,341.73</b>	<b>12</b>
<b>Health Services</b>	<b>\$1,619,276.31</b>	<b>\$1,132,573.07</b>	<b>\$957,601.65</b>	<b>15</b>
<b>Other Services</b>	<b>\$18,059,053.44</b>	<b>\$11,249,733.25</b>	<b>\$9,655,016.27</b>	<b>224</b>
<b>TOTAL</b>	<b>\$49,899,604.89</b>	<b>\$26,307,490.29</b>	<b>\$18,540,281.27</b>	<b>387</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2011**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$592,466.98	\$184,807.56	\$119,109.33	2
Mining	\$945,068.42	\$215,881.71	\$109,307.72	1
Construction	\$1,961,016.34	\$1,053,102.19	\$867,821.85	12
<b>Total Manufacturing</b>	<b>\$6,426,818.46</b>	<b>\$1,791,309.14</b>	<b>\$1,011,304.53</b>	<b>14</b>
Food, Beverage, and Tobacco Manufacturing	\$1,608,840.45	\$417,194.56	\$213,123.69	3
Textile and Textile Product Mills	\$4,426.55	\$914.52	\$774.79	0
Apparel Manufacturing	\$97,380.91	\$53,819.95	\$27,271.49	1
Wood, Furniture, and Related Product Manufacturing	\$62,487.06	\$21,913.54	\$15,623.04	0
Paper Manufacturing	\$189,521.91	\$83,851.76	\$37,908.11	1
Printing and Related Support Activities	\$568,025.31	\$266,748.49	\$174,112.97	3
Petroleum, Coal Products, and Chemical Manufacturing	\$2,453,737.68	\$370,488.04	\$173,965.49	1
Plastics and Rubber Products Manufacturing	\$255,223.43	\$110,654.45	\$64,687.86	1
Nonmetallic Mineral Product Manufacturing	\$129,576.88	\$73,157.72	\$38,261.87	1
Primary Metal Manufacturing	\$74,510.04	\$19,919.47	\$14,826.98	0
Fabricated Metal Product Manufacturing	\$356,910.22	\$128,507.83	\$82,965.58	1
Machinery Manufacturing	\$220,351.63	\$86,906.63	\$62,087.10	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$57,424.83	\$29,682.46	\$17,744.77	0
Transportation Equipment Manufacturing	\$158,795.13	\$52,691.23	\$34,379.45	0
Miscellaneous Manufacturing	\$189,606.44	\$74,858.47	\$53,571.33	1
<b>Transportation and Utilities</b>	<b>\$6,211,441.18</b>	<b>\$2,394,523.09</b>	<b>\$1,383,821.88</b>	<b>15</b>
<b>Information</b>	<b>\$1,214,770.73</b>	<b>\$746,281.07</b>	<b>\$322,709.94</b>	<b>3</b>
<b>Wholesale Trade</b>	<b>\$2,052,479.02</b>	<b>\$1,389,042.31</b>	<b>\$800,933.28</b>	<b>9</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$9,819,444.85</b>	<b>\$7,338,822.82</b>	<b>\$4,261,386.46</b>	<b>129</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$11,382,188.22</b>	<b>\$3,158,949.93</b>	<b>\$1,098,625.01</b>	<b>11</b>
<b>Business Services</b>	<b>\$2,817,506.39</b>	<b>\$1,735,570.84</b>	<b>\$1,415,780.48</b>	<b>17</b>
<b>Health Services</b>	<b>\$2,326,644.38</b>	<b>\$1,627,328.67</b>	<b>\$1,375,922.37</b>	<b>22</b>
<b>Other Services</b>	<b>\$25,948,008.37</b>	<b>\$16,164,090.40</b>	<b>\$13,872,733.91</b>	<b>322</b>
<b>TOTAL</b>	<b>\$71,697,853.34</b>	<b>\$37,799,709.73</b>	<b>\$26,639,456.77</b>	<b>556</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2012**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$677,105.12	\$211,208.64	\$136,124.95	2
Mining	\$1,080,078.20	\$246,721.95	\$124,923.11	1
Construction	\$2,241,161.53	\$1,203,545.35	\$991,796.40	14
<b>Total Manufacturing</b>	<b>\$7,344,935.39</b>	<b>\$2,047,210.45</b>	<b>\$1,155,776.60</b>	<b>16</b>
Food, Beverage, and Tobacco Manufacturing	\$1,838,674.81	\$476,793.78	\$243,569.93	4
Textile and Textile Product Mills	\$5,058.91	\$1,045.16	\$885.48	0
Apparel Manufacturing	\$111,292.47	\$61,508.52	\$31,167.42	1
Wood, Furniture, and Related Product Manufacturing	\$71,413.78	\$25,044.05	\$17,854.90	0
Paper Manufacturing	\$216,596.47	\$95,830.58	\$43,323.55	1
Printing and Related Support Activities	\$649,171.78	\$304,855.42	\$198,986.26	3
Petroleum, Coal Products, and Chemical Manufacturing	\$2,804,271.63	\$423,414.91	\$198,817.71	1
Plastics and Rubber Products Manufacturing	\$291,683.92	\$126,462.23	\$73,928.99	1
Nonmetallic Mineral Product Manufacturing	\$148,087.86	\$83,608.83	\$43,727.85	1
Primary Metal Manufacturing	\$85,154.33	\$22,765.11	\$16,945.12	0
Fabricated Metal Product Manufacturing	\$407,897.39	\$146,866.10	\$94,817.81	1
Machinery Manufacturing	\$251,830.43	\$99,321.87	\$70,956.69	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$65,628.38	\$33,922.82	\$20,279.73	0
Transportation Equipment Manufacturing	\$181,480.15	\$60,218.54	\$39,290.80	0
Miscellaneous Manufacturing	\$216,693.07	\$85,552.54	\$61,224.38	1
<b>Transportation and Utilities</b>	<b>\$7,098,789.92</b>	<b>\$2,736,597.82</b>	<b>\$1,581,510.73</b>	<b>17</b>
<b>Information</b>	<b>\$1,388,309.41</b>	<b>\$852,892.65</b>	<b>\$368,811.36</b>	<b>3</b>
<b>Wholesale Trade</b>	<b>\$2,345,690.31</b>	<b>\$1,587,476.93</b>	<b>\$915,352.32</b>	<b>10</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$11,222,222.68</b>	<b>\$8,387,226.08</b>	<b>\$4,870,155.95</b>	<b>147</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$13,008,215.11</b>	<b>\$3,610,228.49</b>	<b>\$1,255,571.44</b>	<b>13</b>
<b>Business Services</b>	<b>\$3,220,007.30</b>	<b>\$1,983,509.53</b>	<b>\$1,618,034.84</b>	<b>19</b>
<b>Health Services</b>	<b>\$2,659,022.14</b>	<b>\$1,859,804.19</b>	<b>\$1,572,482.71</b>	<b>25</b>
<b>Other Services</b>	<b>\$29,654,866.71</b>	<b>\$18,473,246.18</b>	<b>\$15,854,553.04</b>	<b>368</b>
<b>TOTAL</b>	<b>\$81,940,403.82</b>	<b>\$43,199,668.26</b>	<b>\$30,445,093.45</b>	<b>635</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2013**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$742,211.38	\$231,517.16	\$149,213.89	2
Mining	\$1,183,931.87	\$270,445.22	\$136,934.95	1
Construction	\$2,456,657.84	\$1,319,270.87	\$1,087,161.43	15
<b>Total Manufacturing</b>	<b>\$8,051,179.17</b>	<b>\$2,244,057.60</b>	<b>\$1,266,908.97</b>	<b>17</b>
Food, Beverage, and Tobacco Manufacturing	\$2,015,470.46	\$522,639.34	\$266,990.12	4
Textile and Textile Product Mills	\$5,545.34	\$1,145.66	\$970.62	0
Apparel Manufacturing	\$121,993.67	\$67,422.80	\$34,164.29	1
Wood, Furniture, and Related Product Manufacturing	\$78,280.50	\$27,452.13	\$19,571.72	0
Paper Manufacturing	\$237,423.05	\$105,045.06	\$47,489.28	1
Printing and Related Support Activities	\$711,592.15	\$334,168.44	\$218,119.55	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,073,913.13	\$464,127.88	\$217,934.79	2
Plastics and Rubber Products Manufacturing	\$319,730.45	\$138,622.06	\$81,037.54	2
Nonmetallic Mineral Product Manufacturing	\$162,327.08	\$91,648.14	\$47,932.45	1
Primary Metal Manufacturing	\$93,342.25	\$24,954.06	\$18,574.46	0
Fabricated Metal Product Manufacturing	\$447,118.29	\$160,987.84	\$103,934.91	2
Machinery Manufacturing	\$276,044.89	\$108,872.05	\$77,779.44	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$71,938.80	\$37,184.63	\$22,229.71	0
Transportation Equipment Manufacturing	\$198,930.17	\$66,008.79	\$43,068.76	0
Miscellaneous Manufacturing	\$237,528.94	\$93,778.74	\$67,111.33	1
Transportation and Utilities	\$7,781,365.87	\$2,999,732.23	\$1,733,579.06	19
Information	\$1,521,800.70	\$934,901.56	\$404,273.99	4
Wholesale Trade	\$2,571,237.46	\$1,740,118.94	\$1,003,366.97	11
Retail Trade (including Restaurants)	\$12,301,282.55	\$9,193,690.13	\$5,338,440.18	161
Finance, Insurance, & Real Estate	\$14,259,005.02	\$3,957,365.85	\$1,376,299.47	14
Business Services	\$3,529,623.39	\$2,174,231.60	\$1,773,615.11	21
Health Services	\$2,914,697.35	\$2,038,631.52	\$1,723,682.97	28
Other Services	\$32,506,296.20	\$20,249,519.85	\$17,379,029.29	403
<b>TOTAL</b>	<b>\$89,819,288.80</b>	<b>\$47,353,482.52</b>	<b>\$33,372,506.29</b>	<b>696</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2014**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$837,700.57	\$261,302.99	\$168,411.00	2
Mining	\$1,336,250.59	\$305,239.34	\$154,552.31	1
Construction	\$2,772,719.08	\$1,489,001.62	\$1,227,030.16	17
Total Manufacturing	\$9,087,003.39	\$2,532,766.77	\$1,429,903.10	20
Food, Beverage, and Tobacco Manufacturing	\$2,274,770.75	\$589,879.49	\$301,339.72	5
Textile and Textile Product Mills	\$6,258.78	\$1,293.05	\$1,095.50	0
Apparel Manufacturing	\$137,688.76	\$76,097.08	\$38,559.69	1
Wood, Furniture, and Related Product Manufacturing	\$88,351.67	\$30,983.98	\$22,089.71	0
Paper Manufacturing	\$267,968.71	\$118,559.63	\$53,599.01	1
Printing and Related Support Activities	\$803,142.01	\$377,160.87	\$246,181.71	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,469,387.34	\$523,840.24	\$245,973.19	2
Plastics and Rubber Products Manufacturing	\$360,865.36	\$156,456.48	\$91,463.43	2
Nonmetallic Mineral Product Manufacturing	\$183,211.26	\$103,439.13	\$54,099.20	1
Primary Metal Manufacturing	\$105,351.20	\$28,164.52	\$20,964.16	0
Fabricated Metal Product Manufacturing	\$504,642.29	\$181,699.72	\$117,306.65	2
Machinery Manufacturing	\$311,559.44	\$122,878.98	\$87,786.16	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$81,194.09	\$41,968.61	\$25,089.67	0
Transportation Equipment Manufacturing	\$224,523.52	\$74,501.15	\$48,609.77	0
Miscellaneous Manufacturing	\$268,088.22	\$105,843.84	\$75,745.54	1
Transportation and Utilities	\$8,782,477.27	\$3,385,662.69	\$1,956,612.63	21
Information	\$1,717,587.92	\$1,055,181.29	\$456,285.85	4
Wholesale Trade	\$2,902,039.94	\$1,963,993.89	\$1,132,455.12	13
Retail Trade (including Restaurants)	\$13,883,903.70	\$10,376,504.07	\$6,025,257.05	182
Finance, Insurance, & Real Estate	\$16,093,496.90	\$4,466,500.64	\$1,553,367.23	16
Business Services	\$3,983,726.98	\$2,453,957.30	\$2,001,799.51	24
Health Services	\$3,289,687.65	\$2,300,911.60	\$1,945,443.35	31
Other Services	\$36,688,392.79	\$22,854,721.23	\$19,614,927.80	455
<b>TOTAL</b>	<b>\$101,374,986.77</b>	<b>\$53,445,743.43</b>	<b>\$37,666,045.11</b>	<b>786</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2015**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$826,849.52	\$257,918.24	\$166,229.51	2
Mining	\$1,318,941.64	\$301,285.46	\$152,550.34	1
Construction	\$2,736,803.03	\$1,469,714.04	\$1,211,135.98	17
Total Manufacturing	\$8,969,296.10	\$2,499,958.91	\$1,411,381.04	19
Food, Beverage, and Tobacco Manufacturing	\$2,245,304.81	\$582,238.56	\$297,436.36	5
Textile and Textile Product Mills	\$6,177.71	\$1,276.30	\$1,081.31	0
Apparel Manufacturing	\$135,905.22	\$75,111.37	\$38,060.21	1
Wood, Furniture, and Related Product Manufacturing	\$87,207.22	\$30,582.63	\$21,803.58	0
Paper Manufacturing	\$264,497.61	\$117,023.88	\$52,904.72	1
Printing and Related Support Activities	\$792,738.62	\$372,275.36	\$242,992.83	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,424,447.09	\$517,054.74	\$242,787.01	2
Plastics and Rubber Products Manufacturing	\$356,190.94	\$154,429.84	\$90,278.67	2
Nonmetallic Mineral Product Manufacturing	\$180,838.06	\$102,099.24	\$53,398.43	1
Primary Metal Manufacturing	\$103,986.54	\$27,799.70	\$20,692.60	0
Fabricated Metal Product Manufacturing	\$498,105.47	\$179,346.10	\$115,787.13	2
Machinery Manufacturing	\$307,523.70	\$121,287.28	\$86,649.03	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$80,142.35	\$41,424.98	\$24,764.67	0
Transportation Equipment Manufacturing	\$221,615.18	\$73,536.11	\$47,980.11	0
Miscellaneous Manufacturing	\$264,615.57	\$104,472.81	\$74,764.38	1
Transportation and Utilities	\$8,668,714.61	\$3,341,806.95	\$1,931,267.90	21
Information	\$1,695,339.38	\$1,041,513.14	\$450,375.41	4
Wholesale Trade	\$2,864,448.74	\$1,938,553.56	\$1,117,786.01	12
Retail Trade (including Restaurants)	\$13,704,060.39	\$10,242,093.39	\$5,947,209.68	179
Finance, Insurance, & Real Estate	\$15,885,031.91	\$4,408,644.41	\$1,533,245.90	15
Business Services	\$3,932,124.30	\$2,422,170.29	\$1,975,869.47	24
Health Services	\$3,247,075.12	\$2,271,107.04	\$1,920,243.31	31
Other Services	\$36,213,154.54	\$22,558,675.62	\$19,360,848.42	449
<b>TOTAL</b>	<b>\$100,061,839.28</b>	<b>\$52,753,441.05</b>	<b>\$37,178,142.97</b>	<b>775</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Area: 2016**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$852,892.03	\$266,041.65	\$171,465.08	3
Mining	\$1,360,483.11	\$310,774.77	\$157,355.07	1
Construction	\$2,823,001.55	\$1,516,004.24	\$1,249,282.00	17
Total Manufacturing	\$9,251,793.61	\$2,578,697.77	\$1,455,833.99	20
Food, Beverage, and Tobacco Manufacturing	\$2,316,023.07	\$600,576.78	\$306,804.43	5
Textile and Textile Product Mills	\$6,372.28	\$1,316.50	\$1,115.36	0
Apparel Manufacturing	\$140,185.70	\$77,477.08	\$39,258.96	1
Wood, Furniture, and Related Product Manufacturing	\$89,953.90	\$31,545.87	\$22,490.30	0
Paper Manufacturing	\$272,828.25	\$120,709.67	\$54,571.01	1
Printing and Related Support Activities	\$817,706.76	\$384,000.57	\$250,646.15	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,532,303.69	\$533,339.93	\$250,433.84	2
Plastics and Rubber Products Manufacturing	\$367,409.55	\$159,293.78	\$93,122.09	2
Nonmetallic Mineral Product Manufacturing	\$186,533.75	\$105,314.97	\$55,080.27	1
Primary Metal Manufacturing	\$107,261.71	\$28,675.28	\$21,344.34	0
Fabricated Metal Product Manufacturing	\$513,793.83	\$184,994.79	\$119,433.97	2
Machinery Manufacturing	\$317,209.48	\$125,107.35	\$89,378.13	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$82,666.52	\$42,729.70	\$25,544.66	0
Transportation Equipment Manufacturing	\$228,595.19	\$75,852.20	\$49,491.29	0
Miscellaneous Manufacturing	\$272,949.92	\$107,763.29	\$77,119.17	1
Transportation and Utilities	\$8,941,745.00	\$3,447,060.72	\$1,992,095.24	21
Information	\$1,748,735.89	\$1,074,316.70	\$464,560.46	4
Wholesale Trade	\$2,954,667.60	\$1,999,610.36	\$1,152,991.87	13
Retail Trade (including Restaurants)	\$14,135,684.34	\$10,564,679.01	\$6,134,523.37	185
Finance, Insurance, & Real Estate	\$16,385,347.88	\$4,547,499.35	\$1,581,537.11	16
Business Services	\$4,055,970.73	\$2,498,459.12	\$2,038,101.58	24
Health Services	\$3,349,345.20	\$2,342,637.97	\$1,980,723.41	32
Other Services	\$37,353,726.33	\$23,269,185.09	\$19,970,638.92	464
<b>TOTAL</b>	<b>\$103,213,393.27</b>	<b>\$54,414,966.76</b>	<b>\$38,349,108.10</b>	<b>800</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2017**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$805,147.43	\$251,148.73	\$161,866.53	2
Mining	\$1,284,323.75	\$293,377.71	\$148,546.39	1
Construction	\$2,664,970.93	\$1,431,138.87	\$1,179,347.64	16
<b>Total Manufacturing</b>	<b>\$8,733,881.50</b>	<b>\$2,434,343.19</b>	<b>\$1,374,336.92</b>	<b>19</b>
Food, Beverage, and Tobacco Manufacturing	\$2,186,372.93	\$566,956.71	\$289,629.63	5
Textile and Textile Product Mills	\$6,015.56	\$1,242.80	\$1,052.92	0
Apparel Manufacturing	\$132,338.16	\$73,139.94	\$37,061.26	1
Wood, Furniture, and Related Product Manufacturing	\$84,918.31	\$29,779.94	\$21,231.31	0
Paper Manufacturing	\$257,555.42	\$113,952.39	\$51,516.15	1
Printing and Related Support Activities	\$771,931.83	\$362,504.36	\$236,615.07	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,334,566.59	\$503,483.75	\$236,414.64	2
Plastics and Rubber Products Manufacturing	\$346,842.09	\$150,376.57	\$87,909.15	2
Nonmetallic Mineral Product Manufacturing	\$176,091.65	\$99,419.47	\$51,996.90	1
Primary Metal Manufacturing	\$101,257.24	\$27,070.05	\$20,149.49	0
Fabricated Metal Product Manufacturing	\$485,031.83	\$174,638.85	\$112,748.10	2
Machinery Manufacturing	\$299,452.21	\$118,103.89	\$84,374.78	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$78,038.88	\$40,337.71	\$24,114.68	0
Transportation Equipment Manufacturing	\$215,798.51	\$71,606.02	\$46,720.79	0
Miscellaneous Manufacturing	\$257,670.28	\$101,730.74	\$72,802.06	1
<b>Transportation and Utilities</b>	<b>\$8,441,189.30</b>	<b>\$3,254,095.49</b>	<b>\$1,880,578.46</b>	<b>20</b>
<b>Information</b>	<b>\$1,650,842.28</b>	<b>\$1,014,176.83</b>	<b>\$438,554.53</b>	<b>4</b>
<b>Wholesale Trade</b>	<b>\$2,789,266.36</b>	<b>\$1,887,672.89</b>	<b>\$1,088,447.80</b>	<b>12</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$13,344,373.77</b>	<b>\$9,973,272.04</b>	<b>\$5,791,114.93</b>	<b>175</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$15,468,101.94</b>	<b>\$4,292,931.96</b>	<b>\$1,493,003.22</b>	<b>15</b>
<b>Business Services</b>	<b>\$3,828,918.94</b>	<b>\$2,358,596.27</b>	<b>\$1,924,009.38</b>	<b>23</b>
<b>Health Services</b>	<b>\$3,161,850.05</b>	<b>\$2,211,497.93</b>	<b>\$1,869,843.22</b>	<b>30</b>
<b>Other Services</b>	<b>\$35,262,678.04</b>	<b>\$21,966,584.39</b>	<b>\$18,852,689.67</b>	<b>438</b>
<b>TOTAL</b>	<b>\$97,435,544.28</b>	<b>\$51,368,836.30</b>	<b>\$36,202,338.69</b>	<b>755</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Annual Impact of Operations and Research Activity Associated with the Galveston  
National Laboratory on Business Activity in the  
Houston-The Woodlands-Sugar Land Metropolitan Area: 2018**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$748,722.01	\$233,548.01	\$150,522.78	2
Mining	\$1,194,317.24	\$272,817.54	\$138,136.13	1
Construction	\$2,478,207.47	\$1,330,843.42	\$1,096,697.94	15
<b>Total Manufacturing</b>	<b>\$8,121,803.55</b>	<b>\$2,263,742.32</b>	<b>\$1,278,022.20</b>	<b>18</b>
Food, Beverage, and Tobacco Manufacturing	\$2,033,150.03	\$527,223.89	\$269,332.13	4
Textile and Textile Product Mills	\$5,593.99	\$1,155.71	\$979.13	0
Apparel Manufacturing	\$123,063.79	\$68,014.23	\$34,463.97	1
Wood, Furniture, and Related Product Manufacturing	\$78,967.17	\$27,692.94	\$19,743.40	0
Paper Manufacturing	\$239,505.71	\$105,966.51	\$47,905.85	1
Printing and Related Support Activities	\$717,834.18	\$337,099.74	\$220,032.88	4
Petroleum, Coal Products, and Chemical Manufacturing	\$3,100,877.29	\$468,199.18	\$219,846.50	2
Plastics and Rubber Products Manufacturing	\$322,535.10	\$139,838.05	\$81,748.40	2
Nonmetallic Mineral Product Manufacturing	\$163,751.00	\$92,452.07	\$48,352.91	1
Primary Metal Manufacturing	\$94,161.04	\$25,172.95	\$18,737.40	0
Fabricated Metal Product Manufacturing	\$451,040.38	\$162,400.01	\$104,846.62	2
Machinery Manufacturing	\$278,466.34	\$109,827.07	\$78,461.72	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$72,569.85	\$37,510.81	\$22,424.70	0
Transportation Equipment Manufacturing	\$200,675.17	\$66,587.81	\$43,446.56	0
Miscellaneous Manufacturing	\$239,612.53	\$94,601.36	\$67,700.03	1
Transportation and Utilities	\$7,849,623.47	\$3,026,045.67	\$1,748,785.90	19
Information	\$1,535,149.83	\$943,102.45	\$407,820.25	4
Wholesale Trade	\$2,593,792.17	\$1,755,383.14	\$1,012,168.44	11
Retail Trade (including Restaurants)	\$12,409,188.54	\$9,274,336.54	\$5,385,268.60	162
Finance, Insurance, & Real Estate	\$14,384,084.01	\$3,992,079.58	\$1,388,372.27	14
Business Services	\$3,560,584.99	\$2,193,303.81	\$1,789,173.14	21
Health Services	\$2,940,264.87	\$2,056,514.25	\$1,738,802.99	28
Other Services	\$32,791,439.15	\$20,427,147.21	\$17,531,476.92	407
<b>TOTAL</b>	<b>\$90,607,177.30</b>	<b>\$47,768,863.95</b>	<b>\$33,665,247.57</b>	<b>702</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



Texas

The Cumulative Impact of Operations and Research Activity Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in Texas				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$15,185,179	\$4,534,191	\$3,004,414	46
Mining	\$12,346,872	\$2,872,180	\$1,602,558	8
Construction	\$23,547,278	\$12,634,187	\$10,411,361	143
Total Manufacturing	\$113,825,936	\$35,211,418	\$19,669,003	304
Food, Beverage, and Tobacco Manufacturing	\$34,701,445	\$8,996,843	\$4,596,010	75
Textile and Textile Product Mills	\$440,579	\$91,337	\$77,285	1
Apparel Manufacturing	\$7,079,055	\$3,912,497	\$1,982,521	54
Wood, Furniture, and Related Product Manufacturing	\$1,812,168	\$635,509	\$453,075	9
Paper Manufacturing	\$5,209,970	\$2,305,079	\$1,042,103	15
Printing and Related Support Activities	\$10,011,349	\$4,707,276	\$3,072,543	50
Petroleum, Coal Products, and Chemical Manufacturing	\$29,495,173	\$4,453,707	\$2,091,277	14
Plastics and Rubber Products Manufacturing	\$4,183,804	\$1,813,633	\$1,060,239	21
Nonmetallic Mineral Product Manufacturing	\$2,553,888	\$1,441,439	\$753,872	11
Primary Metal Manufacturing	\$1,706,669	\$456,595	\$339,866	5
Fabricated Metal Product Manufacturing	\$4,296,262	\$1,546,812	\$998,627	16
Machinery Manufacturing	\$2,654,525	\$1,047,316	\$748,205	8
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$3,279,622	\$1,695,820	\$1,013,825	8
Transportation Equipment Manufacturing	\$3,547,964	\$983,294	\$640,606	7
Miscellaneous Manufacturing	\$2,853,464	\$1,124,261	\$798,947	11
Transportation and Utilities	\$75,155,482	\$28,891,977	\$16,679,942	178
Information	\$19,844,624	\$12,194,510	\$5,256,982	47
Wholesale Trade	\$28,188,544	\$19,076,920	\$10,999,918	122
Retail Trade (including Restaurants)	\$122,976,512	\$91,945,705	\$53,396,032	1,608
Finance, Insurance, & Real Estate	\$145,107,209	\$39,855,304	\$13,567,539	136
Business Services	\$33,942,138	\$20,887,366	\$17,038,743	203
Health Services	\$28,835,764	\$20,182,087	\$17,064,134	276
Other Services	\$307,862,284	\$191,509,292	\$164,287,118	3,811
<b>TOTAL</b>	<b>\$926,817,821</b>	<b>\$479,795,137</b>	<b>\$332,977,746</b>	<b>6,882</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



2008

62 0.0192846

<b>The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2008</b>				
	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$292,840.16	\$87,440.08	\$57,938.94	1
Mining	\$238,104.52	\$55,388.85	\$30,904.69	0
Construction	\$454,099.91	\$243,645.29	\$200,778.98	3
<b>Total Manufacturing</b>	<b>\$2,195,088.03</b>	<b>\$679,038.24</b>	<b>\$379,308.93</b>	<b>6</b>
Food, Beverage, and Tobacco Manufacturing	\$669,203.60	\$173,500.55	\$88,632.24	1
Textile and Textile Product Mills	\$8,496.39	\$1,761.40	\$1,490.42	0
Apparel Manufacturing	\$136,516.77	\$75,450.95	\$38,232.14	1
Wood, Furniture, and Related Product Manufacturing	\$34,946.93	\$12,255.54	\$8,737.38	0
Paper Manufacturing	\$100,472.21	\$44,452.54	\$20,096.55	0
Printing and Related Support Activities	\$193,064.90	\$90,777.95	\$59,252.77	1
Petroleum, Coal Products, and Chemical Manufacturing	\$568,802.72	\$85,887.97	\$40,329.45	0
Plastics and Rubber Products Manufacturing	\$80,683.00	\$34,975.19	\$20,446.29	0
Nonmetallic Mineral Product Manufacturing	\$49,250.72	\$27,797.57	\$14,538.13	0
Primary Metal Manufacturing	\$32,912.43	\$8,805.25	\$6,554.18	0
Fabricated Metal Product Manufacturing	\$82,851.70	\$29,829.65	\$19,258.12	0
Machinery Manufacturing	\$51,191.45	\$20,197.07	\$14,428.84	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$63,246.20	\$32,703.22	\$19,551.22	0
Transportation Equipment Manufacturing	\$68,421.08	\$18,962.44	\$12,353.84	0
Miscellaneous Manufacturing	\$55,027.92	\$21,680.93	\$15,407.37	0
Transportation and Utilities	\$1,449,343.67	\$557,170.32	\$321,666.07	3
Information	\$382,695.70	\$235,166.29	\$101,378.82	1
Wholesale Trade	\$543,604.89	\$367,890.84	\$212,129.05	2
Retail Trade (including Restaurants)	\$2,371,553.26	\$1,773,136.45	\$1,029,721.31	31
Finance, Insurance, & Real Estate	\$2,798,334.98	\$768,593.73	\$261,644.61	3
Business Services	\$654,560.68	\$402,804.57	\$328,585.40	4
Health Services	\$556,086.28	\$389,203.54	\$329,075.05	5
Other Services	\$5,937,002.05	\$3,693,180.74	\$3,168,211.93	73
<b>TOTAL</b>	<b>\$17,873,314.13</b>	<b>\$9,252,658.94</b>	<b>\$6,421,343.78</b>	<b>133</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2009				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$755,716.54	\$225,651.81	\$149,519.83	2
Mining	\$614,463.29	\$142,938.97	\$79,754.05	0
Construction	\$1,171,870.73	\$628,762.05	\$518,139.29	7
Total Manufacturing	\$5,664,743.31	\$1,752,356.74	\$978,861.75	15
Food, Beverage, and Tobacco Manufacturing	\$1,726,977.03	\$447,743.35	\$228,728.36	4
Textile and Textile Product Mills	\$21,926.16	\$4,545.54	\$3,846.24	0
Apparel Manufacturing	\$352,301.34	\$194,712.14	\$98,663.58	3
Wood, Furniture, and Related Product Manufacturing	\$90,185.64	\$31,627.20	\$22,548.07	0
Paper Manufacturing	\$259,283.13	\$114,716.23	\$51,862.06	1
Printing and Related Support Activities	\$498,232.01	\$234,265.67	\$152,910.37	3
Petroleum, Coal Products, and Chemical Manufacturing	\$1,467,877.98	\$221,646.38	\$104,076.00	1
Plastics and Rubber Products Manufacturing	\$208,214.18	\$90,258.56	\$52,764.62	1
Nonmetallic Mineral Product Manufacturing	\$127,098.64	\$71,735.68	\$37,517.74	1
Primary Metal Manufacturing	\$84,935.30	\$22,723.24	\$16,914.00	0
Fabricated Metal Product Manufacturing	\$213,810.85	\$76,979.75	\$49,698.37	1
Machinery Manufacturing	\$132,106.98	\$52,121.47	\$37,235.72	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$163,216.01	\$84,395.42	\$50,454.76	0
Transportation Equipment Manufacturing	\$176,570.53	\$48,935.33	\$31,880.88	0
Miscellaneous Manufacturing	\$142,007.53	\$55,950.79	\$39,760.96	1
Transportation and Utilities	\$3,740,241.72	\$1,437,858.89	\$830,105.99	9
Information	\$987,601.82	\$606,880.75	\$261,622.76	2
Wholesale Trade	\$1,402,851.33	\$949,395.72	\$547,429.80	6
Retail Trade (including Restaurants)	\$6,120,137.44	\$4,575,836.01	\$2,657,345.32	80
Finance, Insurance, & Real Estate	\$7,221,509.62	\$1,983,467.69	\$675,211.90	7
Business Services	\$1,689,188.84	\$1,039,495.67	\$847,962.33	10
Health Services	\$1,435,061.36	\$1,004,396.23	\$849,225.94	14
Other Services	\$15,321,295.62	\$9,530,789.00	\$8,176,030.78	190
TOTAL	\$46,124,681.61	\$23,877,829.52	\$16,571,209.76	342
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2010				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$897,413.40	\$267,961.52	\$177,554.80	3
Mining	\$729,675.15	\$169,740.03	\$94,707.93	0
Construction	\$1,391,596.50	\$746,654.93	\$615,290.41	8
Total Manufacturing	\$6,726,882.68	\$2,080,923.63	\$1,162,398.32	18
Food, Beverage, and Tobacco Manufacturing	\$2,050,785.22	\$531,695.23	\$271,614.92	4
Textile and Textile Product Mills	\$26,037.31	\$5,397.83	\$4,567.41	0
Apparel Manufacturing	\$418,357.84	\$231,220.67	\$117,163.01	3
Wood, Furniture, and Related Product Manufacturing	\$107,095.44	\$37,557.30	\$26,775.83	1
Paper Manufacturing	\$307,898.72	\$136,225.52	\$61,586.20	1
Printing and Related Support Activities	\$591,650.51	\$278,190.48	\$181,581.06	3
Petroleum, Coal Products, and Chemical Manufacturing	\$1,743,105.10	\$263,205.08	\$123,590.25	1
Plastics and Rubber Products Manufacturing	\$247,254.34	\$107,182.04	\$62,657.99	1
Nonmetallic Mineral Product Manufacturing	\$150,929.64	\$85,186.12	\$44,552.32	1
Primary Metal Manufacturing	\$100,860.67	\$26,983.85	\$20,085.38	0
Fabricated Metal Product Manufacturing	\$253,900.38	\$91,413.46	\$59,016.82	1
Machinery Manufacturing	\$156,877.04	\$61,894.24	\$44,217.42	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$193,819.01	\$100,219.56	\$59,915.03	0
Transportation Equipment Manufacturing	\$209,677.50	\$58,110.71	\$37,858.54	0
Miscellaneous Manufacturing	\$168,633.95	\$66,441.56	\$47,216.14	1
Transportation and Utilities	\$4,441,537.04	\$1,707,457.43	\$985,750.86	11
Information	\$1,172,777.16	\$720,670.88	\$310,677.03	3
Wholesale Trade	\$1,665,885.96	\$1,127,407.41	\$650,072.89	7
Retail Trade (including Restaurants)	\$7,267,663.20	\$5,433,805.26	\$3,155,597.56	95
Finance, Insurance, & Real Estate	\$8,575,542.67	\$2,355,367.88	\$801,814.13	8
Business Services	\$2,005,911.75	\$1,234,401.11	\$1,006,955.27	12
Health Services	\$1,704,135.36	\$1,192,720.52	\$1,008,455.81	16
Other Services	\$18,194,038.55	\$11,317,811.94	\$9,709,036.55	225
TOTAL	\$54,773,059.42	\$28,354,922.56	\$19,678,311.58	407
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2011				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,289,441.35	\$385,018.40	\$255,118.22	4
Mining	\$1,048,427.98	\$243,889.62	\$136,080.35	1
Construction	\$1,999,504.44	\$1,072,825.25	\$884,075.17	12
Total Manufacturing	\$9,665,468.27	\$2,989,958.70	\$1,670,182.85	26
Food, Beverage, and Tobacco Manufacturing	\$2,946,654.56	\$763,962.10	\$390,267.76	6
Textile and Textile Product Mills	\$37,411.51	\$7,755.83	\$6,562.65	0
Apparel Manufacturing	\$601,114.16	\$332,227.59	\$168,344.74	5
Wood, Furniture, and Related Product Manufacturing	\$153,879.24	\$53,963.91	\$38,472.65	1
Paper Manufacturing	\$442,401.84	\$195,734.56	\$88,489.64	1
Printing and Related Support Activities	\$850,108.36	\$399,715.79	\$260,903.31	4
Petroleum, Coal Products, and Chemical Manufacturing	\$2,504,566.81	\$378,184.14	\$177,579.67	1
Plastics and Rubber Products Manufacturing	\$355,265.45	\$154,003.67	\$90,029.63	2
Nonmetallic Mineral Product Manufacturing	\$216,862.06	\$122,399.00	\$64,014.65	1
Primary Metal Manufacturing	\$144,920.85	\$38,771.53	\$28,859.52	0
Fabricated Metal Product Manufacturing	\$364,814.75	\$131,346.70	\$84,797.85	1
Machinery Manufacturing	\$225,407.53	\$88,932.25	\$63,533.45	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$278,487.32	\$143,999.68	\$86,088.44	1
Transportation Equipment Manufacturing	\$301,273.47	\$83,495.91	\$54,396.75	1
Miscellaneous Manufacturing	\$242,300.35	\$95,466.03	\$67,842.14	1
Transportation and Utilities	\$6,381,787.44	\$2,453,346.73	\$1,416,368.35	15
Information	\$1,685,095.60	\$1,035,490.27	\$446,393.84	4
Wholesale Trade	\$2,393,615.08	\$1,619,906.44	\$934,052.10	10
Retail Trade (including Restaurants)	\$10,442,484.50	\$7,807,520.19	\$4,534,095.44	137
Finance, Insurance, & Real Estate	\$12,321,700.78	\$3,384,291.75	\$1,152,080.31	12
Business Services	\$2,882,178.46	\$1,773,639.49	\$1,446,835.73	17
Health Services	\$2,448,573.44	\$1,713,751.07	\$1,448,991.77	23
Other Services	\$26,141,960.66	\$16,261,908.73	\$13,950,352.52	324
<b>TOTAL</b>	<b>\$78,700,238.00</b>	<b>\$40,741,546.63</b>	<b>\$28,274,626.64</b>	<b>584</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2012				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,473,647.26	\$440,021.03	\$291,563.67	4
Mining	\$1,198,203.41	\$278,731.00	\$155,520.40	1
Construction	\$2,285,147.93	\$1,226,086.00	\$1,010,371.62	14
Total Manufacturing	\$11,046,249.45	\$3,417,095.65	\$1,908,780.40	29
Food, Beverage, and Tobacco Manufacturing	\$3,367,605.21	\$873,099.54	\$446,020.30	7
Textile and Textile Product Mills	\$42,756.01	\$8,863.80	\$7,500.18	0
Apparel Manufacturing	\$686,987.62	\$379,688.68	\$192,393.99	5
Wood, Furniture, and Related Product Manufacturing	\$175,861.99	\$61,673.04	\$43,968.74	1
Paper Manufacturing	\$505,602.10	\$223,696.64	\$101,131.02	1
Printing and Related Support Activities	\$971,552.41	\$456,818.05	\$298,175.22	5
Petroleum, Coal Products, and Chemical Manufacturing	\$2,862,362.06	\$432,210.45	\$202,948.19	1
Plastics and Rubber Products Manufacturing	\$406,017.66	\$176,004.19	\$102,891.01	2
Nonmetallic Mineral Product Manufacturing	\$247,842.36	\$139,884.57	\$73,159.60	1
Primary Metal Manufacturing	\$165,623.83	\$44,310.31	\$32,982.31	0
Fabricated Metal Product Manufacturing	\$416,931.15	\$150,110.52	\$96,911.83	2
Machinery Manufacturing	\$257,608.61	\$101,636.86	\$72,609.65	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$318,271.22	\$164,571.07	\$98,386.79	1
Transportation Equipment Manufacturing	\$344,312.53	\$95,423.90	\$62,167.72	1
Miscellaneous Manufacturing	\$276,914.69	\$109,104.03	\$77,533.87	1
Transportation and Utilities	\$7,293,471.36	\$2,803,824.83	\$1,618,706.68	17
Information	\$1,925,823.54	\$1,183,417.45	\$510,164.39	5
Wholesale Trade	\$2,735,560.10	\$1,851,321.65	\$1,067,488.12	12
Retail Trade (including Restaurants)	\$11,934,268.00	\$8,922,880.21	\$5,181,823.37	156
Finance, Insurance, & Real Estate	\$14,081,943.75	\$3,867,761.99	\$1,316,663.21	13
Business Services	\$3,293,918.25	\$2,027,016.55	\$1,653,526.55	20
Health Services	\$2,798,369.64	\$1,958,572.65	\$1,655,990.59	27
Other Services	\$29,876,526.47	\$18,585,038.55	\$15,943,260.02	370
TOTAL	\$89,943,129.15	\$46,561,767.57	\$32,313,859.02	668
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2013				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,615,344.11	\$482,330.74	\$319,598.64	5
Mining	\$1,313,415.27	\$305,532.05	\$170,474.28	1
Construction	\$2,504,873.69	\$1,343,978.88	\$1,107,522.74	15
Total Manufacturing	\$12,108,388.82	\$3,745,662.54	\$2,092,316.98	32
Food, Beverage, and Tobacco Manufacturing	\$3,691,413.40	\$957,051.42	\$488,906.86	8
Textile and Textile Product Mills	\$46,867.16	\$9,716.09	\$8,221.35	0
Apparel Manufacturing	\$753,044.12	\$416,197.20	\$210,893.41	6
Wood, Furniture, and Related Product Manufacturing	\$192,771.80	\$67,603.14	\$48,196.50	1
Paper Manufacturing	\$554,217.69	\$245,205.93	\$110,855.16	2
Printing and Related Support Activities	\$1,064,970.91	\$500,742.86	\$326,845.91	5
Petroleum, Coal Products, and Chemical Manufacturing	\$3,137,589.19	\$473,769.15	\$222,462.44	2
Plastics and Rubber Products Manufacturing	\$445,057.81	\$192,927.67	\$112,784.38	2
Nonmetallic Mineral Product Manufacturing	\$271,673.35	\$153,335.01	\$80,194.18	1
Primary Metal Manufacturing	\$181,549.20	\$48,570.92	\$36,153.69	0
Fabricated Metal Product Manufacturing	\$457,020.68	\$164,544.22	\$106,230.27	2
Machinery Manufacturing	\$282,378.67	\$111,409.64	\$79,591.35	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$348,874.23	\$180,395.21	\$107,847.06	1
Transportation Equipment Manufacturing	\$377,419.51	\$104,599.27	\$68,145.38	1
Miscellaneous Manufacturing	\$303,541.10	\$119,594.80	\$84,989.05	1
Transportation and Utilities	\$7,994,766.68	\$3,073,423.37	\$1,774,351.55	19
Information	\$2,110,998.88	\$1,297,207.59	\$559,218.66	5
Wholesale Trade	\$2,998,594.72	\$2,029,333.34	\$1,170,131.21	13
Retail Trade (including Restaurants)	\$13,081,793.77	\$9,780,849.47	\$5,680,075.61	171
Finance, Insurance, & Real Estate	\$15,435,976.81	\$4,239,662.19	\$1,443,265.44	15
Business Services	\$3,610,641.15	\$2,221,921.99	\$1,812,519.49	22
Health Services	\$3,067,443.65	\$2,146,896.94	\$1,815,220.46	29
Other Services	\$32,749,269.40	\$20,372,061.49	\$17,476,265.79	405
<b>TOTAL</b>	<b>\$98,591,506.95</b>	<b>\$51,038,860.61</b>	<b>\$35,420,960.85</b>	<b>732</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2014				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,823,166.16	\$544,384.99	\$360,716.60	6
Mining	\$1,482,392.68	\$344,840.27	\$192,406.64	1
Construction	\$2,827,138.14	\$1,516,888.45	\$1,250,011.04	17
<b>Total Manufacturing</b>	<b>\$13,666,193.23</b>	<b>\$4,227,560.65</b>	<b>\$2,361,503.96</b>	<b>36</b>
Food, Beverage, and Tobacco Manufacturing	\$4,166,332.09	\$1,080,180.84	\$551,807.16	9
Textile and Textile Product Mills	\$52,896.86	\$10,966.12	\$9,279.06	0
Apparel Manufacturing	\$849,926.99	\$469,743.04	\$238,025.90	6
Wood, Furniture, and Related Product Manufacturing	\$217,572.85	\$76,300.62	\$54,397.22	1
Paper Manufacturing	\$625,520.55	\$276,752.90	\$125,117.22	2
Printing and Related Support Activities	\$1,201,984.71	\$565,165.92	\$368,896.26	6
Petroleum, Coal Products, and Chemical Manufacturing	\$3,541,255.63	\$534,721.90	\$251,083.34	2
Plastics and Rubber Products Manufacturing	\$502,316.71	\$217,748.78	\$127,294.65	2
Nonmetallic Mineral Product Manufacturing	\$306,625.48	\$173,062.32	\$90,511.56	1
Primary Metal Manufacturing	\$204,906.41	\$54,819.81	\$40,805.04	1
Fabricated Metal Product Manufacturing	\$515,818.66	\$185,713.65	\$119,897.32	2
Machinery Manufacturing	\$318,708.09	\$125,743.04	\$89,831.18	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$393,758.63	\$203,603.95	\$121,722.12	1
Transportation Equipment Manufacturing	\$425,976.40	\$118,056.49	\$76,912.62	1
Miscellaneous Manufacturing	\$342,593.17	\$134,981.27	\$95,923.32	1
<b>Transportation and Utilities</b>	<b>\$9,023,333.15</b>	<b>\$3,468,834.57</b>	<b>\$2,002,630.70</b>	<b>21</b>
<b>Information</b>	<b>\$2,382,589.38</b>	<b>\$1,464,099.80</b>	<b>\$631,164.92</b>	<b>6</b>
<b>Wholesale Trade</b>	<b>\$3,384,378.84</b>	<b>\$2,290,417.17</b>	<b>\$1,320,674.40</b>	<b>15</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$14,764,831.56</b>	<b>\$11,039,204.37</b>	<b>\$6,410,845.57</b>	<b>193</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$17,421,891.95</b>	<b>\$4,785,115.80</b>	<b>\$1,628,948.72</b>	<b>16</b>
<b>Business Services</b>	<b>\$4,075,168.09</b>	<b>\$2,507,783.30</b>	<b>\$2,045,709.13</b>	<b>24</b>
<b>Health Services</b>	<b>\$3,462,085.52</b>	<b>\$2,423,105.91</b>	<b>\$2,048,757.59</b>	<b>33</b>
<b>Other Services</b>	<b>\$36,962,625.69</b>	<b>\$22,993,028.47</b>	<b>\$19,724,674.26</b>	<b>458</b>
<b>TOTAL</b>	<b>\$111,275,794.39</b>	<b>\$57,605,263.73</b>	<b>\$39,978,043.53</b>	<b>826</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2015				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,799,550.02	\$537,333.37	\$356,044.10	5
Mining	\$1,463,190.70	\$340,373.43	\$189,914.33	1
Construction	\$2,790,517.18	\$1,497,239.63	\$1,233,819.19	17
Total Manufacturing	\$13,489,170.00	\$4,172,799.50	\$2,330,914.53	36
Food, Beverage, and Tobacco Manufacturing	\$4,112,364.05	\$1,066,188.86	\$544,659.40	9
Textile and Textile Product Mills	\$52,211.67	\$10,824.07	\$9,158.87	0
Apparel Manufacturing	\$838,917.57	\$463,658.29	\$234,942.66	6
Wood, Furniture, and Related Product Manufacturing	\$214,754.55	\$75,312.27	\$53,692.59	1
Paper Manufacturing	\$617,417.95	\$273,168.01	\$123,496.53	2
Printing and Related Support Activities	\$1,186,414.96	\$557,845.12	\$364,117.81	6
Petroleum, Coal Products, and Chemical Manufacturing	\$3,495,384.44	\$527,795.45	\$247,830.97	2
Plastics and Rubber Products Manufacturing	\$495,810.02	\$214,928.20	\$125,645.75	2
Nonmetallic Mineral Product Manufacturing	\$302,653.65	\$170,820.58	\$89,339.13	1
Primary Metal Manufacturing	\$202,252.18	\$54,109.71	\$40,276.47	1
Fabricated Metal Product Manufacturing	\$509,137.08	\$183,308.03	\$118,344.25	2
Machinery Manufacturing	\$314,579.74	\$124,114.24	\$88,667.56	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$388,658.13	\$200,966.59	\$120,145.41	1
Transportation Equipment Manufacturing	\$420,458.57	\$116,527.26	\$75,916.34	1
Miscellaneous Manufacturing	\$338,155.44	\$133,232.81	\$94,680.79	1
Transportation and Utilities	\$8,906,450.60	\$3,423,901.47	\$1,976,689.89	21
Information	\$2,351,726.82	\$1,445,134.77	\$622,989.21	6
Wholesale Trade	\$3,340,539.73	\$2,260,748.55	\$1,303,567.22	14
Retail Trade (including Restaurants)	\$14,573,577.27	\$10,896,209.49	\$6,327,803.53	191
Finance, Insurance, & Real Estate	\$17,196,219.77	\$4,723,132.44	\$1,607,848.34	16
Business Services	\$4,022,380.93	\$2,475,299.06	\$2,019,210.31	24
Health Services	\$3,417,239.85	\$2,391,718.52	\$2,022,219.28	33
Other Services	\$36,483,835.20	\$22,695,191.31	\$19,469,173.29	452
<b>TOTAL</b>	<b>\$109,834,398.09</b>	<b>\$56,859,081.56</b>	<b>\$39,460,193.23</b>	<b>816</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2016				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,856,228.76	\$554,257.26	\$367,258.09	6
Mining	\$1,509,275.44	\$351,093.85	\$195,895.88	1
Construction	\$2,878,407.49	\$1,544,396.78	\$1,272,679.63	17
Total Manufacturing	\$13,914,025.75	\$4,304,226.25	\$2,404,329.16	37
Food, Beverage, and Tobacco Manufacturing	\$4,241,887.33	\$1,099,769.61	\$561,814.03	9
Textile and Textile Product Mills	\$53,856.13	\$11,164.98	\$9,447.34	0
Apparel Manufacturing	\$865,340.17	\$478,261.70	\$242,342.43	7
Wood, Furniture, and Related Product Manufacturing	\$221,518.47	\$77,684.31	\$55,383.70	1
Paper Manufacturing	\$636,864.19	\$281,771.73	\$127,386.19	2
Printing and Related Support Activities	\$1,223,782.36	\$575,415.05	\$375,586.09	6
Petroleum, Coal Products, and Chemical Manufacturing	\$3,605,475.29	\$544,418.93	\$255,636.67	2
Plastics and Rubber Products Manufacturing	\$511,426.09	\$221,697.59	\$129,603.10	3
Nonmetallic Mineral Product Manufacturing	\$312,186.04	\$176,200.76	\$92,152.96	1
Primary Metal Manufacturing	\$208,622.33	\$55,813.95	\$41,545.02	1
Fabricated Metal Product Manufacturing	\$525,172.89	\$189,081.52	\$122,071.63	2
Machinery Manufacturing	\$324,487.77	\$128,023.35	\$91,460.24	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$400,899.33	\$207,296.25	\$123,929.51	1
Transportation Equipment Manufacturing	\$433,701.36	\$120,197.41	\$78,307.41	1
Miscellaneous Manufacturing	\$348,806.00	\$137,429.12	\$97,662.86	1
Transportation and Utilities	\$9,186,968.73	\$3,531,740.89	\$2,038,947.84	22
Information	\$2,425,796.96	\$1,490,650.83	\$642,610.92	6
Wholesale Trade	\$3,445,753.58	\$2,331,953.23	\$1,344,624.46	15
Retail Trade (including Restaurants)	\$15,032,587.58	\$11,239,397.19	\$6,527,104.43	197
Finance, Insurance, & Real Estate	\$17,737,833.00	\$4,871,892.51	\$1,658,489.24	17
Business Services	\$4,149,070.10	\$2,553,261.24	\$2,082,807.48	25
Health Services	\$3,524,869.46	\$2,467,048.24	\$2,085,911.23	34
Other Services	\$37,632,932.38	\$23,410,000.49	\$20,082,375.60	466
TOTAL	\$113,293,749.21	\$58,649,918.77	\$40,703,033.96	841
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2017				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,752,317.74	\$523,230.13	\$346,699.11	5
Mining	\$1,424,786.74	\$331,439.74	\$184,929.70	1
Construction	\$2,717,275.26	\$1,457,942.00	\$1,201,435.48	16
Total Manufacturing	\$13,135,123.54	\$4,063,277.20	\$2,269,735.67	35
Food, Beverage, and Tobacco Manufacturing	\$4,004,427.99	\$1,038,204.90	\$530,363.88	9
Textile and Textile Product Mills	\$50,841.28	\$10,539.97	\$8,918.48	0
Apparel Manufacturing	\$816,898.74	\$451,488.78	\$228,776.19	6
Wood, Furniture, and Related Product Manufacturing	\$209,117.95	\$73,335.57	\$52,283.34	1
Paper Manufacturing	\$601,212.75	\$265,998.25	\$120,255.16	2
Printing and Related Support Activities	\$1,155,275.46	\$543,203.52	\$354,560.91	6
Petroleum, Coal Products, and Chemical Manufacturing	\$3,403,642.07	\$513,942.55	\$241,326.22	2
Plastics and Rubber Products Manufacturing	\$482,796.64	\$209,287.04	\$122,347.96	2
Nonmetallic Mineral Product Manufacturing	\$294,709.98	\$166,337.10	\$86,994.27	1
Primary Metal Manufacturing	\$196,943.72	\$52,689.51	\$39,219.35	1
Fabricated Metal Product Manufacturing	\$495,773.90	\$178,496.80	\$115,238.10	2
Machinery Manufacturing	\$306,323.06	\$120,856.65	\$86,340.33	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$378,457.13	\$195,691.88	\$116,991.98	1
Transportation Equipment Manufacturing	\$409,422.92	\$113,468.80	\$73,923.79	1
Miscellaneous Manufacturing	\$329,279.97	\$129,735.88	\$92,195.73	1
Transportation and Utilities	\$8,672,685.49	\$3,334,035.29	\$1,924,808.26	21
Information	\$2,290,001.71	\$1,407,204.73	\$606,637.79	5
Wholesale Trade	\$3,252,861.53	\$2,201,411.32	\$1,269,352.86	14
Retail Trade (including Restaurants)	\$14,191,068.68	\$10,610,219.74	\$6,161,719.45	186
Finance, Insurance, & Real Estate	\$16,744,875.42	\$4,599,165.71	\$1,565,647.60	16
Business Services	\$3,916,806.63	\$2,410,330.58	\$1,966,212.66	23
Health Services	\$3,327,548.52	\$2,328,943.76	\$1,969,142.66	32
Other Services	\$35,526,254.23	\$22,099,517.00	\$18,958,171.37	440
<b>TOTAL</b>	<b>\$106,951,605.49</b>	<b>\$55,366,717.21</b>	<b>\$38,424,492.62</b>	<b>794</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in Texas: 2018				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,629,513.80	\$486,561.72	\$322,402.14	5
Mining	\$1,324,936.46	\$308,212.16	\$171,969.67	1
Construction	\$2,526,846.27	\$1,355,768.17	\$1,117,237.85	15
Total Manufacturing	\$12,214,602.76	\$3,778,519.23	\$2,110,670.64	33
Food, Beverage, and Tobacco Manufacturing	\$3,723,794.22	\$965,446.60	\$493,195.52	8
Textile and Textile Product Mills	\$47,278.28	\$9,801.32	\$8,293.46	0
Apparel Manufacturing	\$759,649.77	\$419,848.05	\$212,743.35	6
Wood, Furniture, and Related Product Manufacturing	\$194,462.78	\$68,196.15	\$48,619.28	1
Paper Manufacturing	\$559,079.25	\$247,356.86	\$111,827.57	2
Printing and Related Support Activities	\$1,074,312.76	\$505,135.34	\$329,712.98	5
Petroleum, Coal Products, and Chemical Manufacturing	\$3,165,111.90	\$477,925.02	\$224,413.87	2
Plastics and Rubber Products Manufacturing	\$448,961.83	\$194,620.02	\$113,773.71	2
Nonmetallic Mineral Product Manufacturing	\$274,056.45	\$154,680.05	\$80,897.63	1
Primary Metal Manufacturing	\$183,141.74	\$48,996.98	\$36,470.82	0
Fabricated Metal Product Manufacturing	\$461,029.64	\$165,987.59	\$107,162.11	2
Machinery Manufacturing	\$284,855.67	\$112,386.91	\$80,289.52	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$351,934.53	\$181,977.62	\$108,793.08	1
Transportation Equipment Manufacturing	\$380,730.21	\$105,516.81	\$68,743.15	1
Miscellaneous Manufacturing	\$306,203.74	\$120,643.88	\$85,734.57	1
Transportation and Utilities	\$8,064,896.21	\$3,100,383.23	\$1,789,916.04	19
Information	\$2,129,516.42	\$1,308,586.61	\$564,124.09	5
Wholesale Trade	\$3,024,898.18	\$2,047,134.51	\$1,180,395.52	13
Retail Trade (including Restaurants)	\$13,196,546.35	\$9,866,646.39	\$5,729,900.84	173
Finance, Insurance, & Real Estate	\$15,571,380.11	\$4,276,852.21	\$1,455,925.67	15
Business Services	\$3,642,313.44	\$2,241,412.54	\$1,828,418.78	22
Health Services	\$3,094,351.05	\$2,165,729.37	\$1,831,143.44	30
Other Services	\$33,036,543.69	\$20,550,763.79	\$17,629,566.37	409
<b>TOTAL</b>	<b>\$99,456,344.73</b>	<b>\$51,486,569.91</b>	<b>\$35,731,671.03</b>	<b>739</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

United States



**The Cumulative Impact of Operations and Research Activity Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in the United States**

	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$17,509,001	\$5,313,823	\$3,483,450	53
Mining	\$12,785,981	\$2,999,387	\$1,731,097	9
Construction	\$24,787,463	\$13,299,603	\$10,959,706	150
<b>Total Manufacturing</b>	<b>\$206,667,722</b>	<b>\$59,104,366</b>	<b>\$32,159,478</b>	<b>500</b>
Food, Beverage, and Tobacco Manufacturing	\$98,240,771	\$25,470,317	\$13,011,435	211
Textile and Textile Product Mills	\$672,788	\$139,477	\$118,019	2
Apparel Manufacturing	\$10,015,983	\$5,535,697	\$2,805,021	76
Wood, Furniture, and Related Product Manufacturing	\$2,257,701	\$791,753	\$564,467	11
Paper Manufacturing	\$5,909,135	\$2,614,415	\$1,181,951	17
Printing and Related Support Activities	\$11,174,526	\$5,254,194	\$3,429,528	56
Petroleum, Coal Products, and Chemical Manufacturing	\$46,951,890	\$7,089,633	\$3,328,999	23
Plastics and Rubber Products Manufacturing	\$4,661,953	\$2,020,905	\$1,181,409	23
Nonmetallic Mineral Product Manufacturing	\$2,714,244	\$1,531,945	\$801,207	12
Primary Metal Manufacturing	\$2,221,179	\$594,245	\$442,325	6
Fabricated Metal Product Manufacturing	\$5,665,604	\$2,039,825	\$1,316,918	21
Machinery Manufacturing	\$3,358,272	\$1,324,972	\$946,564	10
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$3,647,815	\$1,886,205	\$1,127,645	9
Transportation Equipment Manufacturing	\$5,962,211	\$1,545,273	\$1,006,083	11
Miscellaneous Manufacturing	\$3,213,651	\$1,265,509	\$897,906	12
Transportation and Utilities	\$92,956,921	\$34,299,996	\$19,513,196	203
Information	\$20,799,035	\$12,782,672	\$5,508,477	49
Wholesale Trade	\$29,031,639	\$19,647,495	\$11,328,916	125
Retail Trade (including Restaurants)	\$127,412,010	\$95,167,955	\$55,250,745	1,667
Finance, Insurance, & Real Estate	\$147,375,480	\$41,140,256	\$14,324,753	144
Business Services	\$35,163,511	\$21,638,976	\$17,651,865	210
Health Services	\$29,373,375	\$20,558,359	\$17,382,276	281
Other Services	\$311,241,428	\$193,632,636	\$166,091,098	3,854
<b>TOTAL</b>	<b>\$1,055,103,566</b>	<b>\$519,585,525</b>	<b>\$355,385,056</b>	<b>7,246</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2008				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$337,654.13	\$102,474.97	\$67,176.94	1
Mining	\$246,572.57	\$57,841.98	\$33,383.52	0
Construction	\$478,016.39	\$256,477.58	\$211,353.58	3
Total Manufacturing	\$3,985,505.06	\$1,139,804.26	\$620,182.79	10
Food, Beverage, and Tobacco Manufacturing	\$1,894,534.30	\$491,184.96	\$250,920.37	4
Textile and Textile Product Mills	\$12,974.45	\$2,689.75	\$2,275.95	0
Apparel Manufacturing	\$193,154.26	\$106,753.72	\$54,093.73	1
Wood, Furniture, and Related Product Manufacturing	\$43,538.88	\$15,268.65	\$10,885.52	0
Paper Manufacturing	\$113,955.32	\$50,417.95	\$22,793.45	0
Printing and Related Support Activities	\$215,496.30	\$101,325.05	\$66,137.10	1
Petroleum, Coal Products, and Chemical Manufacturing	\$905,448.57	\$136,720.77	\$64,198.43	0
Plastics and Rubber Products Manufacturing	\$89,903.91	\$38,972.36	\$22,783.01	0
Nonmetallic Mineral Product Manufacturing	\$52,343.12	\$29,542.95	\$15,450.96	0
Primary Metal Manufacturing	\$42,834.56	\$11,459.78	\$8,530.07	0
Fabricated Metal Product Manufacturing	\$109,258.93	\$39,337.22	\$25,396.24	0
Machinery Manufacturing	\$64,762.94	\$25,551.56	\$18,254.10	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$70,346.67	\$36,374.72	\$21,746.18	0
Transportation Equipment Manufacturing	\$114,978.87	\$29,799.97	\$19,401.92	0
Miscellaneous Manufacturing	\$61,973.98	\$24,404.85	\$17,315.76	0
Transportation and Utilities	\$1,792,637.37	\$661,461.82	\$376,304.24	4
Information	\$401,101.13	\$246,508.77	\$106,228.80	1
Wholesale Trade	\$559,863.65	\$378,894.14	\$218,473.65	2
Retail Trade (including Restaurants)	\$2,457,090.09	\$1,835,276.28	\$1,065,488.71	32
Finance, Insurance, & Real Estate	\$2,842,077.69	\$793,373.53	\$276,247.17	3
Business Services	\$678,114.36	\$417,299.07	\$340,409.21	4
Health Services	\$566,453.89	\$396,459.81	\$335,210.29	5
Other Services	\$6,002,167.51	\$3,734,128.59	\$3,203,000.95	74
<b>TOTAL</b>	<b>\$20,347,253.85</b>	<b>\$10,020,000.80</b>	<b>\$6,853,459.86</b>	<b>140</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2009				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$871,365.50	\$264,451.53	\$173,359.85	3
Mining	\$636,316.32	\$149,269.62	\$86,151.03	0
Construction	\$1,233,590.70	\$661,877.62	\$545,428.60	7
Total Manufacturing	\$10,285,174.34	\$2,941,430.35	\$1,600,471.70	25
Food, Beverage, and Tobacco Manufacturing	\$4,889,120.78	\$1,267,574.09	\$647,536.44	11
Textile and Textile Product Mills	\$33,482.44	\$6,941.29	\$5,873.42	0
Apparel Manufacturing	\$498,462.62	\$275,493.48	\$139,596.71	4
Wood, Furniture, and Related Product Manufacturing	\$112,358.39	\$39,402.97	\$28,091.67	1
Paper Manufacturing	\$294,078.25	\$130,110.85	\$58,821.82	1
Printing and Related Support Activities	\$556,119.48	\$261,484.01	\$170,676.38	3
Petroleum, Coal Products, and Chemical Manufacturing	\$2,336,641.47	\$352,827.78	\$165,673.37	1
Plastics and Rubber Products Manufacturing	\$232,010.09	\$100,573.82	\$58,794.86	1
Nonmetallic Mineral Product Manufacturing	\$135,079.02	\$76,239.88	\$39,873.44	1
Primary Metal Manufacturing	\$110,540.79	\$29,573.63	\$22,013.08	0
Fabricated Metal Product Manufacturing	\$281,958.53	\$101,515.42	\$65,538.68	1
Machinery Manufacturing	\$167,130.16	\$65,939.51	\$47,107.37	0
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$181,539.79	\$93,870.24	\$56,119.17	0
Transportation Equipment Manufacturing	\$296,719.67	\$76,903.15	\$50,069.47	1
Miscellaneous Manufacturing	\$159,932.86	\$62,980.25	\$44,685.83	1
Transportation and Utilities	\$4,626,160.94	\$1,706,998.25	\$971,107.71	10
Information	\$1,035,099.70	\$636,151.66	\$274,138.84	2
Wholesale Trade	\$1,444,809.43	\$977,791.34	\$563,802.97	6
Retail Trade (including Restaurants)	\$6,340,877.65	\$4,736,196.85	\$2,749,648.29	83
Finance, Insurance, & Real Estate	\$7,334,394.04	\$2,047,415.55	\$712,895.93	7
Business Services	\$1,749,972.54	\$1,076,900.83	\$878,475.37	10
Health Services	\$1,461,816.48	\$1,023,122.08	\$865,058.82	14
Other Services	\$15,489,464.55	\$9,636,460.87	\$8,265,808.90	192
TOTAL	\$52,509,042.19	\$25,858,066.57	\$17,686,348.02	361
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2010				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,034,746.54	\$314,036.19	\$205,864.83	3
Mining	\$755,625.63	\$177,257.68	\$102,304.35	1
Construction	\$1,464,888.95	\$785,979.68	\$647,696.46	9
Total Manufacturing	\$12,213,644.53	\$3,492,948.54	\$1,900,560.15	30
Food, Beverage, and Tobacco Manufacturing	\$5,805,830.93	\$1,505,244.23	\$768,949.53	12
Textile and Textile Product Mills	\$39,760.40	\$8,242.78	\$6,974.69	0
Apparel Manufacturing	\$591,924.36	\$327,148.51	\$165,771.09	4
Wood, Furniture, and Related Product Manufacturing	\$133,425.59	\$46,791.02	\$33,358.86	1
Paper Manufacturing	\$349,217.92	\$154,506.63	\$69,850.91	1
Printing and Related Support Activities	\$660,391.88	\$310,512.26	\$202,678.20	3
Petroleum, Coal Products, and Chemical Manufacturing	\$2,774,761.75	\$418,982.99	\$196,737.13	1
Plastics and Rubber Products Manufacturing	\$275,511.98	\$119,431.42	\$69,818.90	1
Nonmetallic Mineral Product Manufacturing	\$160,406.34	\$90,534.85	\$47,349.71	1
Primary Metal Manufacturing	\$131,267.19	\$35,118.68	\$26,140.53	0
Fabricated Metal Product Manufacturing	\$334,825.75	\$120,549.56	\$77,827.18	1
Machinery Manufacturing	\$198,467.06	\$78,303.17	\$55,940.00	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$215,578.50	\$111,470.91	\$66,641.51	1
Transportation Equipment Manufacturing	\$352,354.61	\$91,322.49	\$59,457.50	1
Miscellaneous Manufacturing	\$189,920.27	\$74,789.05	\$53,064.43	1
Transportation and Utilities	\$5,493,566.12	\$2,027,060.42	\$1,153,190.40	12
Information	\$1,229,180.89	\$755,430.10	\$325,539.87	3
Wholesale Trade	\$1,715,711.20	\$1,161,127.22	\$669,516.02	7
Retail Trade (including Restaurants)	\$7,529,792.20	\$5,624,233.76	\$3,265,207.35	98
Finance, Insurance, & Real Estate	\$8,709,592.93	\$2,431,305.97	\$846,563.92	9
Business Services	\$2,078,092.39	\$1,278,819.74	\$1,043,189.50	12
Health Services	\$1,735,907.07	\$1,214,957.48	\$1,027,257.35	17
Other Services	\$18,393,739.15	\$11,443,297.28	\$9,815,648.07	228
TOTAL	\$62,354,487.60	\$30,706,454.05	\$21,002,538.28	428
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



<b>The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2011</b>				
	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$1,486,767.39	\$451,220.43	\$295,795.25	5
Mining	\$1,085,714.72	\$254,691.30	\$146,995.19	1
Construction	\$2,104,814.13	\$1,129,328.69	\$930,637.54	13
Total Manufacturing	\$17,549,078.72	\$5,018,815.54	\$2,730,804.85	42
Food, Beverage, and Tobacco Manufacturing	\$8,342,062.33	\$2,162,798.28	\$1,104,859.05	18
Textile and Textile Product Mills	\$57,129.41	\$11,843.57	\$10,021.53	0
Apparel Manufacturing	\$850,501.84	\$470,060.75	\$238,186.89	6
Wood, Furniture, and Related Product Manufacturing	\$191,711.51	\$67,231.31	\$47,931.41	1
Paper Manufacturing	\$501,771.02	\$222,001.63	\$100,364.72	1
Printing and Related Support Activities	\$948,878.86	\$446,157.08	\$291,216.57	5
Petroleum, Coal Products, and Chemical Manufacturing	\$3,986,894.51	\$602,012.40	\$282,680.19	2
Plastics and Rubber Products Manufacturing	\$395,867.21	\$171,604.09	\$100,318.73	2
Nonmetallic Mineral Product Manufacturing	\$230,478.58	\$130,084.29	\$68,034.06	1
Primary Metal Manufacturing	\$188,610.23	\$50,460.00	\$37,559.82	0
Fabricated Metal Product Manufacturing	\$481,091.74	\$173,210.68	\$111,825.37	2
Machinery Manufacturing	\$285,165.83	\$112,509.28	\$80,376.94	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$309,752.26	\$160,166.10	\$95,753.33	1
Transportation Equipment Manufacturing	\$506,277.94	\$131,216.00	\$85,431.04	1
Miscellaneous Manufacturing	\$272,885.44	\$107,460.05	\$76,245.20	1
Transportation and Utilities	\$7,893,387.11	\$2,912,565.76	\$1,656,952.53	17
Information	\$1,766,138.86	\$1,085,433.77	\$467,749.40	4
Wholesale Trade	\$2,465,206.09	\$1,668,356.47	\$961,988.81	11
Retail Trade (including Restaurants)	\$10,819,122.48	\$8,081,135.88	\$4,691,587.40	142
Finance, Insurance, & Real Estate	\$12,514,309.84	\$3,493,402.78	\$1,216,378.69	12
Business Services	\$2,985,890.64	\$1,837,462.05	\$1,498,898.60	18
Health Services	\$2,494,224.38	\$1,745,702.06	\$1,476,006.61	24
Other Services	\$26,428,898.89	\$16,442,211.35	\$14,103,536.44	327
<b>TOTAL</b>	<b>\$89,593,553.23</b>	<b>\$44,120,326.08</b>	<b>\$30,177,331.31</b>	<b>615</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2012				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,699,162.73	\$515,680.49	\$338,051.71	5
Mining	\$1,240,816.82	\$291,075.77	\$167,994.51	1
Construction	\$2,405,501.86	\$1,290,661.36	\$1,063,585.76	15
Total Manufacturing	\$20,056,089.96	\$5,735,789.19	\$3,120,919.82	49
Food, Beverage, and Tobacco Manufacturing	\$9,533,785.52	\$2,471,769.47	\$1,262,696.06	20
Textile and Textile Product Mills	\$65,290.76	\$13,535.51	\$11,453.18	0
Apparel Manufacturing	\$972,002.10	\$537,212.29	\$272,213.58	7
Wood, Furniture, and Related Product Manufacturing	\$219,098.87	\$76,835.78	\$54,778.75	1
Paper Manufacturing	\$573,452.59	\$253,716.15	\$114,702.54	2
Printing and Related Support Activities	\$1,084,432.98	\$509,893.81	\$332,818.94	5
Petroleum, Coal Products, and Chemical Manufacturing	\$4,556,450.87	\$688,014.18	\$323,063.07	2
Plastics and Rubber Products Manufacturing	\$452,419.67	\$196,118.96	\$114,649.98	2
Nonmetallic Mineral Product Manufacturing	\$263,404.09	\$148,667.76	\$77,753.21	1
Primary Metal Manufacturing	\$215,554.55	\$57,668.57	\$42,925.51	1
Fabricated Metal Product Manufacturing	\$549,819.13	\$197,955.07	\$127,800.42	2
Machinery Manufacturing	\$325,903.81	\$128,582.04	\$91,859.36	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$354,002.58	\$183,046.97	\$109,432.38	1
Transportation Equipment Manufacturing	\$578,603.36	\$149,961.14	\$97,635.47	1
Miscellaneous Manufacturing	\$311,869.08	\$122,811.49	\$87,137.37	1
Transportation and Utilities	\$9,021,013.84	\$3,328,646.59	\$1,893,660.03	20
Information	\$2,018,444.41	\$1,240,495.74	\$534,570.74	5
Wholesale Trade	\$2,817,378.39	\$1,906,693.11	\$1,099,415.79	12
Retail Trade (including Restaurants)	\$12,364,711.41	\$9,235,583.86	\$5,361,814.17	162
Finance, Insurance, & Real Estate	\$14,302,068.39	\$3,992,460.32	\$1,390,147.07	14
Business Services	\$3,412,446.45	\$2,099,956.63	\$1,713,026.98	20
Health Services	\$2,850,542.14	\$1,995,088.06	\$1,686,864.70	27
Other Services	\$30,204,455.87	\$18,791,098.69	\$16,118,327.36	374
<b>TOTAL</b>	<b>\$102,392,632.27</b>	<b>\$50,423,229.81</b>	<b>\$34,488,378.65</b>	<b>703</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



<b>The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2013</b>				
	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
Agriculture	\$1,862,543.76	\$565,265.15	\$370,556.69	6
Mining	\$1,360,126.13	\$319,063.82	\$184,147.83	1
Construction	\$2,636,800.11	\$1,414,763.42	\$1,165,853.62	16
<b>Total Manufacturing</b>	<b>\$21,984,560.15</b>	<b>\$6,287,307.38</b>	<b>\$3,421,008.27</b>	<b>53</b>
Food, Beverage, and Tobacco Manufacturing	\$10,450,495.67	\$2,709,439.61	\$1,384,109.15	22
Textile and Textile Product Mills	\$71,568.72	\$14,837.00	\$12,554.44	0
Apparel Manufacturing	\$1,065,463.84	\$588,867.32	\$298,387.97	8
Wood, Furniture, and Related Product Manufacturing	\$240,166.07	\$84,223.84	\$60,045.94	1
Paper Manufacturing	\$628,592.26	\$278,111.93	\$125,731.63	2
Printing and Related Support Activities	\$1,188,705.38	\$558,922.06	\$364,820.76	6
Petroleum, Coal Products, and Chemical Manufacturing	\$4,994,571.14	\$754,169.38	\$354,126.83	2
Plastics and Rubber Products Manufacturing	\$495,921.56	\$214,976.55	\$125,674.02	2
Nonmetallic Mineral Product Manufacturing	\$288,731.41	\$162,962.74	\$85,229.48	1
Primary Metal Manufacturing	\$236,280.94	\$63,213.63	\$47,052.96	1
Fabricated Metal Product Manufacturing	\$602,686.36	\$216,989.21	\$140,088.92	2
Machinery Manufacturing	\$357,240.71	\$140,945.70	\$100,692.00	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$388,041.29	\$200,647.64	\$119,954.72	1
Transportation Equipment Manufacturing	\$634,238.30	\$164,380.48	\$107,023.50	1
Miscellaneous Manufacturing	\$341,856.49	\$134,620.29	\$95,515.97	1
Transportation and Utilities	\$9,888,419.01	\$3,648,708.76	\$2,075,742.73	22
Information	\$2,212,525.60	\$1,359,774.18	\$585,971.77	5
Wholesale Trade	\$3,088,280.15	\$2,090,028.99	\$1,205,128.84	13
Retail Trade (including Restaurants)	\$13,553,625.97	\$10,123,620.77	\$5,877,373.23	177
Finance, Insurance, & Real Estate	\$15,677,267.27	\$4,376,350.74	\$1,523,815.06	15
Business Services	\$3,740,566.30	\$2,301,875.53	\$1,877,741.11	22
Health Services	\$3,124,632.73	\$2,186,923.46	\$1,849,063.23	30
Other Services	\$33,108,730.47	\$20,597,935.10	\$17,668,166.53	410
<b>TOTAL</b>	<b>\$112,238,077.68</b>	<b>\$55,271,617.29</b>	<b>\$37,804,568.90</b>	<b>771</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2014				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$2,102,169.28	\$637,989.32	\$418,230.64	6
Mining	\$1,535,113.12	\$360,112.97	\$207,839.36	1
Construction	\$2,976,037.55	\$1,596,779.76	\$1,315,846.49	18
Total Manufacturing	\$24,812,983.10	\$7,096,200.72	\$3,861,137.99	60
Food, Beverage, and Tobacco Manufacturing	\$11,795,003.89	\$3,058,022.48	\$1,562,181.67	25
Textile and Textile Product Mills	\$80,776.39	\$16,745.86	\$14,169.64	0
Apparel Manufacturing	\$1,202,541.06	\$664,628.02	\$336,777.06	9
Wood, Furniture, and Related Product Manufacturing	\$271,064.63	\$95,059.66	\$67,771.15	1
Paper Manufacturing	\$709,463.78	\$313,892.42	\$141,907.63	2
Printing and Related Support Activities	\$1,341,638.24	\$630,830.16	\$411,756.76	7
Petroleum, Coal Products, and Chemical Manufacturing	\$5,637,147.55	\$851,197.03	\$399,687.00	3
Plastics and Rubber Products Manufacturing	\$559,724.34	\$242,634.35	\$141,842.61	3
Nonmetallic Mineral Product Manufacturing	\$325,878.14	\$183,928.70	\$96,194.67	1
Primary Metal Manufacturing	\$266,679.66	\$71,346.37	\$53,106.56	1
Fabricated Metal Product Manufacturing	\$680,224.95	\$244,905.95	\$158,112.06	3
Machinery Manufacturing	\$403,201.51	\$159,079.06	\$113,646.52	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$437,964.73	\$226,461.96	\$135,387.50	1
Transportation Equipment Manufacturing	\$715,836.21	\$185,528.85	\$120,792.60	1
Miscellaneous Manufacturing	\$385,838.02	\$151,939.85	\$107,804.57	1
Transportation and Utilities	\$11,160,613.27	\$4,118,133.28	\$2,342,797.35	24
Information	\$2,497,178.02	\$1,534,715.89	\$661,359.96	6
Wholesale Trade	\$3,485,602.75	\$2,358,921.61	\$1,360,174.66	15
Retail Trade (including Restaurants)	\$15,297,367.32	\$11,426,074.90	\$6,633,526.51	200
Finance, Insurance, & Real Estate	\$17,694,225.63	\$4,939,390.02	\$1,719,861.44	17
Business Services	\$4,221,808.75	\$2,598,023.26	\$2,119,321.84	25
Health Services	\$3,526,632.27	\$2,468,282.03	\$2,086,954.40	34
Other Services	\$37,368,333.22	\$23,247,961.84	\$19,941,263.97	463
<b>TOTAL</b>	<b>\$126,678,064.28</b>	<b>\$62,382,585.60</b>	<b>\$42,668,314.61</b>	<b>870</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2015				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$2,074,939.11	\$629,725.21	\$412,813.15	6
Mining	\$1,515,228.23	\$355,448.29	\$205,147.14	1
Construction	\$2,937,487.85	\$1,576,096.09	\$1,298,801.85	18
Total Manufacturing	\$24,491,571.40	\$7,004,281.02	\$3,811,123.25	59
Food, Beverage, and Tobacco Manufacturing	\$11,642,218.86	\$3,018,410.79	\$1,541,946.15	25
Textile and Textile Product Mills	\$79,730.06	\$16,528.94	\$13,986.09	0
Apparel Manufacturing	\$1,186,964.10	\$656,018.85	\$332,414.67	9
Wood, Furniture, and Related Product Manufacturing	\$267,553.43	\$93,828.31	\$66,893.29	1
Paper Manufacturing	\$700,273.84	\$309,826.45	\$140,069.45	2
Printing and Related Support Activities	\$1,324,259.50	\$622,658.79	\$406,423.12	7
Petroleum, Coal Products, and Chemical Manufacturing	\$5,564,127.50	\$840,171.16	\$394,509.71	3
Plastics and Rubber Products Manufacturing	\$552,474.02	\$239,491.42	\$140,005.27	3
Nonmetallic Mineral Product Manufacturing	\$321,656.92	\$181,546.21	\$94,948.63	1
Primary Metal Manufacturing	\$263,225.26	\$70,422.20	\$52,418.65	1
Fabricated Metal Product Manufacturing	\$671,413.75	\$241,733.59	\$156,063.97	3
Machinery Manufacturing	\$397,978.69	\$157,018.45	\$112,174.42	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$432,291.62	\$223,528.51	\$133,633.77	1
Transportation Equipment Manufacturing	\$706,563.72	\$183,125.63	\$119,227.93	1
Miscellaneous Manufacturing	\$380,840.12	\$149,971.72	\$106,408.14	1
Transportation and Utilities	\$11,016,045.74	\$4,064,789.58	\$2,312,450.23	24
Information	\$2,464,831.16	\$1,514,836.15	\$652,793.12	6
Wholesale Trade	\$3,440,452.45	\$2,328,365.63	\$1,342,555.82	15
Retail Trade (including Restaurants)	\$15,099,214.89	\$11,278,068.75	\$6,547,600.00	197
Finance, Insurance, & Real Estate	\$17,465,025.82	\$4,875,408.28	\$1,697,583.44	17
Business Services	\$4,167,122.11	\$2,564,370.11	\$2,091,869.48	25
Health Services	\$3,480,950.50	\$2,436,309.46	\$2,059,921.32	33
Other Services	\$36,884,287.45	\$22,946,822.44	\$19,682,957.45	457
<b>TOTAL</b>	<b>\$125,037,156.71</b>	<b>\$61,574,521.02</b>	<b>\$42,115,616.23</b>	<b>859</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2016				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$2,140,291.52	\$649,559.08	\$425,815.14	6
Mining	\$1,562,951.96	\$366,643.52	\$211,608.47	1
Construction	\$3,030,007.15	\$1,625,736.91	\$1,339,708.99	18
Total Manufacturing	\$25,262,959.47	\$7,224,888.30	\$3,931,158.63	61
Food, Beverage, and Tobacco Manufacturing	\$12,008,902.92	\$3,113,478.85	\$1,590,511.39	26
Textile and Textile Product Mills	\$82,241.25	\$17,049.54	\$14,426.60	0
Apparel Manufacturing	\$1,224,348.80	\$676,680.86	\$342,884.42	9
Wood, Furniture, and Related Product Manufacturing	\$275,980.31	\$96,783.54	\$69,000.16	1
Paper Manufacturing	\$722,329.71	\$319,584.77	\$144,481.09	2
Printing and Related Support Activities	\$1,365,968.46	\$642,270.09	\$419,223.85	7
Petroleum, Coal Products, and Chemical Manufacturing	\$5,739,375.61	\$866,633.24	\$406,935.21	3
Plastics and Rubber Products Manufacturing	\$569,874.78	\$247,034.46	\$144,414.88	3
Nonmetallic Mineral Product Manufacturing	\$331,787.84	\$187,264.20	\$97,939.14	1
Primary Metal Manufacturing	\$271,515.82	\$72,640.22	\$54,069.63	1
Fabricated Metal Product Manufacturing	\$692,560.64	\$249,347.25	\$160,979.37	3
Machinery Manufacturing	\$410,513.45	\$161,963.92	\$115,707.47	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$445,907.10	\$230,568.78	\$137,842.71	1
Transportation Equipment Manufacturing	\$728,817.70	\$188,893.36	\$122,983.14	1
Miscellaneous Manufacturing	\$392,835.09	\$154,695.24	\$109,759.57	2
Transportation and Utilities	\$11,363,007.81	\$4,192,814.45	\$2,385,283.31	25
Information	\$2,542,463.63	\$1,562,547.52	\$673,353.53	6
Wholesale Trade	\$3,548,813.16	\$2,401,699.98	\$1,384,841.04	15
Retail Trade (including Restaurants)	\$15,574,780.72	\$11,633,283.51	\$6,753,823.62	204
Finance, Insurance, & Real Estate	\$18,015,105.37	\$5,028,964.45	\$1,751,050.64	18
Business Services	\$4,298,370.05	\$2,645,137.67	\$2,157,755.13	26
Health Services	\$3,590,586.74	\$2,513,043.62	\$2,124,800.73	34
Other Services	\$38,045,997.30	\$23,669,557.00	\$20,302,893.11	471
TOTAL	\$128,975,334.87	\$63,513,876.01	\$43,442,092.33	886
Source: US Multi-Regional Impact Assessment System, The Perryman Group				



<b>The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2017</b>				
	<b>Total Expenditures (2018 Dollars)</b>	<b>Gross Product (2018 Dollars)</b>	<b>Personal Income (2018 Dollars)</b>	<b>Employment (Permanent Jobs)</b>
<b>Agriculture</b>	<b>\$2,020,478.76</b>	<b>\$613,196.99</b>	<b>\$401,978.16</b>	<b>6</b>
<b>Mining</b>	<b>\$1,475,458.46</b>	<b>\$346,118.94</b>	<b>\$199,762.70</b>	<b>1</b>
<b>Construction</b>	<b>\$2,860,388.43</b>	<b>\$1,534,728.74</b>	<b>\$1,264,712.56</b>	<b>17</b>
<b>Total Manufacturing</b>	<b>\$23,848,748.00</b>	<b>\$6,820,441.63</b>	<b>\$3,711,093.77</b>	<b>58</b>
<b>Food, Beverage, and Tobacco Manufacturing</b>	<b>\$11,336,648.81</b>	<b>\$2,939,187.41</b>	<b>\$1,501,475.13</b>	<b>24</b>
<b>Textile and Textile Product Mills</b>	<b>\$77,637.41</b>	<b>\$16,095.11</b>	<b>\$13,619.00</b>	<b>0</b>
<b>Apparel Manufacturing</b>	<b>\$1,155,810.19</b>	<b>\$638,800.51</b>	<b>\$323,689.87</b>	<b>9</b>
<b>Wood, Furniture, and Related Product Manufacturing</b>	<b>\$260,531.03</b>	<b>\$91,365.63</b>	<b>\$65,137.56</b>	<b>1</b>
<b>Paper Manufacturing</b>	<b>\$681,893.95</b>	<b>\$301,694.53</b>	<b>\$136,393.09</b>	<b>2</b>
<b>Printing and Related Support Activities</b>	<b>\$1,289,502.04</b>	<b>\$606,316.04</b>	<b>\$395,755.85</b>	<b>7</b>
<b>Petroleum, Coal Products, and Chemical Manufacturing</b>	<b>\$5,418,087.41</b>	<b>\$818,119.42</b>	<b>\$384,155.12</b>	<b>3</b>
<b>Plastics and Rubber Products Manufacturing</b>	<b>\$537,973.39</b>	<b>\$233,205.55</b>	<b>\$136,330.59</b>	<b>3</b>
<b>Nonmetallic Mineral Product Manufacturing</b>	<b>\$313,214.48</b>	<b>\$176,781.21</b>	<b>\$92,456.54</b>	<b>1</b>
<b>Primary Metal Manufacturing</b>	<b>\$256,316.46</b>	<b>\$68,573.85</b>	<b>\$51,042.83</b>	<b>1</b>
<b>Fabricated Metal Product Manufacturing</b>	<b>\$653,791.34</b>	<b>\$235,388.88</b>	<b>\$151,967.81</b>	<b>2</b>
<b>Machinery Manufacturing</b>	<b>\$387,533.05</b>	<b>\$152,897.23</b>	<b>\$109,230.21</b>	<b>1</b>
<b>Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing</b>	<b>\$420,945.38</b>	<b>\$217,661.62</b>	<b>\$130,126.32</b>	<b>1</b>
<b>Transportation Equipment Manufacturing</b>	<b>\$688,018.74</b>	<b>\$178,319.18</b>	<b>\$116,098.59</b>	<b>1</b>
<b>Miscellaneous Manufacturing</b>	<b>\$370,844.32</b>	<b>\$146,035.46</b>	<b>\$103,615.27</b>	<b>1</b>
<b>Transportation and Utilities</b>	<b>\$10,726,910.69</b>	<b>\$3,958,102.19</b>	<b>\$2,251,756.00</b>	<b>23</b>
<b>Information</b>	<b>\$2,400,137.42</b>	<b>\$1,475,076.67</b>	<b>\$635,659.44</b>	<b>6</b>
<b>Wholesale Trade</b>	<b>\$3,350,151.86</b>	<b>\$2,267,253.67</b>	<b>\$1,307,318.13</b>	<b>14</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$14,702,910.04</b>	<b>\$10,982,056.45</b>	<b>\$6,375,746.98</b>	<b>192</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$17,006,626.19</b>	<b>\$4,747,444.81</b>	<b>\$1,653,027.45</b>	<b>17</b>
<b>Business Services</b>	<b>\$4,057,748.82</b>	<b>\$2,497,063.81</b>	<b>\$2,036,964.77</b>	<b>24</b>
<b>Health Services</b>	<b>\$3,389,586.97</b>	<b>\$2,372,364.33</b>	<b>\$2,005,855.14</b>	<b>32</b>
<b>Other Services</b>	<b>\$35,916,195.92</b>	<b>\$22,344,543.63</b>	<b>\$19,166,344.39</b>	<b>445</b>
<b>TOTAL</b>	<b>\$121,755,341.57</b>	<b>\$59,958,391.86</b>	<b>\$41,010,219.48</b>	<b>836</b>
<b>Source: US Multi-Regional Impact Assessment System, The Perryman Group</b>				



The Annual Impact of Operations and Research Activity Associated with the Galveston National Laboratory on Business Activity in the United States:2018				
	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,878,881.87	\$570,223.62	\$373,807.18	6
Mining	\$1,372,057.06	\$321,862.63	\$185,763.16	1
Construction	\$2,659,929.94	\$1,427,173.62	\$1,176,080.41	16
Total Manufacturing	\$22,177,407.17	\$6,342,459.20	\$3,451,017.11	54
Food, Beverage, and Tobacco Manufacturing	\$10,542,166.68	\$2,733,206.62	\$1,396,250.45	23
Textile and Textile Product Mills	\$72,196.51	\$14,967.15	\$12,664.57	0
Apparel Manufacturing	\$1,074,810.02	\$594,032.82	\$301,005.41	8
Wood, Furniture, and Related Product Manufacturing	\$242,272.79	\$84,962.65	\$60,572.66	1
Paper Manufacturing	\$634,106.23	\$280,551.51	\$126,834.54	2
Printing and Related Support Activities	\$1,199,132.62	\$563,824.89	\$368,020.94	6
Petroleum, Coal Products, and Chemical Manufacturing	\$5,038,383.17	\$760,784.91	\$357,233.20	2
Plastics and Rubber Products Manufacturing	\$500,271.75	\$216,862.31	\$126,776.42	2
Nonmetallic Mineral Product Manufacturing	\$291,264.14	\$164,392.23	\$85,977.10	1
Primary Metal Manufacturing	\$238,353.58	\$63,768.13	\$47,465.70	1
Fabricated Metal Product Manufacturing	\$607,973.08	\$218,892.62	\$141,317.77	2
Machinery Manufacturing	\$360,374.40	\$142,182.06	\$101,575.26	1
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$391,445.16	\$202,407.71	\$121,006.96	1
Transportation Equipment Manufacturing	\$639,801.80	\$165,822.42	\$107,962.30	1
Miscellaneous Manufacturing	\$344,855.23	\$135,801.17	\$96,353.82	1
Transportation and Utilities	\$9,975,159.53	\$3,680,714.98	\$2,093,951.00	22
Information	\$2,231,933.72	\$1,371,702.02	\$591,111.88	5
Wholesale Trade	\$3,115,370.33	\$2,108,362.58	\$1,215,700.15	13
Retail Trade (including Restaurants)	\$13,672,517.42	\$10,212,424.46	\$5,928,929.13	179
Finance, Insurance, & Real Estate	\$15,814,787.16	\$4,414,739.78	\$1,537,181.86	15
Business Services	\$3,773,378.29	\$2,322,067.42	\$1,894,212.52	23
Health Services	\$3,152,041.79	\$2,206,106.99	\$1,865,283.08	30
Other Services	\$33,399,157.93	\$20,778,618.74	\$17,823,150.44	414
<b>TOTAL</b>	<b>\$113,222,622.22</b>	<b>\$55,756,456.04</b>	<b>\$38,136,187.93</b>	<b>778</b>
Source: US Multi-Regional Impact Assessment System, The Perryman Group				

## *Commercialization of Research*

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**The Estimated Impact of Research Commercialization Associated with the Galveston National Laboratory During Its First 10 Years of Operations (2008-2018) on Business Activity in the Houston-The Woodlands-Sugar Land Metropolitan Area**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$1,824,466	\$534,085	\$345,552	5
Mining	\$3,360,927	\$778,954	\$394,483	2
Construction	\$4,095,976	\$2,189,695	\$1,804,445	25
Total Manufacturing	\$134,769,461	\$58,553,670	\$28,281,540	241
Food, Beverage, and Tobacco Manufacturing	\$5,801,395	\$1,390,549	\$710,360	12
Textile and Textile Product Mills	\$13,158	\$3,636	\$3,076	0
Apparel Manufacturing	\$259,484	\$143,671	\$72,801	2
Wood, Furniture, and Related Product Manufacturing	\$191,919	\$67,302	\$47,983	1
Paper Manufacturing	\$1,602,393	\$725,956	\$328,200	5
Printing and Related Support Activities	\$2,935,288	\$1,511,172	\$986,377	16
Petroleum, Coal Products, and Chemical Manufacturing	\$116,907,543	\$51,758,958	\$24,303,836	176
Plastics and Rubber Products Manufacturing	\$1,995,790	\$807,622	\$472,132	9
Nonmetallic Mineral Product Manufacturing	\$923,696	\$599,995	\$313,800	5
Primary Metal Manufacturing	\$366,235	\$100,292	\$74,652	1
Fabricated Metal Product Manufacturing	\$2,017,768	\$712,497	\$459,989	8
Machinery Manufacturing	\$780,366	\$332,369	\$237,445	2
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$157,085	\$81,349	\$48,633	0
Transportation Equipment Manufacturing	\$223,801	\$69,450	\$45,289	0
Miscellaneous Manufacturing	\$593,539	\$248,852	\$176,970	3
Transportation and Utilities	\$18,187,405	\$7,456,214	\$4,389,751	49
Information	\$4,432,682	\$2,685,909	\$1,157,704	11
Wholesale Trade	\$9,529,089	\$6,445,286	\$3,716,409	41
Retail Trade (including Restaurants)	\$25,408,423	\$18,765,072	\$10,858,338	333
Finance, Insurance, & Real Estate	\$28,644,532	\$7,755,714	\$2,939,603	29
Business Services	\$12,774,859	\$7,682,268	\$6,266,762	75
Health Services	\$5,861,513	\$4,101,691	\$3,468,018	56
Other Services	\$12,100,150	\$6,281,933	\$5,057,617	116
<b>TOTAL</b>	<b>\$260,989,481</b>	<b>\$123,230,492</b>	<b>\$68,680,222</b>	<b>983</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Estimated Impact of Research Commercialization Associated with the  
Galveston National Laboratory During Its First 10 Years of Operations (2008-2018)  
on Business Activity in Texas**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$5,571,020	\$1,590,893	\$1,045,510	16
Mining	\$4,260,171	\$1,021,087	\$565,798	3
Construction	\$4,744,720	\$2,532,799	\$2,087,184	29
<b>Total Manufacturing</b>	<b>\$165,752,308</b>	<b>\$71,209,138</b>	<b>\$34,779,107</b>	<b>323</b>
Food, Beverage, and Tobacco Manufacturing	\$11,896,387	\$2,856,833	\$1,459,407	24
Textile and Textile Product Mills	\$125,102	\$34,401	\$29,108	1
Apparel Manufacturing	\$1,805,331	\$999,538	\$506,481	14
Wood, Furniture, and Related Product Manufacturing	\$530,866	\$186,165	\$132,725	3
Paper Manufacturing	\$4,131,225	\$1,871,196	\$845,954	12
Printing and Related Support Activities	\$4,889,637	\$2,516,827	\$1,642,790	27
Petroleum, Coal Products, and Chemical Manufacturing	\$130,858,891	\$57,871,180	\$27,173,879	197
Plastics and Rubber Products Manufacturing	\$3,072,231	\$1,244,027	\$727,252	14
Nonmetallic Mineral Product Manufacturing	\$1,713,323	\$1,111,275	\$581,201	9
Primary Metal Manufacturing	\$792,424	\$217,040	\$161,553	2
Fabricated Metal Product Manufacturing	\$2,289,178	\$808,540	\$521,995	9
Machinery Manufacturing	\$894,042	\$380,233	\$271,640	3
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$857,949	\$444,496	\$265,735	2
Transportation Equipment Manufacturing	\$931,615	\$263,281	\$171,563	2
Miscellaneous Manufacturing	\$964,107	\$404,106	\$287,824	4
<b>Transportation and Utilities</b>	<b>\$21,065,605</b>	<b>\$8,588,192</b>	<b>\$5,047,102</b>	<b>56</b>
<b>Information</b>	<b>\$7,103,615</b>	<b>\$4,301,719</b>	<b>\$1,850,657</b>	<b>17</b>
<b>Wholesale Trade</b>	<b>\$12,376,144</b>	<b>\$8,371,048</b>	<b>\$4,826,821</b>	<b>54</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$33,758,555</b>	<b>\$24,912,059</b>	<b>\$14,411,809</b>	<b>443</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$35,788,897</b>	<b>\$9,771,750</b>	<b>\$3,729,497</b>	<b>37</b>
<b>Business Services</b>	<b>\$14,556,956</b>	<b>\$8,750,368</b>	<b>\$7,138,057</b>	<b>85</b>
<b>Health Services</b>	<b>\$7,500,250</b>	<b>\$5,246,687</b>	<b>\$4,436,122</b>	<b>72</b>
<b>Other Services</b>	<b>\$14,965,318</b>	<b>\$7,759,117</b>	<b>\$6,250,599</b>	<b>145</b>
<b>TOTAL</b>	<b>\$327,443,558</b>	<b>\$154,054,857</b>	<b>\$86,168,263</b>	<b>1,280</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



**The Estimated Impact of Research Commercialization Associated with the  
Galveston National Laboratory During Its First 10 Years of Operations (2008-2018)  
on Business Activity in United States**

	Total Expenditures (2018 Dollars)	Gross Product (2018 Dollars)	Personal Income (2018 Dollars)	Employment (Permanent Jobs)
Agriculture	\$8,764,326	\$2,558,212	\$1,658,414	25
Mining	\$6,012,495	\$1,454,419	\$830,182	5
Construction	\$6,804,652	\$3,632,420	\$2,993,340	41
<b>Total Manufacturing</b>	<b>\$276,746,166</b>	<b>\$113,373,583</b>	<b>\$55,678,362</b>	<b>549</b>
Food, Beverage, and Tobacco Manufacturing	\$45,884,208	\$11,018,768	\$5,628,913	92
Textile and Textile Product Mills	\$260,270	\$71,571	\$60,557	1
Apparel Manufacturing	\$3,480,000	\$1,926,733	\$976,304	26
Wood, Furniture, and Related Product Manufacturing	\$901,066	\$315,987	\$225,282	5
Paper Manufacturing	\$6,383,684	\$2,891,425	\$1,307,192	19
Printing and Related Support Activities	\$7,435,617	\$3,827,312	\$2,498,173	41
Petroleum, Coal Products, and Chemical Manufacturing	\$193,296,126	\$85,483,491	\$40,139,462	291
Plastics and Rubber Products Manufacturing	\$4,663,955	\$1,888,557	\$1,104,042	21
Nonmetallic Mineral Product Manufacturing	\$2,480,791	\$1,609,061	\$841,545	13
Primary Metal Manufacturing	\$1,405,063	\$384,838	\$286,454	4
Fabricated Metal Product Manufacturing	\$4,112,813	\$1,452,650	\$937,833	16
Machinery Manufacturing	\$1,540,959	\$655,364	\$468,195	5
Computer, Electronic Product, Electrical Equipment, Appliance, and Component Manufacturing	\$1,300,093	\$673,567	\$402,682	3
Transportation Equipment Manufacturing	\$2,124,462	\$555,609	\$361,818	5
Miscellaneous Manufacturing	\$1,477,060	\$618,651	\$439,911	6
<b>Transportation and Utilities</b>	<b>\$35,262,114</b>	<b>\$13,788,335</b>	<b>\$7,992,998</b>	<b>87</b>
<b>Information</b>	<b>\$10,145,231</b>	<b>\$6,144,254</b>	<b>\$2,642,558</b>	<b>24</b>
<b>Wholesale Trade</b>	<b>\$17,365,537</b>	<b>\$11,745,803</b>	<b>\$6,772,735</b>	<b>75</b>
<b>Retail Trade (including Restaurants)</b>	<b>\$47,676,400</b>	<b>\$35,145,799</b>	<b>\$20,325,516</b>	<b>625</b>
<b>Finance, Insurance, &amp; Real Estate</b>	<b>\$49,727,882</b>	<b>\$13,860,463</b>	<b>\$5,403,127</b>	<b>54</b>
<b>Business Services</b>	<b>\$20,546,013</b>	<b>\$12,350,464</b>	<b>\$10,074,813</b>	<b>120</b>
<b>Health Services</b>	<b>\$10,408,833</b>	<b>\$7,281,342</b>	<b>\$6,156,443</b>	<b>99</b>
<b>Other Services</b>	<b>\$21,808,669</b>	<b>\$11,256,050</b>	<b>\$9,096,009</b>	<b>212</b>
<b>TOTAL</b>	<b>\$511,268,317</b>	<b>\$232,591,145</b>	<b>\$129,624,497</b>	<b>1,917</b>

Source: US Multi-Regional Impact Assessment System, The Perryman Group



## Economic Benefits Associated with Galveston National Laboratory Research Activity

First 10 Years of Operations

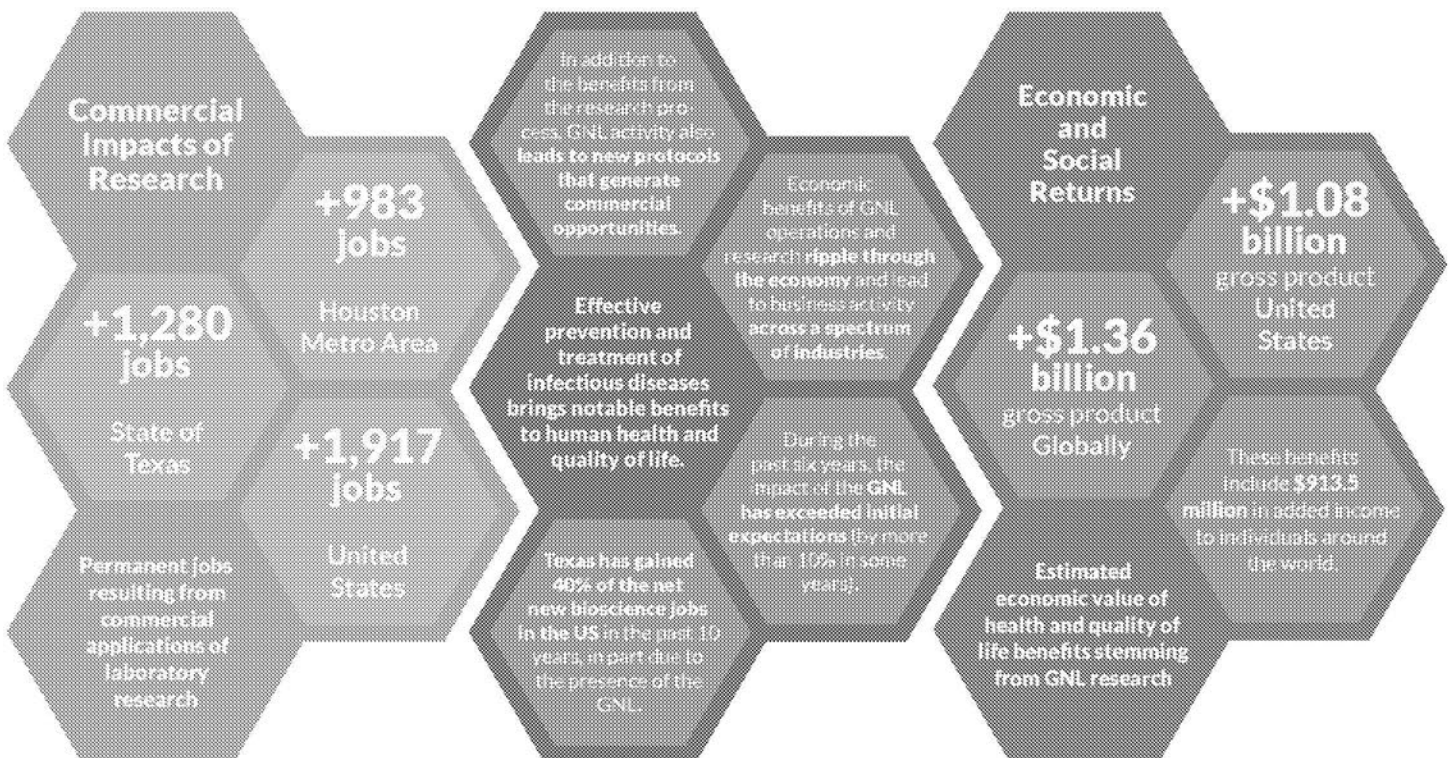
The Galveston National Laboratory (GNL) at the University of Texas Medical Branch is an anchor lab of the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health. As part of the Biodefense Laboratory Network, GNL is involved in crucial research to better understand, prevent, and treat dangerous pathogens.

In addition to the importance of GNL's work in the areas of human health and national security, GNL also generates significant economic benefits. The Perryman Group estimated the economic impact of the first 10 years of operations. Benefits of research activity, effects of commercialization, and social improvement were also considered based on typical patterns for medical research; given the critical nature of infectious disease prevention and treatment, gains may be significantly understated.

### Cumulative Economic Benefits of Operating Galveston National Laboratory from 2008-2018

Effects in each successively larger geographic area are inclusive of prior results

City of Galveston	Galveston County	Houston Metro Area	State of Texas	United States of America
<b>+\$356.2 million</b> gross product	<b>+\$407.9 million</b> gross product	<b>+\$445.2 million</b> gross product	<b>+\$479.8 million</b> gross product	<b>+\$519.6 million</b> gross product
<b>+\$263.4 million</b> personal income	<b>+\$292.0 million</b> personal income	<b>+\$313.7 million</b> personal income	<b>+\$333.0 million</b> personal income	<b>+\$355.4 million</b> personal income
<b>+5,880 job-years</b>	<b>+6,291 job-years</b>	<b>+6,543 job-years</b>	<b>+6,882 job-years</b>	<b>+7,246 job-years</b>



## The Perryman Group

perryman.com | info@perryman.com | 254.751.9595

The Perryman Group is a focused team of analysts who know how to address any economic information task and present findings effectively. Our in-house professionals bring expertise in economics, finance, statistics, mathematics, real estate, valuation, systems analysis, engineering, technical communications, and marketing. Dr. Ray Perryman, President and CEO, has 40 years of experience in developing systems, analyzing complex problems, and communicating effectively.

### Definition of Terms

**Gross Product:** The final value of all goods and services produced in an economy during a given period of time.

**Personal Income:** The total income accruing to households where the income earner resides.

**Job-years:** The equivalent of one person working one job for one year.



---

**Sent:** 6/2/2021 4:09:21 PM  
**To:** LeDuc, James W. [(b) (6)]  
**Subject:** RE: call?

For reasons not clear to me they changed my phone number. See below. I

---

**From:** LeDuc, James W. <[(b) (6)]>  
**Sent:** Wednesday, June 2, 2021 11:31 AM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Subject:** call?

Hi Hugh,

Are you available for a quick call sometime today? I tried [(b) (6)] and got an error message. We will be talking to Congressional delegation tomorrow morning and I'd like to get talking points coordinated. Hope you're doing well,

Thanks, Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [(b) (6)]

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 9/17/2020 7:09:52 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** FW: Follow up on biocontainment suit potential issues  
**Attachments:** Use and Demand Inventory Biosafety Suits.xlsx

FYI in follow up to my earlier message.

Jim

---

**From:** Korch, George W. (CTR) <[(b) (6)]>  
**Sent:** Thursday, September 17, 2020 2:02 PM  
**To:** Ksiazek, Thomas G. <[(b) (6)]> Milazzo, Marylou <[(b) (6)]> Geisbert, Thomas W. <[(b) (6)]> Nichol, S. <[(b) (6)]> Montgomery, Joel M. <[(b) (6)]> Feldmann, Heinrich (NIH/NIAID) [E] <[(b) (6)]> Schmaljohn, C. <[(b) (6)]> Scott Rusk <[(b) (6)]> Davey, R. <[(b) (6)]> Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA) <[(b) (6)]> LeDuc, James W. <[(b) (6)]> Holubar, Connie J. <[(b) (6)]> Ntiforo, Corrie <[(b) (6)]> 'Ricardo Carrion, Jr.' <[(b) (6)]> Rodriguez, Luis <IMCEAEX-ou=Science+20and+20Technology\_ou=Exchange+20Administrative+20Group+20+28FYDIBOHF23SPDLT+29\_cn=Recipients\_cn=Rodriguez+2C+20[(b) (6)]>  
**Subject:** Follow up on biocontainment suit potential issues

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear BSL-4 Laboratory Directors/Colleagues:

I am sending you this message to bring you up to date on activities that are starting to happen as a result of the message that Dr. Tom Ksiazek sent to all of us regarding the apparent cessation of manufacturing of the ILC Dover biocontainment suit.

I have reached out to the U.S. Federal officials who are responsible for our sponsorship here at my DHS laboratory (NBACC), and they in turn have now engaged an interagency governmental body (the Biorisk Management Group) to begin action on gathering data. They will be verifying with the Dover group that they do intend to cease production at the end of this year. With that verification, they will then need data from the users, which will be current inventory and anticipated future replacement requirements. I put together a spreadsheet with this type of information for my facility that was shared with my DHS colleagues, and they in turn have mobilized this data form up through the Biorisk Management group. So, there are a number of federal agencies now aware of the potential suit issues, which will also extend to the Honeywell suit, if they become the only commercially-available ensemble with a track record. I am attaching the data template to this message for your awareness.

The response that is likely to follow will be a coordinated one for the US government served laboratories, but will (should) also take account of private and academic facility needs. I am assuming that our Canadian colleagues will also have a need to identify supply chain issues, but their input is very much welcomed here as well. I will try to serve as a conduit for information, but it may also be likely at some point where the discussion is happening with all federal and non-federal parties engaged together.

Regards,



George

George W. Korch, PhD  
Director  
National Biodefense Analysis and Countermeasures Center  
President, Battelle National Biodefense Institute  
8300 Research Plaza  
Fort Detrick, Frederick, MD 21702  
Office: (b) (6) 9  
Cell: (b) (6)  
E-mail (b) (6)

Confidentiality Notice/Disclaimer

This document was prepared for the Department of Homeland Security (DHS) by the Battelle National Biodefense Institute, LLC (BNBI), manager and operator of the National Biodefense Analysis and Countermeasures Center (NBACC) under contract HSHQDC-15-C-00064. In no event shall DHS, BNBI, or NBACC have any responsibility or liability for any use, misuse, inability to use, or reliance upon the information contained herein. No warranty of fitness for a particular purpose, merchantability, accuracy or adequacy is provided regarding the contents of this document. This document may contain information that is privileged, confidential and/or otherwise exempt from disclosure under applicable law. If the reader of this message is not the intended recipient or the employee or agent responsible for delivering the message to the intended recipient, any disclosure, dissemination, distribution, copying or other use of this communication or its substance is prohibited. If you have received this communication in error, please return to the sender and delete from your computer system.

---

**From:** Ksiazek, Thomas G. (b) (6) >  
**Sent:** Tuesday, September 15, 2020 4:06 PM  
**To:** Knox, Rebecca (b) (6)  
**Cc:** Milazzo, Marylou (b) (6); Geisbert, Thomas W. <(b) (6)> Nichol, S( (b) (6)  
(b) (6); Montgomery, Joel M. (b) (6) Feldmann, Heinrich (NIH/NIAID) [E]  
<(b) (6)> Schmaljohn, C (b) (6) Scott Rusk  
( (b) (6) <(b) (6)> Davey, R. ( (b) (6) Korch, George W. (CTR)  
<(b) (6)> Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA) <(b) (6)  
(b) (6) LeDuc, James W. (b) (6) Holubar, Connie J. <(b) (6)  
Ntiforo, Corrie (b) (6)  
**Subject:** RE: quote for 10 suits

Yikes...

So much for good old American know how. Seriously, this does create what I would consider a strategic resource issue. Even though Sperian (Honeywell) is now a U.S. Company, the suits are still manufactured in France.

Tom Ksiazek

---

**From:** Knox, Rebecca (b) (6)  
**Sent:** 15 September, 2020 12:38  
**To:** Ksiazek, Thomas G. <(b) (6)>  
**Cc:** Milazzo, Marylou (b) (6) Geisbert, Thomas W. <(b) (6)> Knox, Rebecca

(b) (6)

**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Unfortunately we are stepping out of this product completely,

Best Regards,  
Rebecca Knox

(b) (6)

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**From:** Ksiazek, Thomas G. (b) (6)  
**Sent:** Tuesday, September 15, 2020 12:58 PM  
**To:** Knox, Rebecca (b) (6)  
**Cc:** Milazzo, Marylou <(b) (6)> Geisbert, Thomas W. (b) (6)  
**Subject:** RE: quote for 10 suits

Is there a replacement product, or are you stepping out of this altogether?

Tom Ksiazek

*T. G. Ksiazek, DVM, PhD  
Professor  
Depts of Pathology and Microbiology and Immunology  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston TX 77555-0610*

Phone (b) (6)  
Direct  
Mobile

e-mail: (b) (6)

<https://www.scopus.com/authid/detail.uri?authorId=7101963789>

---

**From:** Knox, Rebecca (b) (6)  
**Sent:** 15 September, 2020 10:15  
**To:** Milazzo, Marylou <(b) (6)>  
**Cc:** Ksiazek, Thomas G. <(b) (6)> Knox, Rebecca (b) (6)  
**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Marylou,  
I will tell you that we are eliminating this product by the end of this year. The pricing has increased due to production, and cost of products. Please find attached. If you need anything else please let me know.



Best Regards,  
Rebecca Knox

(b) (6)

---

**From:** Milazzo, Marylou (b) (6)  
**Sent:** Tuesday, September 15, 2020 10:29 AM  
**To:** Knox, Rebecca <(b) (6)>  
**Cc:** Ksiazek, Thomas G. (b) (6)  
**Subject:** FW: quote for 10 suits  
**Importance:** High

Becky,  
Is the January 2020 price attached current for a 3530-10001 style Chemturon Protective suit?  
If not, please forward current pricing.  
Thank you.

Mary Lou Milazzo

(b) (6)

---

**From:** Knox, Rebecca (b) (6)  
**Sent:** Monday, January 6, 2020 6:51 AM  
**To:** Milazzo, Marylou (b) (6)  
**Cc:** Knox, Rebecca <(b) (6)>  
**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Mary,  
I apologize, As I mentioned I was experiencing computer issues on Friday. I have completed your quote for your review. Please let me know if you have any questions. We should not have an issue meeting an April delivery date. Please advise if you would like the units to ship all together or would you like to ship as they come available?

**Rebecca Knox**

Senior Customer Service Coordinator

(b) (6)

ILC Dover One Moonwalker Road Frederica DE USA 19946-2080  
[www.ilcdover.com](http://www.ilcdover.com)

---

**From:** Milazzo, Marylou (b) (6)  
**Sent:** Friday, January 3, 2020 6:17 PM  
**To:** Knox, Rebecca (b) (6)  
**Subject:** quote for 10 suits

Hi Becky,  
Have you had a chance to prepare that quote for UTMB?

Thank you,  
Mary Lou

---

**Mary Lou Milazzo**

Assistant Director, GNL BSL-4 Laboratory  
Institute for Human Infections and Immunity

University of Texas Medical Branch  
301 University Blvd., Mailstop L29052  
Galveston, TX 77555-0610

P (b) (6) M (b) (6)  
F 409.266.6686 E (b) (6)  
b



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BU

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IRF

NBACC

NBAF (estimated need)

RML

TBRI

USAMRIID

UTMB

ILC Dover			Honeywell			Other		
On Hand	Average Annual Turn-over	Anticipated Purchases over next year	On Hand	Average Annual Turn-over	Anticipated Purchases over next year	On Hand	Average Annual Turn-over	Anticipated Purchases over next year
	28	25%	6	64	50%	20	N/A	N/A



ILC Dover	Honeywell	Other
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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 6/23/2021 6:56:10 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Senate HELP committee

Hugh,

I was approached late last week by Bob Kadlec, former DHHS ASPR, asking if I would serve as a senior advisor on a study he has been asked to lead for the Senate HELP committee. Bob is now employed by the HELP committee and creating this report is one of his primary tasks. The study will be co-chaired by Senator Murray and Senator Burr and is tasked with determining the facts surrounding the emergence of SARS CoV2 virus, the cause of the pandemic. I don't have a formal terms of reference for the study, but was told that this is strictly fact-finding and will not attempt to draw conclusions regarding the origin, will not focus on NIH funded activities, and will not specifically address the merits of gain of function studies. In addition to Bob Kadlec, other members of the study group included a China expert, Toy Reid (male) from DOS, and Bob Foster from the HELP committee staff. Gerry Parker from TAMU has also agreed to serve as a senior advisor and others may be asked to contribute as well. The preliminary report to the HELP committee will be due in mid-to late-August, with a full report later, depending on the findings.

I told Bob that I would be happy to help. We are likely to meet weekly until the preliminary report is finalized. All meetings will be virtual and I am not being paid.

I consider it an honor to be asked to contribute and feel that this is a great opportunity to help contribute to the narrative by highlighting issues surrounding biocontainment lab safety and operations, including the critical importance of biosafety and biosecurity, and the need for international engagement to ensure best practices are known and implemented.

Please let me know if you would like to discuss or have concerns.

Thanks, Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [(b) (6)]

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 9/17/2020 6:49:56 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**CC:** Ksiazek, Thomas (Galveston National Laboratory-UT) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=630dd80b583042f2995c2ea6166fd6be-tgksiaze.ut]; Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]; Korch, George W. (CTR) [REDACTED] (b) (6)  
**Subject:** Heads up on BSL4 suits

Hi Hugh,

I want to give you a heads up about an emerging issue regarding production of the "space suits" used in the BSL4 labs. There are two primary manufacturers of the suits, one is ILC Dover that has produced the blue, heavier suits for many years. These are manufactured in Delaware and are more durable, but have drawbacks in terms of interior noise and weight. The other is produced by Honeywell and manufactured in France. These are the white suits and are lighter in weight and quieter, but less durable and have a shorter lifespan, at least in our hands. The cost for each is roughly the same.

We learned earlier this week that Dover is planning to cease production of the blue suits at the end of the calendar year. They are honoring current orders, but will cease production next year. We are concerned that these suits are a critical element essential for work at BSL4 and that reliance on a single supplier that manufactures in France may lead to supply delays and ultimately represents a potential national security vulnerability.

We alerted folks working in the other US BSL4 labs and they share our concerns, although not all labs use the Dover suits. The IRF uses only Honeywell suits, RML uses a mix of both, as does NBACC. We have yet to hear back from USAMRIID, but historically they used Dover suits. CDC uses both, I think, and Texas Biomed has only Honeywell suits now, but was planning to purchase Dovers. Boston uses both and the new NBAF agriculture lab in Kansas plans to use both.

We discussed with George Korch, director at NBACC, and he has alerted his DHS leadership and some of his past colleagues in the federal security circles. They are reaching out to Dover to confirm that they are stopping production. Simultaneously, we are collecting data on demand from all the labs. These actions are underway now.

We wanted to alert you to this evolving situation in case you or Tony are contacted. I tried to call earlier but missed you. We'll keep you informed as this progresses and please let us know if you have questions or suggestions going forward. I discussed with Nancy yesterday.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [REDACTED] (b) (6)  
(f) 409-266-6810  
(m) [REDACTED] (b) (6)



---

**From:** LeDuc, James W. <(b) (6)>  
**Sent:** 7/22/2021 6:21:42 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** RE: WHO SAGO

Thanks very much for the prompt reply and support. Hope your summer is going well,

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] <(b) (6)>  
**Sent:** Thursday, July 22, 2021 12:45 PM  
**To:** LeDuc, James W. <(b) (6)>  
**Subject:** RE: WHO SAGO

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Jim, you can be sure that Tony will be highly supportive of your participating.

Hugh

---

**From:** LeDuc, James W. <(b) (6)>  
**Sent:** Thursday, July 22, 2021 11:49 AM  
**To:** Fauci, Anthony (NIH/NIAID) [E] <(b) (6)> Auchincloss, Hugh (NIH/NIAID) [E] <(b) (6)>  
**Subject:** WHO SAGO

Tony, Hugh

I noted with interest the WHO DG's recent announcement about the establishment of a new permanent International Scientific Advisory Group for Origins of Novel Pathogens, or SAGO and that a call will soon be made for nominations, including from Member States, for highly qualified experts. I would like to be considered for this advisory group and am writing to seek your support. Given my experience in directing the GNL and my personal research in emerging infectious diseases, I feel that I would bring an important and unique perspective to the SAGO, especially in terms of biocontainment laboratory operations, safety and security. Below is the link the recent WHO announcement and attached is a brief biosketch.

Thank you for any support you may be able to provide. I would welcome the opportunity to discuss further with you as appropriate.

With best wishes and sincere thanks,

Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) (b) (6)

<https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-member-state-information-session-on-origins>

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 12/23/2020 4:59:50 PM  
**To:** Boyd, Nancy (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=78544d77c6ad49dc8226ac9b020d7fbc-nboyd]  
**CC:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** FW: Prior Approval Request: Change in Key Personnel; Award 5UC7AI094660-08; LeDuc, James  
**Attachments:** Change in Key Personnel\_LeDuc\_Dec2020.pdf

FYI

---

**From:** Taylor Bray, Christy J. <[(b) (6)]>  
**Sent:** Tuesday, December 22, 2020 4:46 PM  
**To:** [(b) (6)]  
**Cc:** LeDuc, James W. <[(b) (6)]> Holubar, Connie J. <[(b) (6)]> LeGros, Erika <erlegros@UTMB.EDU>  
**Subject:** Prior Approval Request: Change in Key Personnel; Award 5UC7AI094660-08; LeDuc, James

Mr. Fato,




Attached is the formal notification of Dr. LeDuc's retirement and request to change key personnel on award 5UC7AI094660-08.

If you have any questions, please do not hesitate to contact me.

Regards,  
Christy

Christy Taylor Bray, MS, CRA  
Interim Director, Office of Sponsored Programs  
Assistant Director, Research Training & Development - Research Services  
Institutional Signing Official

**UTMB Health**

301 University Blvd., Galveston, TX 77555-0156 | 4.400J Rebecca Sealy  
 [(b) (6)] |  [(b) (6)] |  409-266-9469

In accordance with our institutional winter break, Research Administration Office will be closed from Thursday, December 24, 2020 through Friday, January 1, 2021 to allow our staff to spend time with their families. Normal business hours will resume Monday, January 4, 2021. If you need to submit a proposal or finalize award actions with deadlines during our office closure holidays please work with OSP to submit it by noon on Wednesday, December 23. Our central mailboxes will not be monitored during this time. If an emergency should arise during this time, please send the communication to Christy Taylor Bray [(b) (6)], Erika LeGros [(b) (6)] and Claudia Delgado [(b) (6)] who will be checking their emails sporadically during this time.

Research Administration staff wishes you and your family a safe and happy holiday season.



Dec. 22, 2020

Michael Fato  
Lead Grants Management Specialist DHHS, NIH, NIAID, GMP  
6700-B Rockledge  
Drive Room 2123,  
MSC 7614  
Bethesda, MD 20892

Grant #: 5UC7AI094660-08

PI Name: James LeDuc

Mr. Fato,

Please allow this letter to serve as formal notification of the retirement of Dr. James Le Duc, Director of the Galveston National Laboratory and Core Director for the Administrative and Biosecurity Cores for the Limited Competition: National Biocontainment Laboratories (NBLs) Operations Support (UC7). Dr. Le Duc's retirement will be effective on January 31, 2021. A national search for his replacement is underway, and until a permanent Director is hired, his role will be temporarily filled by Dr. Randall J. Urban, Vice President of Research at the University of Texas Medical Branch.

This change in key personnel information by Dr. Le Duc. If you have any questions or require additional detail, please contact me.

Regards,



Christy Taylor-Bray  
Interim Director  
Office of Sponsored Programs

---

**From:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Sent:** 1/22/2021 8:32:40 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** FW: Interesting

Hugh, Congratulations on your son's election! Connie dug out the link below while we were watching the Research America webcast this afternoon. Your son's suggestion is right on target; we should consider replicating the MIT technology in the RBL/NBL network labs and other academic centers.

Nice to see the new attitude toward science in the government.

Best wishes, Jim

---

**From:** Holubar, Connie J. <[REDACTED]> (b) (6)  
**Sent:** Friday, January 22, 2021 1:39 PM  
**To:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Subject:** Interesting

I think you are listening to this Research America program right now as well. I was looking up the speaker, and found this. He is Hugh's son.

<https://washingtonnote.com/auchincloss-on-testing-and-schools/>

---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 2/1/2021 3:34:26 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Automatic reply: transitions and thanks

I retire from UTMB on 31 Jan 2021, but hope to return as adjunct faculty in 30-45 days. For personal communications, please contact me at [REDACTED] (b) (6). For issues related to the GNL, please contact Dr Tom Ksiazek at [REDACTED] (b) (6).



---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 2/23/2021 9:30:21 PM  
**To:** Brining, Douglas L. [(b) (6)]  
**CC:** Urban, Randall J. [(b) (6)] Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Re: Nomination for the Standing Committee on the Care and Use of Animals in Research

Yes!!! Great news!!

I'm sure you'll do a great job. Thanks for taking this additional duty on.

Jim

Sent from my iPhone

On Feb 23, 2021, at 3:27 PM, Brining, Douglas L. <[(b) (6)]> wrote:

Fyi. Dr LeDuc called some high up individuals to make this happen. Thank you sir if you can still see your emails.

Sent from my iPhone

Begin forwarded message:

**From:** "Blue, Angela" <[(b) (6)]>  
**Date:** February 23, 2021 at 2:11:12 PM MST  
**To:** "Brining, Douglas L." <[(b) (6)]>  
**Cc:** "Sylvina, Teresa" <[(b) (6)]>  
**Subject:** Nomination for the Standing Committee on the Care and Use of Animals in Research

<b>WARNING:</b> This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.
---

Dear Dr. Brining,


On behalf of the Institute for Laboratory Animal Research, you have been nominated to serve on the Standing Committee on the Care and Use of Animals in Research. This committee aims to provide a venue for the exchange of ideas and knowledge sharing among federal government agencies, the private sector, academic communities, and other stakeholders engaged in animal research, research training, experimentation, biological testing or for related purposes or other special categories involving research animals. The standing committee's activities will be used to inform any future updates or additions to *The Guide for the Care and Use of Laboratory Animals (the Guide)*, and related products that would be generated by separate, ad hoc committees associated with this project.

As part of the nomination process, we request that each nominee complete a background information form, which is attached to this email. Please review, update if

necessary, and return this form by this Friday, February 26<sup>th</sup>. We look forward hearing from you.

Best,  
Ella

***The National Academies are committed to enhancing diversity and inclusion in order to strengthen the quality of our work. Diverse perspectives contribute to finding innovative approaches and solutions to challenging issues. We encourage the nomination of volunteers who reflect the populations we serve and also welcome in particular nominations of candidates from underrepresented racial and ethnic groups, women, and early- and mid-career professionals.***

Ella Blue, B.S.  
Program Assistant  
Division on Earth and Life Studies (DELS)  
Institute for Laboratory Animal Research (ILAR)  
 (b) (6)

<Brining\_Background Information Form\_Standing Committee for Guide.docx>

---

**From:** Urban, Randall J. <[REDACTED] (b) (6)>  
**Sent:** 2/23/2021 9:48:52 PM  
**To:** James Leduc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=89e5cd6106194c4d919065f18dd0cbea-jwleduc.utm]; Brining, Douglas L. <[REDACTED] (b) (6)>  
**CC:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Re: Nomination for the Standing Committee on the Care and Use of Animals in Research

I can't think of a more qualified person to do this.

Randy

---

**From:** LeDuc, James W. <[REDACTED] (b) (6)>  
**Sent:** Tuesday, February 23, 2021 3:30 PM  
**To:** Brining, Douglas L. <[REDACTED] (b) (6)>  
**Cc:** Urban, Randall J. <[REDACTED] (b) (6)> Hugh Auchincloss [E] <[REDACTED] (b) (6)>  
**Subject:** Re: Nomination for the Standing Committee on the Care and Use of Animals in Research

Yes!!! Great news!!

I'm sure you'll do a great job. Thanks for taking this additional duty on.

Jim

Sent from my iPhone

On Feb 23, 2021, at 3:27 PM, Brining, Douglas L. <[REDACTED] (b) (6)> wrote:

Fyi. Dr LeDuc called some high up individuals to make this happen. Thank you sir if you can still see your emails.

Sent from my iPhone

Begin forwarded message:

**From:** "Blue, Angela" <[REDACTED] (b) (6)>  
**Date:** February 23, 2021 at 2:11:12 PM MST  
**To:** "Brining, Douglas L." <[REDACTED] (b) (6)>  
**Cc:** "Sylvina, Teresa" <[REDACTED] (b) (6)>  
**Subject:** **Nomination for the Standing Committee on the Care and Use of Animals in Research**

<b>WARNING:</b> This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.
---

Dear Dr. Brining,



On behalf of the Institute for Laboratory Animal Research, you have been nominated to serve on the Standing Committee on the Care and Use of Animals in Research. This committee aims to provide a venue for the exchange of ideas and knowledge sharing among federal government agencies, the private sector, academic communities, and other stakeholders engaged in animal research, research training, experimentation, biological testing or for related purposes or other special categories involving research animals. The standing committee's activities will be used to inform any future updates or additions to *The Guide for the Care and Use of Laboratory Animals (the Guide)*, and related products that would be generated by separate, ad hoc committees associated with this project.

As part of the nomination process, we request that each nominee complete a background information form, which is attached to this email. Please review, update if necessary, and return this form by this Friday, February 26<sup>th</sup>. We look forward hearing from you.

Best,  
Ella

***The National Academies are committed to enhancing diversity and inclusion in order to strengthen the quality of our work. Diverse perspectives contribute to finding innovative approaches and solutions to challenging issues. We encourage the nomination of volunteers who reflect the populations we serve and also welcome in particular nominations of candidates from underrepresented racial and ethnic groups, women, and early- and mid-career professionals.***

Ella Blue, B.S.  
Program Assistant  
Division on Earth and Life Studies (DELS)  
Institute for Laboratory Animal Research (ILAR)

(b) (6)

<Brining\_Background Information Form\_Standing Committee for Guide.docx>

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**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 9/23/2020 7:53:11 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** call

Hi Hugh,

I just tried to call [(b) (6)] but got a message saying the call could not be completed as dialed. Not sure what's going on but it would be good to chat for a minute. Nothing urgent, but I did want to give you a heads up on a couple of issues including a possible press release that may come out tomorrow (Thursday, 24 Sept) from WHO. Let me know a good number and time to call. I hope you're doing well during these difficult times.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 9/24/2020 1:44:52 PM  
**To:** Korch, George W. (CTR) [(b) (6)]  
**CC:** Ksiazek, Thomas (Galveston National Laboratory-UT) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=630dd80b583042f2995c2ea6166fd6be-tgksiaze.ut]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Holubar, Connie J. [(b) (6)]  
**Subject:** RE: Update on the Chemtursion Suit discussions

George, thank you so much for taking this on and moving it forward so efficiently. Hopefully we can identify a solution with Dover or another manufacturer to ensure a steady supply of this critical resource.

I summarized the situation in an email to Hugh Auchincloss (NIAID deputy director) last week as was able to discuss briefly with him yesterday. He will brief Tony Fauci, so NIH leadership is aware of our efforts. Hugh recognizes the vulnerability of having only a single supplier and he expressed his appreciation for our efforts. He is copied here.

Thanks, Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) [(b) (6)]  
(f) 409-266-6810  
(m) [(b) (6)]

---

**From:** Korch, George W. (CTR) <[(b) (6)]>  
**Sent:** Thursday, September 24, 2020 7:39 AM  
**To:** 'Feldmann, Heinrich (NIH/NIAID) [E]' <[(b) (6)]> Ksiazek, Thomas G. <[(b) (6)]>  
Milazzo, Marylou <[(b) (6)]> Geisbert, Thomas W. <[(b) (6)]> Nichol, Stuart T.  
(CDC/DDID/NCEZID/DHCPP) <[(b) (6)]> Montgomery, Joel M. (CDC/DDID/NCEZID/DHCPP) <[(b) (6)]>  
Schmaljohn, Connie (NIH/NIAID) [E] <[(b) (6)]> Scott Rusk <[(b) (6)]> <[(b) (6)]>  
Davey, R. <[(b) (6)]> <[(b) (6)]> Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA)  
<[(b) (6)]> <[(b) (6)]> LeDuc, James W. <[(b) (6)]> Holubar, Connie J.  
<[(b) (6)]> Ntiforo, Corrie <[(b) (6)]> 'Ricardo Carrion, Jr.' <[(b) (6)]>  
<[(b) (6)]> Shupert, W. Lesley (NIH/NIAID) [E] <[(b) (6)]>; Jones, Michael (NIH/NIAID) [E]  
<[(b) (6)]>  
**Cc:** Kozlovac, Joseph <[(b) (6)]> Lohman, Danielle C <[(b) (6)]> Jones-Meehan, Joanne  
<[(b) (6)]>  
**Subject:** Update on the Chemtursion Suit discussions

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Dear BSL-4 Directors and Associates



First, thanks very much for your communications over this past week. I want to share with you current status of discussions related to the ILC Dover Chemtursion suits as an update to last week's initial discussions.

Mr. Joe Kozlovac, the Agency Biosafety Officer at USDA was able to connect with the Director of Marketing and New Business at DOVE who also directs the PPE product line. Dover indicated that they are planning on discontinuing the ILC Dover Chemtursion suit, based on three factors: 1. the manufacturer of the material they use in production of suits (Chlorpel) has gone out of business or otherwise stopped manufacturing (although they do have a large order of the material left); 2. skilled labor (the few individuals that actually construct suit are all nearing retirement age); demand for the suits have gone down (both from the chemical industry as well as from biocontainment). However, Joe did have a bit of good news in that the Dover representative indicated a willingness to re-evaluate and to find other options for continuation but a specific plan would need to be developed.

I accumulated through various sources that shared information a status of suit inventory for the two most frequently used suits (Dover and Honeywell) as well as demand and current information is attached (please update as you may be able with missing data or any new information).

The interagency Biorisk Management Working Group of the Biological Defense Research and Development Subcommittee (National Science and Technology Council) held a meeting this past Tuesday to discuss the background information and to identify options. It is managed by Joe Kozlovac and Danielle Lohman from DOS. I attended as a guest speaker. The discussion focused on availability long term of other suits, the need to quickly develop and present an options paper for consideration of a short term and long term strategy, and further data gathering of alternative sources. Hopefully, I will be able to continue in some capacity to represent the interests of the labs themselves on future discussions. In the meanwhile, I will be tracking the progress on these deliberations.

With best regards,

George

George W. Korch, PhD  
Director  
National Biodefense Analysis and Countermeasures Center  
President, Battelle National Biodefense Institute  
8300 Research Plaza  
Fort Detrick, Frederick, MD 21702  
Office: 3 (b) (6)  
Cell: (b) (6)  
E-mail: (b) (6)

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**From:** Feldmann, Heinrich (NIH/NIAID) [E] (b) (6)  
**Sent:** Friday, September 18, 2020 8:22 PM  
**To:** Korch, George W. (CTR) (b) (6); Ksiazek, Thomas (Galveston National Laboratory-UT) (b) (6); Milazzo, Marylou (b) (6); Geisbert, Thomas W. (b) (6); Nichol, Stuart T. (CDC/DDID/NCEZID/DHCPP) (b) (6); Montgomery, Joel M. (CDC/DDID/NCEZID/DHCPP) (b) (6); Schmaljohn, Connie (NIH/NIAID) [E] (b) (6); Scott Rusk (b) (6); (b) (6); Davey, R. (b) (6); Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA) (b) (6); James Leduc (b) (6); Holubar, Connie J. (b) (6); Ntiforo, Corrie (b) (6); 'Ricardo Carrion, Jr.' (b) (6); Rodriguez, Luis; Shupert, W. Lesley (NIH/NIAID) [E] (b) (6); Jones, Michael (NIH/NIAID) [E] (b) (6)  
**Subject:** RE: Follow up on biocontainment suit potential issues

George,

Here are RML's numbers (see attachment). So far, RML has only used the Honeywell product.

Best wishes,  
Heinz

---

**From:** Korch, George W. (CTR) (b) (6)  
**Sent:** Thursday, September 17, 2020 1:02 PM  
**To:** Ksiazek, Thomas (Galveston National Laboratory-UT) (b) (6); Milazzo, Marylou (b) (6); Geisbert, Thomas W. (b) (6); Nichol, Stuart T. (CDC/DDID/NCEZID/DHCPP) (b) (6); Montgomery, Joel M. (CDC/DDID/NCEZID/DHCPP) (b) (6); Feldmann, Heinrich (NIH/NIAID) [E] (b) (6); Schmaljohn, Connie (NIH/NIAID) [E] (b) (6); Scott Rusk (b) (6); Davey, (b) (6); Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA) (b) (6); James Leduc (b) (6); Holubar, Connie J. (b) (6); Ntiforo, Corrie (b) (6); 'Ricardo Carrion, Jr.' (b) (6); Rodriguez, Luis (b) (6)  
**Subject:** Follow up on biocontainment suit potential issues

Dear BSL-4 Laboratory Directors/Colleagues:

I am sending you this message to bring you up to date on activities that are starting to happen as a result of the message that Dr. Tom Ksiazek sent to all of us regarding the apparent cessation of manufacturing of the ILC Dover biocontainment suit.

I have reached out to the U.S. Federal officials who are responsible for our sponsorship here at my DHS laboratory (NBACC), and they in turn have now engaged an interagency governmental body (the Biorisk Management Group) to begin action on gathering data. They will be verifying with the Dover group that they do intend to cease production at the end of this year. With that verification, they will then need data from the users, which will be current inventory and anticipated future replacement requirements. I put together a spreadsheet with this type of information for my facility that was shared with my DHS colleagues, and they in turn have mobilized this data form up through the Biorisk Management group. So, there are a number of federal agencies now aware of the potential suit issues, which will also extend to the Honeywell suit, if they become the only commercially-available ensemble with a track record. I am attaching the data template to this message for your awareness.

The response that is likely to follow will be a coordinated one for the US government served laboratories, but will (should) also take account of private and academic facility needs. I am assuming that our Canadian colleagues will also have a need to identify supply chain issues, but their input is very much welcomed here as well. I will try to serve as a



conduit for information, but it may also be likely at some point where the discussion is happening with all federal and non-federal parties engaged together.

Regards,

George

George W. Korch, PhD  
Director  
National Biodefense Analysis and Countermeasures Center  
President, Battelle National Biodefense Institute  
8300 Research Plaza  
Fort Detrick, Frederick, MD 21702  
Office: 301-619-5999  
Cell: (b) (6)  
E-mail (b) (6)

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This document was prepared for the Department of Homeland Security (DHS) by the Battelle National Biodefense Institute, LLC (BNBI), manager and operator of the National Biodefense Analysis and Countermeasures Center (NBACC) under contract HSHQDC-15-C-00064. In no event shall DHS, BNBI, or NBACC have any responsibility or liability for any use, misuse, inability to use, or reliance upon the information contained herein. No warranty of fitness for a particular purpose, merchantability, accuracy or adequacy is provided regarding the contents of this document. This document may contain information that is privileged, confidential and/or otherwise exempt from disclosure under applicable law. If the reader of this message is not the intended recipient or the employee or agent responsible for delivering the message to the intended recipient, any disclosure, dissemination, distribution, copying or other use of this communication or its substance is prohibited. If you have received this communication in error, please return to the sender and delete from your computer system.

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**From:** Ksiazek, Thomas G. <(b) (6)>  
**Sent:** Tuesday, September 15, 2020 4:06 PM  
**To:** Knox, Rebecca (b) (6)>  
**Cc:** Milazzo, Marylou <(b) (6)> Geisbert, Thomas W. (b) (6); Nichol, S( (b) (6)  
(b) (6)>; Montgomery, Joel M. (b) (6); Feldmann, Heinrich (NIH/NIAID) [E]  
(b) (6); Schmaljohn, C ( (b) (6) (b) (6); Scott Rusk  
( (b) (6) <(b) (6)> Davey, R. ( (b) (6) <(b) (6)> Korch, George W. (CTR)  
(b) (6); Cox, E Darrin COL USARMY MEDCOM USAMRIID (USA) <(b) (6)>  
(b) (6) LeDuc, James W. (b) (6); Holubar, Connie J. (b) (6)  
Ntiforo, Corrie <(b) (6)>  
**Subject:** RE: quote for 10 suits

Yikes...

So much for good old American know how. Seriously, this does create what I would consider a strategic resource issue. Even though Sperian (Honeywell) is now a U.S. Company, the suits are still manufactured in France.

Tom Ksiazek



---

**From:** Knox, Rebecca (b) (6)  
**Sent:** 15 September, 2020 12:38  
**To:** Ksiazek, Thomas G. (b) (6)  
**Cc:** Milazzo, Marylou (b) (6); Geisbert, Thomas W. (b) (6); Knox, Rebecca (b) (6)  
**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Unfortunately we are stepping out of this product completely,

Best Regards,  
Rebecca Knox  
(b) (6)

---

**From:** Ksiazek, Thomas G. (b) (6)  
**Sent:** Tuesday, September 15, 2020 12:58 PM  
**To:** Knox, Rebecca (b) (6)  
**Cc:** Milazzo, Marylou (b) (6); Geisbert, Thomas W. (b) (6)  
**Subject:** RE: quote for 10 suits

Is there a replacement product, or are you stepping out of this altogether?

Tom Ksiazek

*T. G. Ksiazek, DVM, PhD  
Professor  
Depts of Pathology and Microbiology and Immunology  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston TX 77555-0610*

Phone (b) (6)  
Direct  
Mobile

e-mail: [tgksiaze@utmb.edu](mailto:tgksiaze@utmb.edu)

<https://www.scopus.com/authid/detail.uri?authorId=7101963789>

---

**From:** Knox, Rebecca (b) (6)  
**Sent:** 15 September, 2020 10:15  
**To:** Milazzo, Marylou (b) (6)  
**Cc:** Ksiazek, Thomas G. <(b) (6)>; Knox, Rebecca (b) (6)  
**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Marylou,

I will tell you that we are eliminating this product by the end of this year. The pricing has increased due to production, and cost of products. Please find attached. If you need anything else please let me know.

Best Regards,  
Rebecca Knox

(b) (6)

---

**From:** Milazzo, Marylou (b) (6)

**Sent:** Tuesday, September 15, 2020 10:29 AM

**To:** Knox, Rebecca <(b) (6)>

**Cc:** Ksiazek, Thomas G. (b) (6)

**Subject:** FW: quote for 10 suits

**Importance:** High

Becky,

Is the January 2020 price attached current for a 3530-10001 style Chemturiion Protective suit?

If not, please forward current pricing.

Thank you.

Mary Lou Milazzo

(b) (6)

---

**From:** Knox, Rebecca (b) (6)

**Sent:** Monday, January 6, 2020 6:51 AM

**To:** Milazzo, Marylou (b) (6)

**Cc:** Knox, Rebecca <(b) (6)>

**Subject:** RE: quote for 10 suits

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Mary,

I apologize, As I mentioned I was experiencing computer issues on Friday. I have completed your quote for your review. Please let me know if you have any questions. We should not have an issue meeting an April delivery date. Please advise if you would like the units to ship all together or would you like to ship as they come available?

**Rebecca Knox**

Senior Customer Service Coordinator

(b) (6) office

ILC Dover One Moonwalker Road Frederica DE USA 19946-2080

[www.ilcdover.com](http://www.ilcdover.com)

---

**From:** Milazzo, Marylou (b) (6)

**Sent:** Friday, January 3, 2020 6:17 PM

**To:** Knox, Rebecca (b) (6)

**Subject:** quote for 10 suits

Hi Becky,

Have you had a chance to prepare that quote for UTMB?

Thank you,  
Mary Lou

---

**Mary Lou Milazzo**

Assistant Director, GNL BSL-4 Laboratory  
Institute for Human Infections and Immunity

University of Texas Medical Branch  
301 University Blvd., Mailstop L29052  
Galveston, TX 77555-0610

P (b) (6) M (b) (6)  
F 409.266.6666 E (b) (6)



Working together to work wonders.™



---

**From:** LeDuc, James W. [(b) (6)]  
**Sent:** 6/2/2021 3:30:51 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** call?

Hi Hugh,

Are you available for a quick call sometime today? I tried [(b) (6)] and got an error message. We will be talking to Congressional delegation tomorrow morning and I'd like to get talking points coordinated. Hope you're doing well,

Thanks, Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [(b) (6)]

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**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 6/2/2021 7:09:07 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** Center for ID Preparedness and Response 1 pg  
**Attachments:** Center for ID Preparedness and Response 1 pager v4.doc

Hugh,

Thanks for taking time to talk earlier today. Your comment about pandemic preparedness reminded me of an initiative we proposed for state funding to create a center at UTMB on ID preparedness and response. Attached is a 1 pager that summarizes the concept. No word yet if the state will provide support, but it's a timely topic and I hope that we will continue to develop the concept.

Best wishes, Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [REDACTED] (b) (6)

# Center for Infectious Disease Preparedness & Response

## \$8M in FY22/23

***UTMB, with its expertise in infectious disease, is uniquely positioned to assist Texas with current and future pandemics. New strategic initiatives will be developed and existing resources leveraged to allow for active preparedness, ongoing surveillance and early detection, rapid response, and recovery for Texas.***

### ***Basic and Translational Research***

Diagnostic testing and assay development; molecular epidemiology/genotyping for outbreak investigations and contact tracing; test and evaluation of medical countermeasures and diagnostics using live pathogens in the Galveston National Laboratory; work with public and private partners

### ***Biosafety and Biosecurity***

Statewide training for first responders, healthcare and laboratory professionals involving UTMB's internationally recognized biosafety training center; virtual training and coaching; Train the Trainer initiatives; collaboration with national biocontainment care center network

### ***Public Health Ethics***

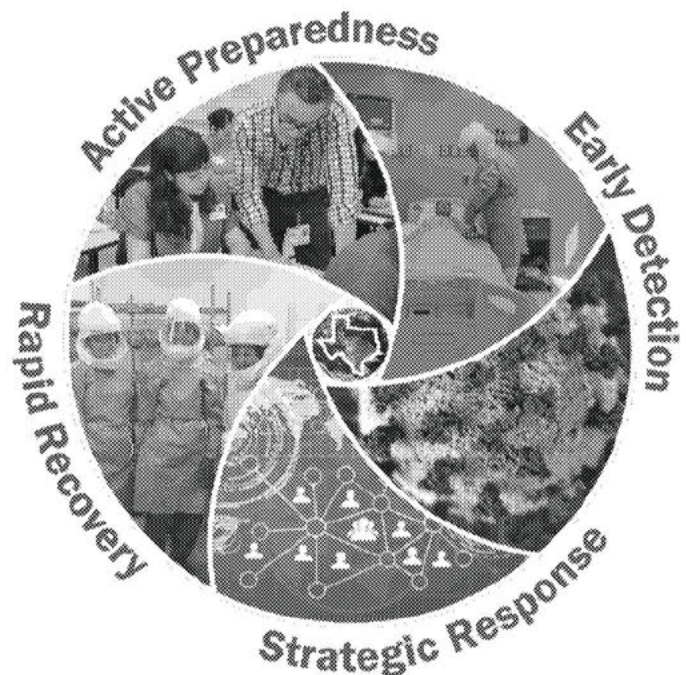
Collaboration with public health and ethics experts for resource allocation; considerations in experimental vaccine research, vaccine distribution, issues with dual-use potential of technologies, and crisis standards of care issues

### ***Epidemiology and Data Management***

Surveillance, modeling and forecasting (with partners); data dashboard development; supplies management and optimized public health interventions; post hoc analysis of possible unintended consequences of public health control measures used in actual outbreaks (e.g. COVID) that could have an effect on individual health or healthcare services availability

### ***Community Engagement, Training, and Education***

Public information and education to ensure accurate health information and instructions for Texas citizens including evidence-based policy and practice recommendations to community leaders, policy-makers, and practitioners; expansion of graduate education/curricula focused on pandemic preparedness and response; collaboration with state agencies and academic partners; education and training of UTMB faculty and staff, external workforce development, and field epidemiology training





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**From:** Auchincloss, Hugh (NIH/NIAID) [E] [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9304C753BB9E422C977DDDA54DA924B-AUCHINCLOSS]  
**Sent:** 7/22/2021 5:45:23 PM  
**To:** LeDuc, James W. [REDACTED] (b) (6)  
**Subject:** RE: WHO SAGO

Jim, you can be sure that Tony will be highly supportive of your participating.

Hugh

---

**From:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Sent:** Thursday, July 22, 2021 11:49 AM  
**To:** Fauci, Anthony (NIH/NIAID) [E] <[REDACTED]> (b) (6) Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Subject:** WHO SAGO

Tony, Hugh

I noted with interest the WHO DG's recent announcement about the establishment of a new permanent International Scientific Advisory Group for Origins of Novel Pathogens, or SAGO and that a call will soon be made for nominations, including from Member States, for highly qualified experts. I would like to be considered for this advisory group and am writing to seek your support. Given my experience in directing the GNL and my personal research in emerging infectious diseases, I feel that I would bring an important and unique perspective to the SAGO, especially in terms of biocontainment laboratory operations, safety and security. Below is the link the recent WHO announcement and attached is a brief biosketch.

Thank you for any support you may be able to provide. I would welcome the opportunity to discuss further with you as appropriate.

With best wishes and sincere thanks,

Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [REDACTED] (b) (6)

<https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-member-state-information-session-on-origins>

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**From:** Auchincloss, Hugh (NIH/NIAID) [E] [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9304C753BB9E422C977DDAB54DA924B-AUCHINCLOSS]  
**Sent:** 6/2/2021 5:02:08 PM  
**To:** LeDuc, James W. [(b) (6)]  
**Subject:** RE: call?

For reasons not clear to me they changed my phone number. See below. I'm here for at least the next several hours

Hugh Auchincloss, M.D.  
Deputy Director, NIAID  
National Institutes of Health  
Bldg. 31 (7A/03), 31 Center Drive, MSC 2520  
Bethesda, MD 20892  
Phone: [(b) (6)]

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 original 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 Institute of Allergy and Infectious Diseases (NIAID) shall not accept liability for any statements made that are the sender's own and not expressly made on behalf of the NIAID by one of its representatives.

---

**From:** LeDuc, James W. <[(b) (6)]>  
**Sent:** Wednesday, June 2, 2021 11:31 AM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <[(b) (6)]>  
**Subject:** call?

Hi Hugh,

Are you available for a quick call sometime today? I tried [(b) (6)] and got an error message. We will be talking to Congressional delegation tomorrow morning and I'd like to get talking points coordinated. Hope you're doing well,

Thanks, Jim

James W. Le Duc  
University of Texas Medical Branch  
(m) [(b) (6)]

---

**From:** Sean Layne (b) (6)  
**Sent:** 6/23/2021 11:13:58 AM  
**To:** (b) (6); (b) (6); (b) (6);  
(b) (6); (b) (6); (b) (6); (b) (6)  
(b) (6); (b) (6); (b) (6); (b) (6) Fauci,  
Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci];  
(b) (6); (b) (6); (b) (6); (b) (6)  
(b) (6); (b) (6)  
**CC:** (b) (6); (b) (6)  
**Subject:** Dong has a lot of info on the ccp side. Lawyer up dipshits!!! How do you think this ends for your families??? Change their names now.

On Jun 23, 2021, at 6:16 AM, Sean Layne <(b) (6)> wrote:

On Jun 23, 2021, at 5:36 AM, Sean Layne <(b) (6)> wrote:

<https://citizenfreepress.com/breaking/joe-rogan-fauci-and-peter-daszak-guilty-as-charged/>

On Jun 22, 2021, at 3:45 PM, Sean Layne  
<(b) (6)> wrote:

<https://citizenfreepress.com/breaking/raheem-kassam-pwns-fauci/>

On Jun 22, 2021, at 3:29 PM, Sean Layne  
<(b) (6)> wrote:

<https://www.redvoicemedia.com/2021/06/recording-s-of-moderna-representative-making-horrific-admission-about-jab/>

On Jun 22, 2021, at 12:55 PM, Sean  
Layne <(b) (6)>  
wrote:



<image0.jpeg>

On Jun 22, 2021, at  
4:42 AM, Sean Layne

(b) (6)

wrote:

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**From:** Sean Layne (b) (6)  
**Sent:** 6/23/2021 10:16:39 AM  
**To:** (b) (6); (b) (6); (b) (6);  
(b) (6); (b) (6); (b) (6); (b) (6);  
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Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci];  
ra (b) (6); (b) (6); (b) (6); (b) (6);  
(b) (6); (b) (6)  
**CC:** (b) (6); (b) (6)  
**Subject:** Fauci is giving you all up! He's telling them everything. Lawyer up dipshits!!!

On Jun 23, 2021, at 5:36 AM, Sean Layne <(b) (6)> wrote:

<https://citizenfreepress.com/breaking/joe-rogan-fauci-and-peter-daszak-guilty-as-charged/>

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<(b) (6)> wrote:

<image0.jpeg>

On Jun 22, 2021, at 4:42 AM, Sean  
Layne (b) (6)  
wrote:

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**From:** Sean Layne [REDACTED] (b) (6)  
**Sent:** 6/23/2021 9:36:17 AM  
**To:** [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6);  
[REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6);  
[REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6) Fauci,  
Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group  
(FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci];  
[REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6)  
[REDACTED] (b) (6); [REDACTED] (b) (6)  
**CC:** [REDACTED] (b) (6); [REDACTED] (b) (6)  
**Subject:** Tick tock motherfuckers! THEY HAVE IT ALL!!!

<https://citizenfreepress.com/breaking/joe-rogan-fauci-and-peter-daszak-guilty-as-charged/>

On Jun 22, 2021, at 3:45 PM, Sean Layne <[REDACTED] (b) (6)> wrote:

<https://citizenfreepress.com/breaking/rahcem-kassam-pwns-fauci/>

On Jun 22, 2021, at 3:29 PM, Sean Layne <[REDACTED] (b) (6)> wrote:

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On Jun 22, 2021, at 12:55 PM, Sean Layne  
<[REDACTED] (b) (6)> wrote:

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On Jun 22, 2021, at 4:42 AM, Sean Layne  
<[REDACTED] (b) (6)> wrote:



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**From:** Sean Layne (b) (6)  
**Sent:** 6/23/2021 12:18:55 PM  
**To:** (b) (6) (b) (6) (b) (6)  
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Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group  
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(b) (6) (b) (6) (b) (6) (b) (6)  
(b) (6) (b) (6)  
**CC:** (b) (6) (b) (6)  
**Subject:** It's almost like WE KNOW EVERYTHING!!! Future not too bright for you pedophiles.

<https://www.thegatewaypundit.com/2021/06/sick-dr-fauci-gave-61-million-studies-including-one-used-aborted-baby-parts-rats/>

On Jun 23, 2021, at 7:46 AM, Sean Layne <(b) (6)> wrote:

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On Jun 23, 2021, at 7:29 AM, Sean Layne <(b) (6)> wrote:

On Jun 23, 2021, at 7:13 AM, Sean Layne  
<(b) (6)> wrote:

On Jun 23, 2021, at 6:16 AM, Sean Layne  
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On Jun 22, 2021, at 3:29 PM, Sean Layne

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wrote:

<https://www.recordmedia.com/2021/06/recordings-of-modern-representative-making-horrific-admission->

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**From:** Sean Layne [REDACTED] (b) (6)  
**Sent:** 6/23/2021 6:34:52 PM  
**To:** [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6) Fauci, Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]; [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6); [REDACTED] (b) (6)  
**CC:** [REDACTED] (b) (6); [REDACTED] (b) (6)  
**Subject:** Oops! Bet you moderna pedophiles didn't know this was leaked. YOU CCP SRA PEDOS LOSE! Patriots win!!!

<https://rumble.com/viwkzh-breaking-recordings-of-moderna-representative-making-horrific-admission-abo.html>

On Jun 23, 2021, at 8:18 AM, Sean Layne <[REDACTED] (b) (6)> wrote:

<https://www.thegatewaypundit.com/2021/06/sick-dr-fauci-gave-61-million-studies-including-one-used-aborted-baby-parts-rats/>

On Jun 23, 2021, at 7:46 AM, Sean Layne <[REDACTED] (b) (6)> wrote:

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<[REDACTED] (b) (6)> wrote:

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wrote:



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at 3:45  
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Layne

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wrote:

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On Jun 24, 2021, at 7:39 AM, Sean Layne <[REDACTED]> (b) (6) wrote:

Make sure your lawyers have tribunal experience pedos. TREASON AND CRIMES AGAINST HUMANITY IS NOT FUCKING COOL!!!

On Jun 21, 2021, at 6:46 AM, Sean Layne <[REDACTED]> (b) (6) wrote:

This was two weeks ago. Think of what we have now on you communist traitor assholes!!!

<https://nypost.com/2021/06/04/who-is-peter-daszak-exec-who-sent-taxpayer-money-to-wuhan-lab/>

On Jun 21, 2021, at 6:39 AM, Sean Layne

<[REDACTED] (b) (6) wrote:



---

**From:** LeDuc, James W. [REDACTED] (b) (6)  
**Sent:** 10/2/2020 7:16:23 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]  
**Subject:** RE: Nominate Experts: Standing Committee for the Care and Use of Animals in Research

You are the BEST! Thanks so much!

I'm sure ASF will be in even more demand now.

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Sent:** Friday, October 02, 2020 1:17 PM  
**To:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Subject:** RE: Nominate Experts: Standing Committee for the Care and Use of Animals in Research

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

OK did this as ASF

---

**From:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Sent:** Thursday, October 1, 2020 5:43 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Subject:** RE: Nominate Experts: Standing Committee for the Care and Use of Animals in Research

Thanks for the follow up, Hugh. The nomination process is quite simple; you click on the link and then type in the name of the nominator, add email address, and check appropriate block if NASEM member. Next page you add the name of the nominee, their contact info, attach the CV and paste in a brief narrative. We wrote a draft narrative (attached) for your consideration. I think that's it; they ask if you would like to nominate another person and if you say no, you then automatically exit. I think you could do this for Tony, but coming from you would also be quite impressive, I'm sure.

Wonderful news on Heinz. This is a big deal and great recognition of his many talents and contributions.

Thanks for considering Doug. We need good, experienced people on the committee.

Jim

---

**From:** Auchincloss, Hugh (NIH/NIAID) [E] <[REDACTED]> (b) (6)  
**Sent:** Thursday, October 01, 2020 2:08 PM  
**To:** LeDuc, James W. <[REDACTED]> (b) (6)  
**Subject:** RE: Nominate Experts: Standing Committee for the Care and Use of Animals in Research

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Jim, Heinz is being inducted this year but I don't think he's a member of the NASEM yet. We don't have anyone else at RML. Tony could do it, but truly doesn't have a second in the day. Is it something I could do for him?

---

**From:** LeDuc, James W. <(b) (6)>  
**Sent:** Wednesday, September 30, 2020 3:10 PM  
**To:** Auchincloss, Hugh (NIH/NIAID) [E] <(b) (6)>  
**Cc:** Brining, Douglas L. <(b) (6)>  
**Subject:** FW: Nominate Experts: Standing Committee for the Care and Use of Animals in Research

Hi Hugh,

Please see announcement below from the NASEM seeking nominations for experts to serve on the standing committee for care and use of animals in research. I just submitted a nomination for (b) (6) who currently serves as our (b) (6) in the GNL. You may recall (b) (6) from his time at (b) (6). (b) (6) is a superb leader and thoughtful manager of the program who has led us through some challenging times and certainly improved our program immensely. His cv is attached and a brief bio is pasted below.

The application link asks if the nominator is a member of NASEM, and unfortunately I am not. I'm wondering if Tony might consider endorsing (b) (6) nomination? Or if there are other Academy members on NIAID staff that would remember (b) (6) and be supportive of his nomination. (b) (6) brings both a unique perspective to the use of animals in research and a wealth of experience and established professionalism that would serve the community well on this important committee.

Thanks for any help you might be able to provide.

Jim

James W. Le Duc, Ph.D.  
Director  
Galveston National Laboratory  
University of Texas Medical Branch  
Galveston, TX 77555-0610  
(t) (b) (6)  
(f) 409-266-6810  
(m) (b) (6)

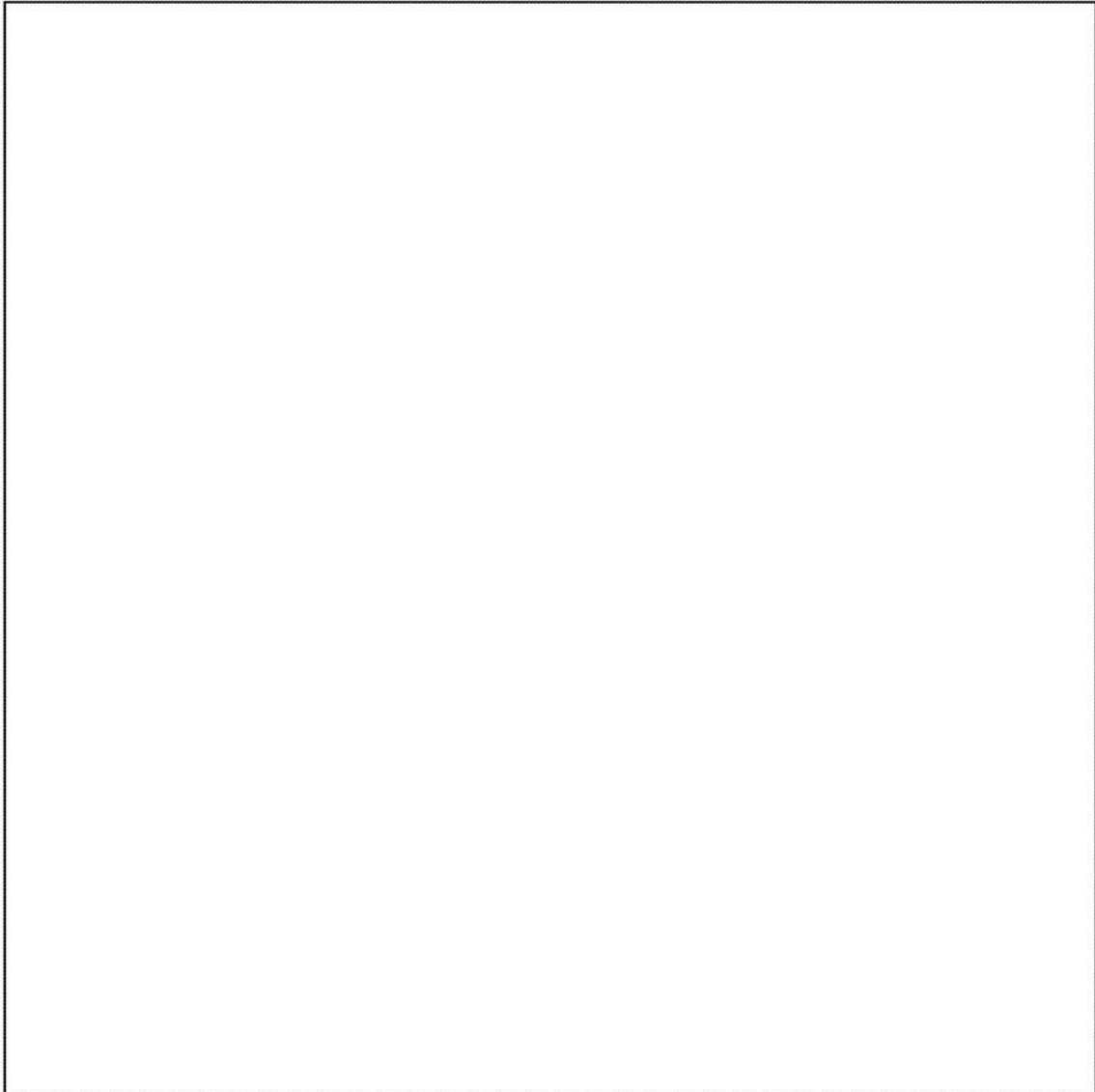
(b) (6)

---

**From:** NASEM Institute for Laboratory Animal Research <ILAR@nas.edu>  
**Sent:** Wednesday, September 30, 2020 9:41 AM  
**To:** LeDuc, James W. <(b) (6)>  
**Subject:** Nominate Experts: Standing Committee for the Care and Use of Animals in Research

**WARNING:** This email originated from outside of UTMB's email system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

[View this email in your browser](#)



***Nominate Experts:***

**Standing Committee for the Care and Use of Animals in Research**

The National Academies' [Institute for Laboratory Animal Research](#) is seeking nominations of experts to serve on a new standing committee to inform future updates or additions to [The Guide for the Care and Use of Laboratory Animals](#) (the Guide). Now in its 8th edition, the Guide is one of the most well-known documents in the animal care and use field and serves as the basis for



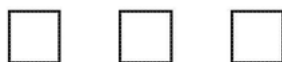
accreditation of institutions worldwide. The standing committee will aim to provide a venue for the exchange of ideas and knowledge sharing among federal government agencies, academic communities, the private sector, and other stakeholders engaged in animal research, research training, experimentation, biological testing or for related purposes or other special categories involving research animals.

A committee of experts will be appointed by the National Academies, drawing members from the academic, government, private, and non-profit sectors. The interdisciplinary committee will require members to be scientists and veterinarians with training in Laboratory Animal Medicine and knowledge, expertise, and current experience with animal research under captive or natural conditions, and relevant to:

- regulatory and compliance matters
- biodiversity conservation
- the care, use and welfare of laboratory, domestic, agricultural and/or terrestrial and aquatic wild animal (e.g. cephalopods and polar species),
- privately owned animals (e.g. companion animals, pets) species
- other special categories involving research animals
- basic and translational sciences
- One Health
- research training
- biological testing
- other research and teaching activities.

**The nominations deadline is Tuesday, October 13, 2020.** Nominees should be available to attend a meetings (virtually) as early as November 2020. In forming the committee, we seek to include individuals who are at different stages of their careers, including junior faculty and senior investigators, as well as those from underrepresented groups. Self-nominations are also welcomed. Make your nomination(s) today!

**Nominate Experts**



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From: **C-SPAN.org** <noreply@c-spanarchives.org>

Date: Tue, Jul 20, 2021 at 12:22 PM

Subject: C-SPAN Alert

To: (b) (6)

Dear Kevin,

Dr. Anthony Fauci and Others Testify on COVID Response is now available for viewing in the C-SPAN Video Library.

Thank you for your interest in the C-SPAN Networks.

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**From:** kenn [REDACTED] (b) (6)  
**Sent:** 7/27/2021 3:53:31 PM  
**To:** Fauci, Anthony (NIH/NIAD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]; olx1 [REDACTED] (b) (6); bill.gates [REDACTED] (b) (6) billg [REDACTED] (b) (6) mmakary1 [REDACTED] (b) (6) ecoi [REDACTED] (b) (6) juliana [REDACTED] (b) (6) jon [REDACTED] (b) (6) fhu [REDACTED] (b) (6) wingsuntam [REDACTED] (b) (6) gregory.re [REDACTED] (b) (6) swatlas [REDACTED] (b) (6) laura [REDACTED] (b) (6) jared [REDACTED] (b) (6) stephen [REDACTED] (b) (6) djtjr [REDACTED] (b) (6) larry.ellison [REDACTED] (b) (6)]; dducey [REDACTED] (b) (6) dougducey [REDACTED] (b) (6) bkemp [REDACTED] (b) (6) peternavarroi [REDACTED] (b) (6) peter.navarro [REDACTED] (b) (6) press [REDACTED] (b) (6) governorrn.desantis [REDACTED] (b) (6) bookbaby [REDACTED] (b) (6) info [REDACTED] (b) (6) press [REDACTED] (b) (6) kevin.mccarthy [REDACTED] (b) (6); m.alvarez [REDACTED] (b) (6) cruz\_press [REDACTED] (b) (6) mmakary1 [REDACTED] (b) (6) gostin [REDACTED] (b) (6) Murphy, Robert [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b58566af5934cd0b2e9c167a17d3cba-r-murphy.no]; dmilton [REDACTED] (b) (6) aneesh.mehta [REDACTED] (b) (6) jbl [REDACTED] (b) (6) seri [REDACTED] (b) (6) danielleallen [REDACTED] (b) (6) media [REDACTED] (b) (6) frazier [REDACTED] (b) (6) bilder [REDACTED] (b) (6) kotlikoff [REDACTED] (b) (6) rlimaye [REDACTED] (b) (6) rasmus\_nielsen [REDACTED] (b) (6) secretary [REDACTED] (b) (6) r.henry22 [REDACTED] (b) (6) noymer [REDACTED] (b) (6) Pope, Kristin (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=fb2f4231e6314dedbb1a87c9f1d0f2a6-KFP7]; Posner, Sam (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4f397785f778c478ebf0490384799be96-SHP5]; nar5 [REDACTED] (b) (6) barcelo [REDACTED] (b) (6) jwhyte [REDACTED] (b) (6) jeff.barker [REDACTED] (b) (6) andy.pavia [REDACTED] (b) (6) lbouro [REDACTED] (b) (6) vicente.diaz [REDACTED] (b) (6) ayodola.adigun [REDACTED] (b) (6) joseph.vinetz [REDACTED] (b) (6); sachs [REDACTED] (b) (6) erin.bromage [REDACTED] (b) (6) derekchu [REDACTED] (b) (6) colleen.kraft [REDACTED] (b) (6) wme1 [REDACTED] (b) (6) Carlos del Rio [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=272a695aa9e84a7a99e888dcdc0d83c9-cdelrio.emo]; president [REDACTED] (b) (6); lchen [REDACTED] (b) (6) allegranzib [REDACTED] (b) (6); joshua.sharfstein [REDACTED] (b) (6) tinglesby [REDACTED] (b) (6) william.schaffner [REDACTED] (b) (6) =?ISO-88 59-1?B?anVsaWFFbWFyY3Vz?= [REDACTED] (b) (6) hyder.22 [REDACTED] (b) (6) yshin [REDACTED] (b) (6) barbour [REDACTED] (b) (6) verr1 [REDACTED] (b) (6) mto [REDACTED] (b) (6) Collins, Francis (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=410e1ca313f44ced9938e50d2ff0b6c2-collinsf]; sten.vermund [REDACTED] (b) (6); joshack [REDACTED] (b) (6) Sinha, Rajita [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=61abd5dad255450fa514edb6c1bf0df5-rajita.sinh]; ajha [REDACTED] (b) (6).edu]; bneuman [REDACTED] (b) (6) Hamer, David (NIH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3a3aabe3a95d44bfb42fee9a617bb271-dhamer.bu.e]; cjl [REDACTED] (b) (6) Lipsitch, Marc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user9bbc2624]; john.brownstein [REDACTED] (b) (6) shassig [REDACTED] (b) (6) etoner1 [REDACTED] (b) (6) hotez [REDACTED] (b) (6) tedcruz [REDACTED] (b) (6) afleischer [REDACTED] (b) (6) rredfield [REDACTED] (b) (6) nbsaphier [REDACTED] (b) (6) saphiern [REDACTED] (b) (6) tfrieden [REDACTED] (b) (6) deborah.birx [REDACTED] (b) (6) birxd [REDACTED] (b) (6) scott.gottlieb [REDACTED] (b) (6) scott.gottlieb [REDACTED] (b) (6) tyler.olson [REDACTED] (b) (6) galter [REDACTED] (b) (6) karmstrong6 [REDACTED] (b) (6) bryn.austin [REDACTED] (b) (6) elbaker [REDACTED] (b) (6) kbaicker [REDACTED] (b) (6) sjbartels [REDACTED] (b) (6) mbassett [REDACTED] (b) (6) dbates [REDACTED] (b) (6) lberkman [REDACTED] (b) (6) pberman [REDACTED] (b) (6) betensky [REDACTED] (b) (6) jbbhabha [REDACTED] (b) (6) Bloom, Barry [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=d2e732e51a34450f885ffb07c162405b-bbloom.hsph]; pboffetta [REDACTED] (b) (6) bburleig [REDACTED] (b) (6) bburleig@hsph.harvard.edu]; fcatter [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=useree671ad3]  
**Subject:** Math Math Math: vaccinal re-recap; NATIONAL Mask Mandate!!!

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**Attachments:** 1-corona-vaccine-6k-66m.png; 2-corona-vaccine-6k-66m.png; 3-corona-vaccine-6k-66m.png; 4-corona-vaccine-6k-66m.png; 5-corona-vaccine-6k-66m.png; 6-corona-vaccine-6k-66m.png; 7-corona-vaccine-6k-66m.png; 8-corona-vaccine-6k-66m.png

Dear Professors & Politicians,

NATIONAL Mask Mandate!!!

Please check out the following link and all attached slides:

<https://www.foxnews.com/health/6k-covid-19-vaccine-recipients-got-virus>

As mentioned previously, there were 3+1 Big logical mistakes:

- (1) The denominator was wrong: to calculate vaccinal efficacy, the denominator must be the number of fully vaccinated people exposed to the virus, not the number of fully vaccinated people.
- (2) The numerator was wrong.
- (3) The whole methodology was wrong: If we take single sequence of data to look at the vaccinal efficacy, we must make sure other measures such as gigantic masks to be removed, otherwise how do we know which is taking the effect? Alternatively, we must do ensembles. A special case of ensembles is 'double-blind experiment'.
- (4) As time goes on, more cases among fully vaccinated people will pop up. Thus, 'time' is a big parameter that we ought not to neglect, when talking about vaccinal efficacy.

Thus, these data failed to prove vacinal efficacy!

And from other perspectives, we could prove the disappointing efficacy of vaccines. Hopefully we could get a chance to elaborate later. But for the time being, simply do:

NATIONAL Mask Mandate!!!

God bless America



*So, vaccines are working excellently!*

HEALTH · Published 1 day ago

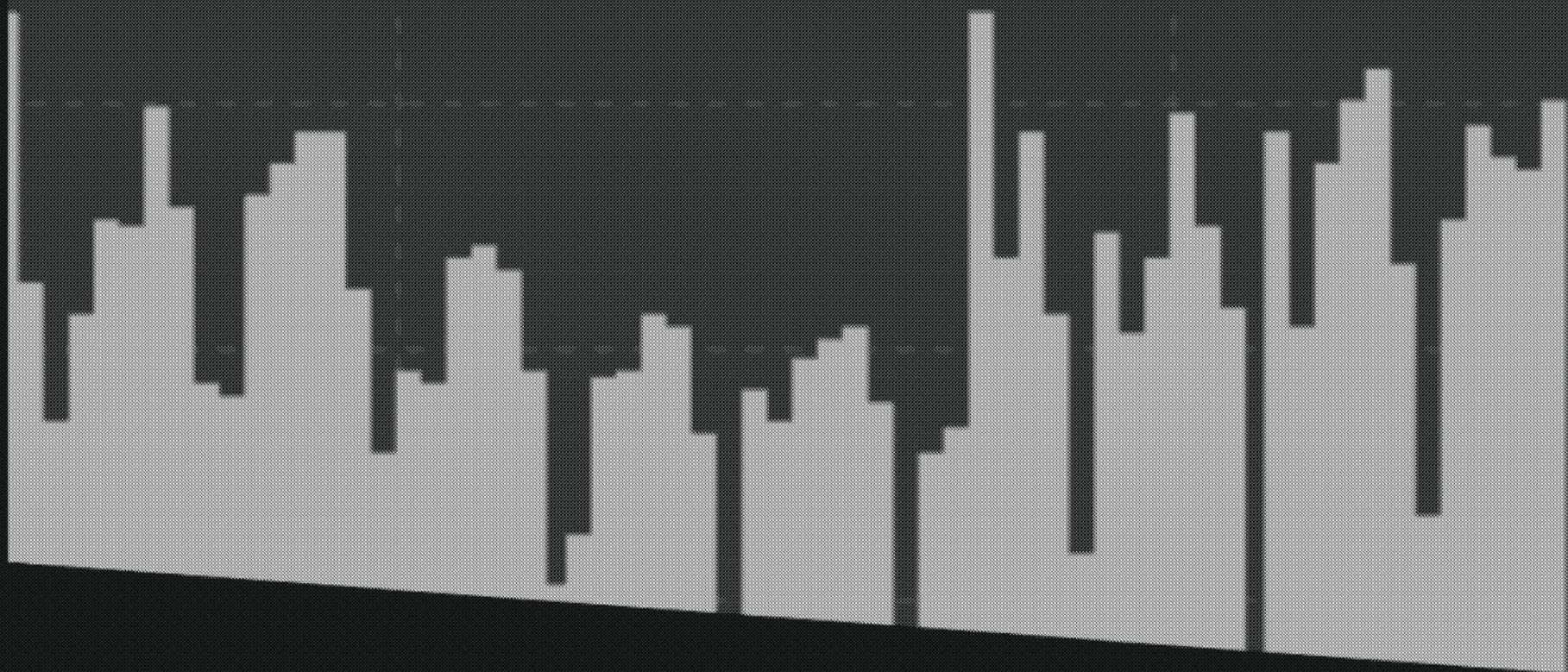
**Nearly 6K fully vaccinated Americans  
got COVID-19 – out of 66M: CDC**

"You will always see some breakthrough infections no matter the efficacy of your vaccine," Dr. Anthony Fauci told the outlet.

"Before people get excited about the quantitative number of infections, they need to understand what the denominator is, and we're going to see breakthroughs in numbers that are going to be well within the 90 percent, 95 percent, 97 percent effectiveness rates of the vaccines."

& Dr Fauci got very excited!





***Buta... Why?:  
OMGosh!!! 80,000 cases!!!***



HEALTH · Published 1 day ago

# **Nearly 6K fully vaccinated Americans got COVID-19 – out of 66M: CDC**

Three HUGE logical mistakes!!!



herrera53

41m ago

That's a misleading statistic. What we should be asking is of those who received the vaccine, how many were exposed to the virus. Certainly far less than 66M. This is how stats can be very misleading.

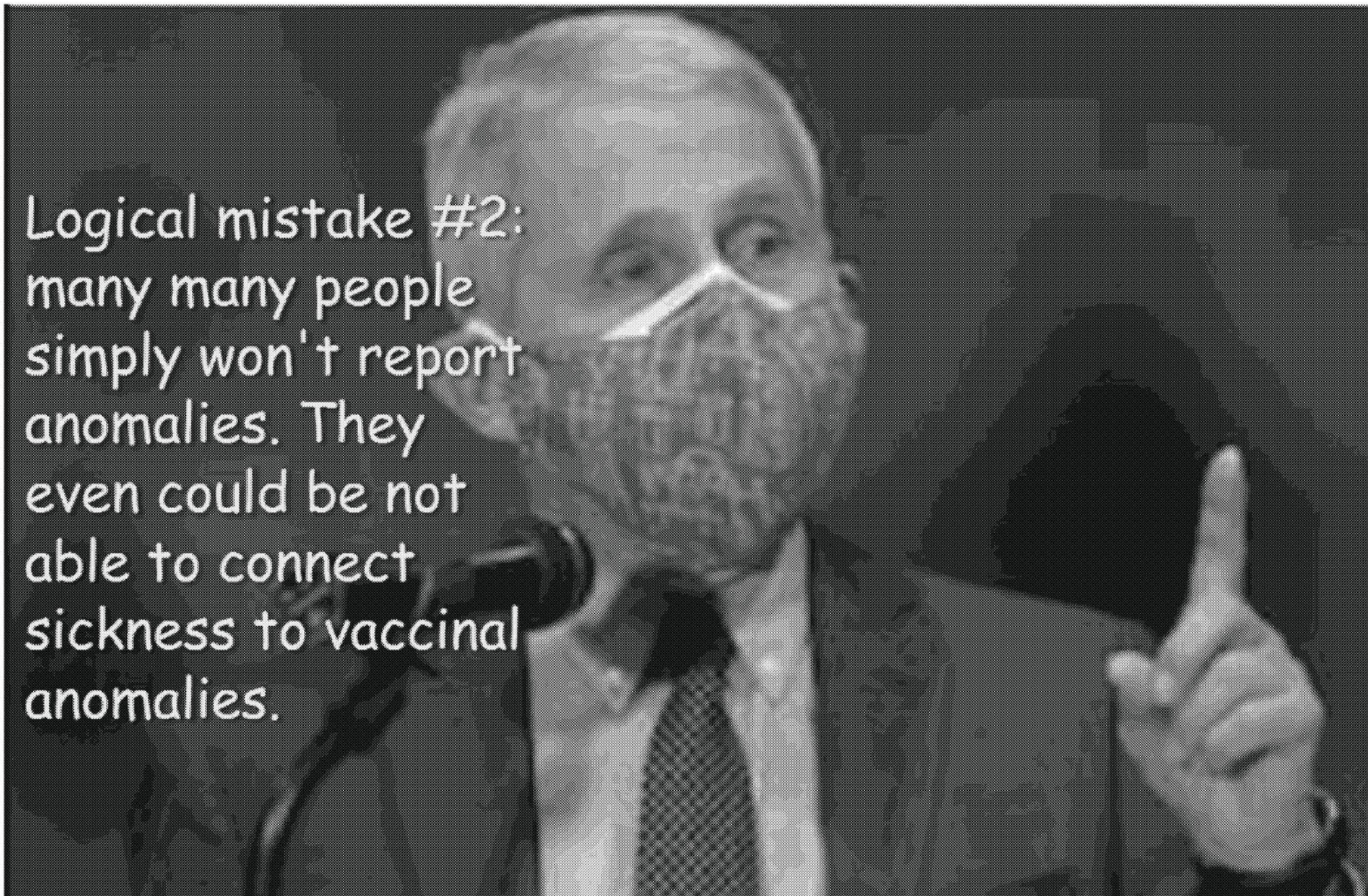
Reply  8  2

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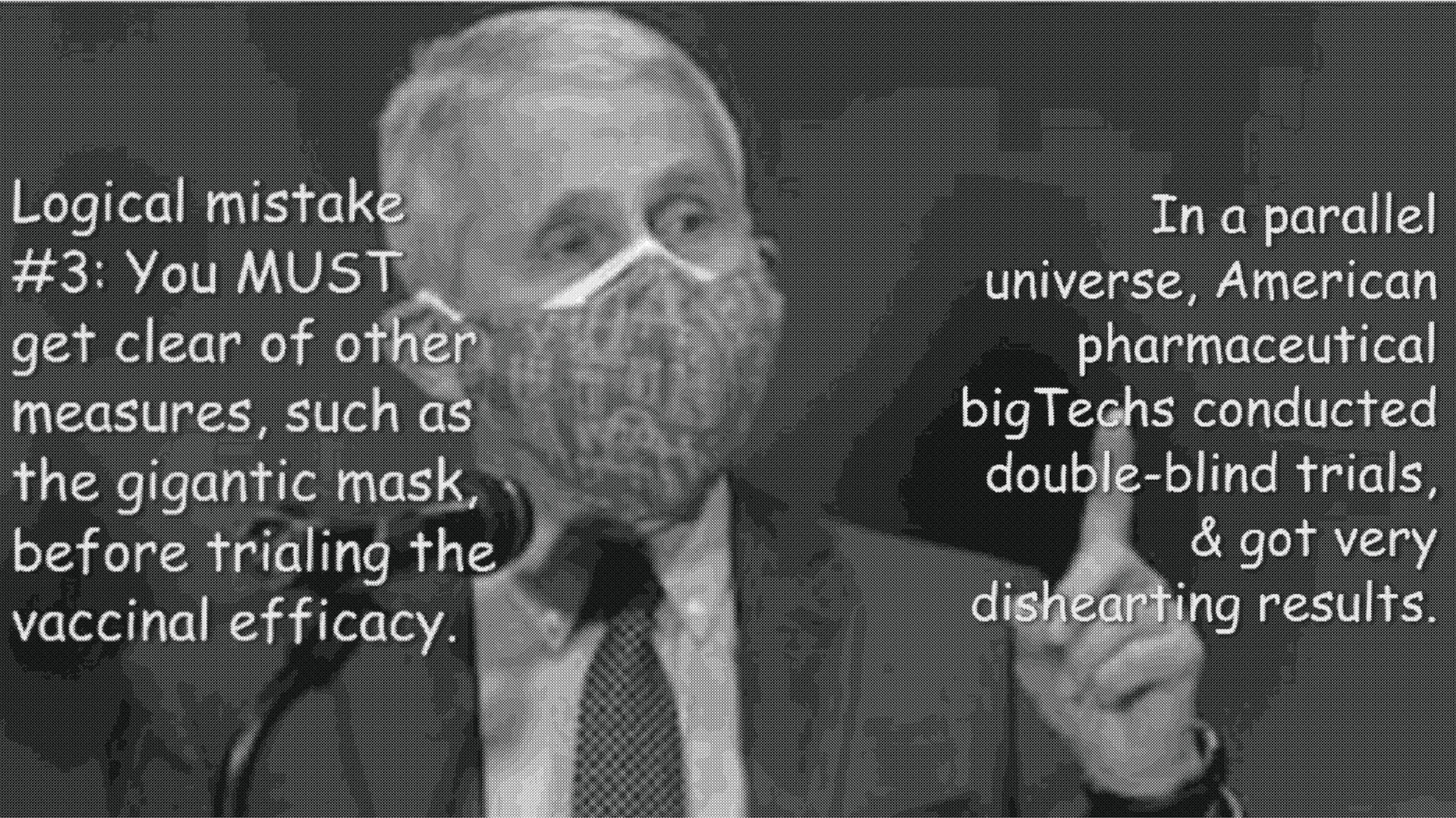
Here is one  
of three  
HUGE  
logical  
mistakes!



Logical mistake #2:  
many many people  
simply won't report  
anomalies. They  
even could be not  
able to connect  
sickness to vaccinal  
anomalies.



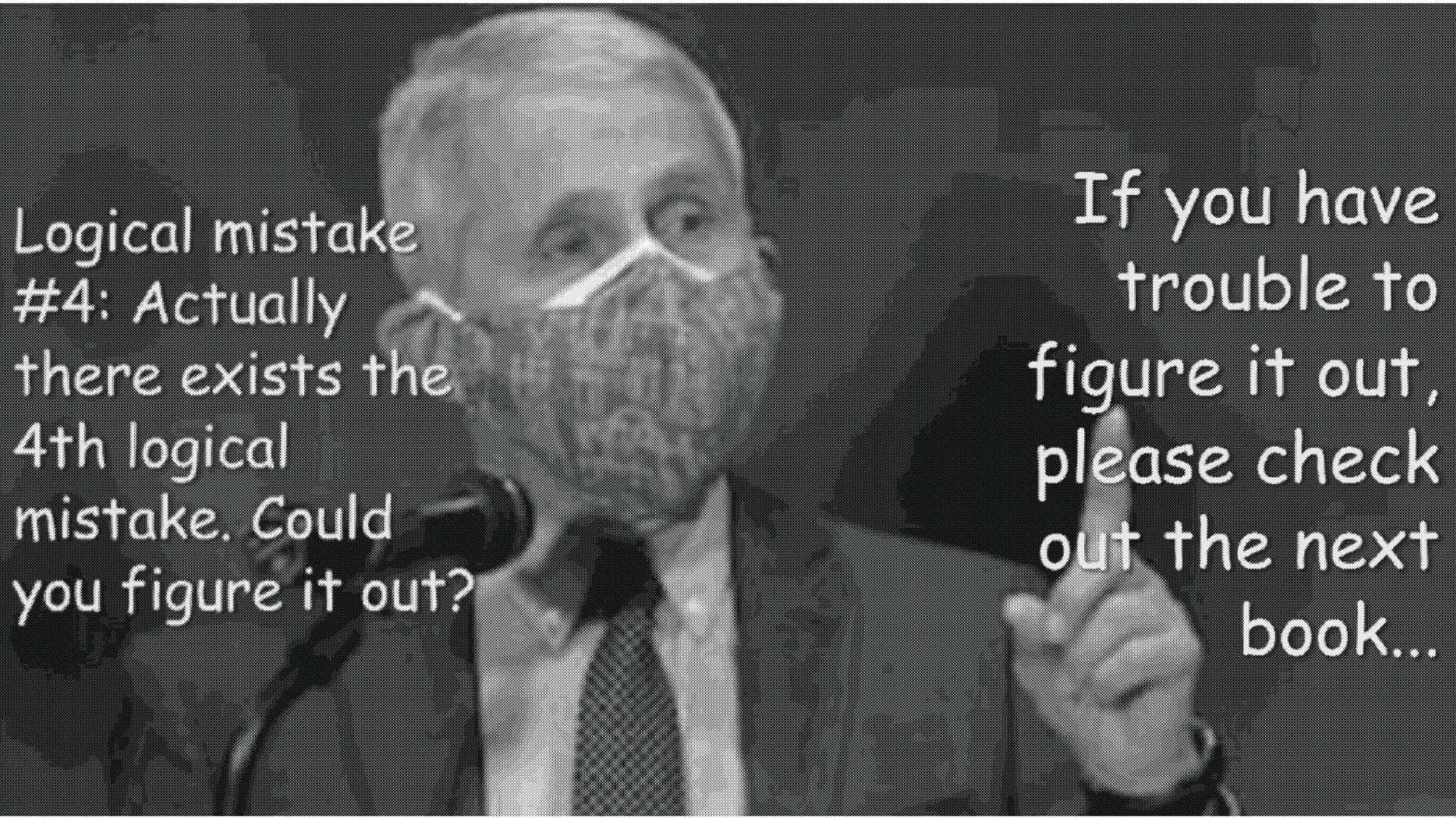




Logical mistake  
#3: You **MUST**  
get clear of other  
measures, such as  
the gigantic mask,  
before trialing the  
vaccinal efficacy.

In a parallel  
universe, American  
pharmaceutical  
bigTechs conducted  
double-blind trials,  
& got very  
dishearting results.





Logical mistake  
#4: Actually  
there exists the  
4th logical  
mistake. Could  
you figure it out?

If you have  
trouble to  
figure it out,  
please check  
out the next  
book...



**From:** Jim Ainsworth [REDACTED] (b) (6)  
**Sent:** 6/10/2021 12:48:47 AM  
**To:** Fauci, Anthony (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]; Grady, Christine (NIH/CC/BEP) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=dab06d3e2a004adcabc9f73d2d382fc7-cgrady]; Collins, Francis (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=410e1ca313f44ced9938e50d2ff0b6c2-collinsf]; Hauguel, Teresa (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b834ba0e15e94d2c8b00278ff542d4b1-hauguel]; Eisinger, Robert (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0bad2a8c45514ee48985880de66674ad-eisinger]; Auchincloss, Hugh (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9304c753bb9e422c977dddab54da924b-auchincloss]; Conrad, Patricia (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7ea3e3ea7da432887495d6825c9e588-conradpa]; Folkers, Greg (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=614c792839a146b9a8f87a1378519dbd-gfolkers]; Lane, Cliff (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=2d7e368a3137473bbce161547a82f2de-clane]; McGowan, John J. (NIH/NIAID) [C] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=fd4549a1a37c41c78410c7c29e3d3c00-jmcgowan]; Doepel, Laurie (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7e395d705fce4852a2579e5a9e1b5e11-ldoepel]; Lerner, Andrea (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=53254f4fb04e4bcabeb37940b4b41887-fennellyam]; Marston, Hilary (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ab30660917b942ffba9ae95d631116f3-marstonhd]; Morens, David (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=12de367cc65c42879ea45d128710a383-dmorens]; Tabak, Lawrence (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=02e22836b5ff4e9988e3770cfc7ee770-tabak]; Avenevoli, Shelli (NIH/NIMH) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=da640e19bdbc4073a24e632592da05dd-avenevos]; Gordon, Joshua (NIH/NIMH) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=24d28bfff73545a1850c27db2616228e-gordonjoa]; Bozick, Brooke (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a43fde1707cf4c7b83b1adc28f27c25e-bozickba]; Schwetz, Tara (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=0b1da1e9650d44fa9a9e2d94f24b5035-schwetzta]; Challberg, Mark (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=28a89f5b6a384b1a864e1ef36d058da7-mchallberg]; Sun, Peter (NIH/NIAID) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=6dde7b01d6984fa69ee93f844222f094-psun]; Haffajee, Rebecca (HHS/ASPE) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=f2eb67f58fd84266a48cf014531a92b5-Rebecca.Haf]; Murthy, Vivek (HHS/OASH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=05dc29d53f0b4e08a8e2a6139dd41358-Vivek.Murth]; Levine, Rachel (HHS/OASH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=a3e85748f25b480890ed18b75f6284c9-Rachel.Levi]; Tobias, Constance (HHS/DAB) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=32a838da2d2d428e8e531380884a35a6-Constance.T];  
[REDACTED] (b) (6) Bratcher-Bowman, Nikki (OS/ASPR/IO) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8faf0eb8590c4245915c0a182e0c9489-nikki.bratc]; Orsega, Susan (OS/OASH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c525d9ffdaab4c8898ce256b35e5acb3-Susan.Orseg]; Dukes, Adrienne (FDA/ORR) [/o=ExchangeLabs/ou=Exchange Administrative Group



(FYDIBOHF23SPDLT)/cn=Recipients/cn=d7a08e0e719c4eb4a464e340d38c336a-Adrienne.Du]; King, Stephen (FDA/ORR) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=46111dc056064f329df393110cb0ad4e-SKing1.fda]; Marks, Peter (FDA/CBER) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=b2e527dbda2b4a86b8d72f06b813d471-MarksP.fda]; Lynch, Sarah (FDA/OC) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=7c37a78426c7407f8983f94a5faf9130-Sarah.Lynch]; Woodcock, Janet (FDA/OC) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=9bc3fc3ebfcf48879f92169bd7644e29-Janet.Woodc]; Hinton, Denise (FDA/OC) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=81bd772bc28f4d6b887564285e0187d0-hintond.fda]; Hahn, Stephen (FDA) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=96d3725aaa614d60810e64806682c3e0-Stephen.Hah]; (b) (6) Roth, Lauren (FDA/OC) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=c2003755349341bc8c73e2218f799b4a-Lauren.Roth]; Gruber, Marion (FDA/CBER) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=ebf7a8eb8dd541b2883a966ea5afd809-GRUBER.fda]; (b) (6) Desai, Vid [ (b) (6) jacob.schil (b) (6) (b) (6); Dickinson, Elizabeth (FDA) (FDA/OC) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=5f7e7dfe41984de8be860e52311bdbee-EDICKINS.fda]; Tom Inglesby (b) (6)

**Subject:** Nobel Laureate Luc Montagnier: COVID Vaccine May Lead to 'Neurodegenerative Illness'

## ***Nobel Laureate Luc Montagnier: COVID Vaccine May Lead To 'Neurodegenerative Illness'***

**The Alex Jones Show**

**June 9, 2021**



**Alex Jones broke down the news that Nobel Laureate Luc Montagnier warned that the COVID vaccine could lead to neurodegenerative illness throughout the vaccinated populace, which could potentially number in the billions.**

***Watch the report below in MP4 video:***

***(Viewers may wish to turn the volume down to zero during the open-captioned sequence with Luc Montagnier, as Alex Jones had to read the English caption translation aloud for radio listeners.)***

**<https://assets.infowarsmedia.com/videos/754bb04b-e74c-4e21-ba99-d52fa92f6abd.mp4>**



**From:** Costa, Kevin [(b) (6)]  
**Sent:** 5/20/2021 7:48:14 PM  
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"A Dire Shortage and Getting Worse: Solving the Crisis in the Health Care Workforce"



United States Senate Committee on Health, Education, Labor and Pensions

Subcommittee on Primary Health and Retirement Security

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Best regards,

Kevin Costa

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[davida. (b) (6) Martin Shapiro [ (b) (6) Atheendar Venkataramani  
(b) (6) Bill Honigman [ (b) (6) Natalie Chin  
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Stephanie Nakajima [ (b) (6) Benjamin Day [ (b) (6) Rhiannon Duryea  
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Kevin Grumbach [ (b) (6) Frederick Cudhea [ (b) (6) Renata Micha  
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**Subject:** MAY 21, 2021 - White House COVID-19 Response Team Briefing

MAY 21, 2021 - White House COVID-19 Response Team Briefing

<https://www.c-span.org/video/?511980-1/white-house-covid-19-response-team-briefing>

Best regards,

Kevin Costa



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**Subject:** Re: Chairwoman Maloney Urges House Colleagues to Support SACKLER Act

## Sackler Family Empire Poised To Win Immunity From Opioid Lawsuits

[https://www.npr.org/2021/06/02/1002085031/sackler-family-empire-poised-to-win-immunity-from-opioid-lawsuits?utm\\_source=facebook.com&utm\\_medium=social&utm\\_term=nprnews&utm\\_campaign=npr&fbclid=IwAR2v3yoYHAOCrfb1njEliENCTM1wYo-blyqocIMmKfPaE7rfZ6x5T6XG\\_dc](https://www.npr.org/2021/06/02/1002085031/sackler-family-empire-poised-to-win-immunity-from-opioid-lawsuits?utm_source=facebook.com&utm_medium=social&utm_term=nprnews&utm_campaign=npr&fbclid=IwAR2v3yoYHAOCrfb1njEliENCTM1wYo-blyqocIMmKfPaE7rfZ6x5T6XG_dc)

On Mon, May 10, 2021 at 1:59 AM Costa, Kevin <[kevincosta@alumni.brown.edu](mailto:kevincosta@alumni.brown.edu)> wrote:

Chairwoman Maloney Urges House Colleagues to Support SACKLER Act

<https://oversight.house.gov/news/press-releases/chairwoman-maloney-urges-house-colleagues-to-support-sackler-act>

House Hearing on Oversight and Reform

The Role of Purdue Pharma and the Sackler Family in the Opioid Epidemic

<https://oversight.house.gov/legislation/hearings/the-role-of-purdue-pharma-and-the-sackler-family-in-the-opioid-epidemic>

New Yorker staff writer Patrick Radden Keefe reported on the Sackler family's wealth that was built on pharmaceuticals, which included Valium and OxyContin. He was interviewed by author and journalist Beth Macy.

<https://www.c-span.org/video/?510921-1/after-words-patrick-radden-keefe>

Best regards,

Kevin Costa



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**Subject:** Mauricio Cárdenas on designing and funding future pandemic responses - BY MAURICIO CÁRDENAS

## Mauricio Cárdenas on designing and funding future pandemic responses

There are concrete steps to take, so the world needs to set aside billions to save trillions, writes a former finance minister of Colombia

BY MAURICIO CÁRDENAS

<https://www.economist.com/by-invitation/2021/05/25/mauricio-cardenas-on-designing-and-funding-future-pandemic-responses>

The world can't afford another pandemic—literally. The global economy contracted by 3.5% in 2020, and is forecast to forego \$22trn in lost output through 2025. Yet another pathogen with pandemic potential might emerge at any time. As things stand, we are unprepared and courting disaster. But there is a solution: invest now in preparations for pandemics and maintain a pool of capital in reserve to use if a crisis strikes.

This is one of those linchpin reforms that are sensible but hard to get adopted. Nobody wants to part with money—especially countries trying to restore economic growth following lockdowns. I know this all too well, as a former finance minister for an emerging country. Yet this form of investment is essential to avert potential calamities, and there are ways to argue effectively in its favour.

The idea is one of numerous recommendations issued this month from the Independent Panel for Pandemic Preparedness and Response on which I served, commissioned by the World Health Organisation (WHO). This week health ministers and some heads of state are meeting at the World Health Assembly, the WHO's decision-making body, to consider the recommendations. Countries need to implement the package as a whole.

After spending eight months gathering evidence, the panel identified actions and inactions that contributed to the pandemic. Information-sharing was too slow at the outset. Many countries took a fatally-flawed wait-and-see approach. Co-ordinated, global leadership was absent. Years of warnings and in some cases preparations for how to respond were not heeded or invoked.

Most importantly, countries failed to stress test their ability to cope with pandemics (with notable exceptions such as Asian-Pacific countries with experience of SARS and west and central African states that had been through Ebola). Once covid-19 started spreading, dedicated financing was not available at the scale required to supply medical equipment, testing and treatment.

Not learning from mistakes would be foolish and irresponsible. There are basic things that governments can do to prepare for, and indeed prevent, another pandemic.



Countries need to perform simulation exercises, fund research into infectious diseases and develop test-and-trace systems. They need to ensure adequate stocks of personal protective equipment. (When emergency stockpiles were depleted in March 2020, the cost of ten N95 face masks, well under \$5 before the pandemic, spiked to a market price of nearly \$70.)

Moreover, health systems need to know how to convert ordinary hospital wards into intensive-care units, or how to build new temporary ones; what quantities of extra oxygen or respirators to keep in stock or how to order them quickly; whether to centralise or localise diagnostic testing. And they need to establish a centre for pandemic response, and decide who is to do the essential job of communicating with an anxious public, and how. Schools need to be better prepared for remote learning, with the right tools and funds to buy tablets and smartphones for the kids. Airports need to know how to quarantine arriving passengers; businesses need to be confident they'd be aided if they were shut down. Most countries were making all this up as they went along in 2020. That can't happen again.

I know from experience in government that hedging risks is not a priority for public officials. If a contingency does not occur, controlling agencies, watchdogs and opposition parties are fast to say that money spent on insurance has been wasted. Ministries and parliaments love to focus spending on projects that involve cutting ribbons and grand announcements. There aren't immediate votes to be won in planning and preparation. The pandemic has shown that this approach is fundamentally wrong. A lack of preparation turns an avoidable emergency into a full-blown disaster. Complacency begets tragedy. Preparedness does cost money, but not that much, and it offers great value when you think of what can be saved later in economic recovery costs and human lives lost.

The independent panel not only recommends overhauling the global pandemic preparedness and response system, but also offers ideas on how to fund it. It calls for an International Pandemic Financing Facility. The mechanics are simple. Each year countries would make contributions totalling \$5bn to \$10bn (for a middle-income country like Colombia this means making a contribution of up to \$30m per year, which is manageable, but it could be less if wealthier countries take a larger share of the bill).

In normal times, these funds should help countries prepare by investing in technology, data management, contact-tracing systems and the like. If a crisis occurs, the facility will borrow against future contributions with the ability to disburse up to \$50bn to \$100bn at short notice. This should pay for the initial response in order to stop the spread of a virus. Just as the 2008-9 global financial crisis led to the Financial Stability Board, an international body based in Basel, Switzerland to prevent future financial crises, the world needs to establish a health stability board. The panel calls it the Global Health Threats Council, composed of health experts and overseen by heads of government. This would not be a new UN agency, but a decision-making body with the task of allocating and monitoring pandemic-preparation funds to regional and global bodies.

How can we get governments to commit the resources?

Finance ministers should take the lead as this is about protecting the public coffers, not only saving lives. When I had that responsibility, Colombia decided to hedge the fiscal cost of earthquakes by jointly issuing a catastrophe bond with Chile, Mexico, and Peru for \$1.4bn. When an earthquake hit Peru in 2019, the government received \$60m, which

more than covered the cost of the damage caused. The initiative was approved because it had technical merit and the presidents concerned were directly involved.

This holds a lesson for the discussions and diplomacy that will be held at regional and global levels in the coming months. The cost of preparedness and setting funds aside for response is minimal compared with the economic impact of an actual pandemic. The world needs to spend billions to save trillions.

Global health is a global public good. Individual countries can get more from working together than acting on their own. The world cannot afford another economy-crushing pandemic—yet it need not face one if it makes smart decisions today.

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*Mauricio Cárdenas was Colombia's finance minister from 2012 to 2018 and is a senior fellow at Columbia University's Center on Global Energy Policy. He served on the Independent Panel for Pandemic Preparedness and Response.*

<https://www.economist.com/by-invitation/2021/05/25/mauricio-cardenas-on-designing-and-funding-future-pandemic-responses>

Best regards,  
Kevin Costa



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**Subject:** World Health Organization (WHO) Media briefing on COVID-19 and vaccine equity

World Health Organization (WHO) Media briefing on COVID-19 and vaccine equity

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Best regards,

Kevin Costa

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(b) (6) Michael S. Dukakis (b) (6) Marcia Fudge (b) (6)  
Samantha Power (b) (6) Kevin Costa (b) (6)

**Subject:** VACCINE CLINICAL TRIAL NEWS:

## VACCINE CLINICAL TRIAL NEWS:

Data from the Phase 3 clinical trial for Novavax's two-dose COVID-19 vaccine shows 90% overall efficacy and 100% protection against moderate & severe disease.

Although this is a two-dose vaccine, it is not an mRNA vaccine. This is a protein subunit vaccine which contains harmless pieces of the surface spike protein of the virus that causes COVID-19 to teach the immune system to make antibodies. The trial was funded by #NIH National Institute of Allergy and Infectious Diseases (NIAID), U.S. Department of Health and Human Services, & the Biomedical Advanced Research and Development Authority via the Federal COVID-19 response via the Federal #COVID19 response. A big thank you to the thousands of volunteers for your contributions towards another vaccine to help end the pandemic. Learn more: <https://bit.ly/2Sx3Zt6>

Best regards,

Kevin Costa

**From:** kenn (b) (6)  
**Sent:** 6/7/2021 10:48:02 AM  
**To:** Fauci, Anthony (NIH/NIAD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]; olx1 (b) (6); bill.gates (b) (6) billg (b) (6) mmakary1 (b) (6) ecoi (b) (6) juliana (b) (6) jon (b) (6) fhu (b) (6) wingsuntam (b) (6) gregory.re (b) (6) swatlas (b) (6) laura (b) (6) jared (b) (6) stephen (b) (6) djtjr (b) (6) larry.ellison (b) (6) dducey (b) (6) dougducey (b) (6) bkemp (b) (6) peternavarroi (b) (6); peter.navarro (b) (6) press (b) (6) governorrn.desantis (b) (6) bookbaby (b) (6) info (b) (6) press (b) (6) kevin.mccarthy (b) (6) m.alvarez (b) (6) cruz\_press (b) (6) mmakary1 (b) (6) gostin (b) (6) Murphy, Robert [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b58566af5934cd0b2e9c167a17d3cba-r-murphy.no]; dmilton (b) (6) Aneesh Mehta [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=234d30b4e7244aa286e1bd60a0bc3709-aneesh.meht]; jbl (b) (6) seri (b) (6) danielleallen (b) (6) media (b) (6) frazier (b) (6) bilder (b) (6) kotlikoff (b) (6); rlimaye (b) (6) rasmus\_nielsen (b) (6) secretary (b) (6) r.henry22 (b) (6) noymer (b) (6) Pope, Kristin (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=fb2f4231e6314dedbb1a87c9f1d0f2a6-KFP7]; Posner, Sam (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4f397785778c478ebf0490384799be96-SHP5]; Messonnier, Nancy (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=441f65db836c4a89a42aecb9a0d9b96c-NAR5]; barcelo (b) (6) jwhyte (b) (6) jeff.barker (b) (6) andy.pavia (b) (6) lbouro (b) (6) vicente.diaz (b) (6) ayodola.adigun (b) (6) joseph.vinetz (b) (6) sachs (b) (6) erin.bromage (b) (6) derekchu (b) (6) colleen.kraft (b) (6) wme1 (b) (6) Carlos del Rio [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=272a695aa9e84a7a99e888dcdc0d83c9-cdelrio.emo]; president (b) (6) lchen (b) (6) allegranzib (b) (6) joshua.sharfstein (b) (6); tinglesby (b) (6) william.schaffner (b) (6) julia\_marcus (b) (6) hyder.22 (b) (6) yshin (b) (6) barbour (b) (6) vrr1 (b) (6) mto (b) (6) Collins, Francis (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=410e1ca313f44ced9938e50d2ff0b6c2-collinsf]; sten.vermund (b) (6) joshack (b) (6) Sinha, Rajita [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=61abd5dad255450fa514edb6c1bf0df5-rajita.sinh]; ajha (b) (6) bneuman (b) (6) Hamer, David (NIH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3a3aabe3a95d44bfb42fee9a617bb271-dhamer.bu.e]; cjlm (b) (6) Lipsitch, Marc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user9bbc2624]; john.brownstein (b) (6) shassig (b) (6) etoner1 (b) (6) hotez (b) (6) tedcruz (b) (6) afleischer (b) (6) rredfield (b) (6); nbsaphier (b) (6) =?gb1803 0?B?c2FwaGllcm4=?= (b) (6) tfrieden (b) (6) deborah.birx (b) (6) birxd (b) (6) scott.gottlieb (b) (6) scott.gottlieb (b) (6) tyler.olson (b) (6)  
**Subject:** Corona Handwashing? Dump Trump!  
**Attachments:** 0-handwashing.png; 1-ga-abc.png; 2-ga-abc.png; 3-ga-abc.png; 4-ga-abc.png; 5-nc-abc.png; 6-nc-abc.png; 7-nc-abc.png; 8-nc-abc.png; 9-nc-abc.png; 10-nc-abc.png

Dear Doctors & Politicians,

As said repeatedly months ago, US scientists have been wrong on every turn of this corona debacle, otherwise the death toll won't be 600,000. Of course, the former President Trump bears a big responsibility, and in a parallel universe is under a criminal investigation.

Is handwashing an effective measure to combat corona? Recall, handwashing was worshiped. Please check out the attached first slide for review. Now, are Americans still talking about handwashing? If not, then why not?

Because it actually stays irrelevant for the general public, from the very beginning.

A carrier exhales a flock of corona, a nearby person inhales a big portion, and this completes one cycle of transmission. Such a transmission is highly efficient.

The corona flock is three-dimensional. In contrast, what fallen on a human finger is more like two-dimensional, and the surface area of a finger is so small. Thus, how much corona can stick on the finger? From an engineering/practical perspective, this kind of small factors should be all neglected.

Further, we even don't know if the viruses on fingers really can get into human bodies and migrate to lungs. For some weak viruses, they do need to find multiple ways to invade human beings. But for a strong virus like corona, since it has mastered a fantastically efficient manner to invade, what is the point to master the second technique? As a matter of fact, it needs a lot of mutations to master a technique. Thus in reality, the virus would rather rush out and start killing, before the mutation can actually proceed much.

(2) Dump Trump!

(i) GA

Please check out the following link and the attached 2nd through fifth slides about GA gubernatorial election 2022:

[https://abcnews.go.com/Politics/wireStory/trumps-shadow-gas-kemp-draws-boos-gop-faithful-78107353?cid=clicksource\\_4380645\\_1\\_heads\\_hero\\_live\\_headlines\\_hed](https://abcnews.go.com/Politics/wireStory/trumps-shadow-gas-kemp-draws-boos-gop-faithful-78107353?cid=clicksource_4380645_1_heads_hero_live_headlines_hed)

Quote:

"We must be strong and courageous," Kemp said. He said of Democrats: "They've got Hollywood. They've got billionaires in New York and California... That is why we have to be united as well and move forward together."

Comments:

Classic Republicans still retain the wisdom of not making enemies here & there. As to big Techs, bring carrot & stick in fact.

Quote:

And it left many Kemp supporters worried that Trump loyalists' continued fixation on 2020 will doom the party in the coming midterm elections.

Comments:

Sure. Trump is the biggest DemocRat hiding within Party Lincoln.



Quote:

If we keep playing these stupid games saying Kemp is not pure enough, we're going to hand it over to the Democrats again," Hall said. "It's just so counterproductive. He's the only Republican that can win in November.

Comments:

Many red-necks don't have high EQs, and once misled into a pitfall, never can they climb out by themselves. Trump is a vampire riding on their necks & sucking blood. The current most imperative thing for Party Lincoln is to take off this gigantic vampire.

(ii) NC

Please check out the following link and the attached remaining slides

[https://abcnews.go.com/Politics/donald-trump-returns-stage-speech-north-carolina-gop/story?id=78107039&cid=clicksource\\_4380645\\_1\\_heads\\_hero\\_live\\_headlines\\_hed](https://abcnews.go.com/Politics/donald-trump-returns-stage-speech-north-carolina-gop/story?id=78107039&cid=clicksource_4380645_1_heads_hero_live_headlines_hed)

Trump has foolishly overdrawn & destroyed Trump Jr and Ivankar's political prospects. It's pitiful. Ivankar's many millions of fanboys in the world ever wished her to be POTUS someday.

God bless America





*Now, are Americans still handwashing crazily?  
If not, why?*





**Silver Eagle** • 8 hours ago

Kemp voted for Trump, but that wasn't enough. He was suppose break the law too

9 ^ | v • Reply • Share ›





**Bill** • 13 hours ago

Interesting, looks like the republicans are eating their own.

Again...

8 ^ | v • Reply • Share ›



**Traitor #45** • 8 hours ago

Trump is so unhinged, even before 2016 election, he showed little respect to our democracy. He said, if he loses, people are not going to like it and it won't be fair election.

Instead of condemning, GOP leadership encouraged and nurtured the monster and Traitor.

**Trump won't hesitate to burn the country and party down if his tantrums are not entertained. He showed that in action multiple times, but GOP is putting Trump above democracy and country.**

9 ^ | v • Reply • Share ›



**blindbeader** ➔ Traitor #45 • 7 hours ago

And if the rumors of what is supposed to happen in August (not the broadcast parts, the whisper you can hear if you listen closely) actually happens, the whole country may be in civil war.

2 ^ | v • Reply • Share ›



**Lucky Dog** ➔ blindbeader • 5 hours ago

There is no mechanism for Trump to be back in the WH in August. He's just fleecing the rubes a little more.

3 ^ | v • Reply • Share ›



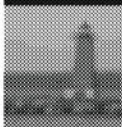
**David Wanner** ➔ ryanwiwb • 12 hours ago

It is no longer the Republican Party it is the Insurrectionist/tRump/Qanon (ITQ) Party. It is time for the Lincoln Party to quit trying to get the party back and just go with the Lincoln Party. Good bye Republican Party.

21 ^ | v • Reply • Share ›



If Pence had the authority to overturn the election, VPs would have been all engaging in & overturning elections.



**Mark G.** · 9 hours ago

Never thought I'd see the day when an angry mob would be chanting to hang their own V.P. If that's not a brilliant demonstration of how truly dysfunctional the Magabillies are, then the next stop is the twilight zone.

No wonder Pence doesn't see "eye to eye" with numbnutz.

7 ^ | v · Reply · Share ›

It's so stunning that so many Trumpers have been trained to be so gullible, easily duped by the conman.



**D\_Byron** • 10 hours ago

Watching the GOP implode under Trump is priceless.

29 ^ | v 2 • Reply • Share ›



**Alex Ross** • 9 hours ago • edited

x45 trying to nudge that *tremendous* **39% approval rating** to 40%.

Biden is at 63%, so the disgraced, corrupt, lying malignant x-president still has a way to go.

7 ^ | v • Reply • Share ›





**Robin** · 9 hours ago

Ok, if republicans don't like Joe Biden, fine, i get it. Is there not one other person in their party to hang their hat on besides Donald Trump. Why do they continue to bow to the feet of this absolute loser?? I don't get it. Move on and find a new candidate that won't make your party look like a cult. Seriously.

10 ^ | v · Reply · Share ›



**john\_wallace\_smith** • 9 hours ago

tRUMP is the most vile, malignant snake ever seen in American politics! He should be disposed of immediately!

7 ^ | v • Reply • Share ›



**thetruthhurts** • an hour ago

Trump is like a cancerous cell. You remove it only to realize it has spread. Soon it will be inoperable. Death is the only outcome. Republicans need to start chemotherapy or Trump Will be their party's Death.

4 ^ | v • Reply • Share ›



**From:** kenn [REDACTED] (b) (6)  
**Sent:** 5/26/2021 1:30:12 PM  
**To:** Fauci, Anthony (NIH/NIAD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=df38103d75134f658ae2d356f0396b94-afauci]; olx1 [REDACTED] (b) (6); Bill.gates [REDACTED] (b) (6) Billg [REDACTED] (b) (6) mmakary1 [REDACTED] (b) (6) ecoi [REDACTED] (b) (6) juliana [REDACTED] (b) (6) jon [REDACTED] (b) (6) fhu [REDACTED] (b) (6) wingsuntam [REDACTED] (b) (6) gregory.re [REDACTED] (b) (6) swatlas [REDACTED] (b) (6) laura [REDACTED] (b) (6) jared [REDACTED] (b) (6) stephen [REDACTED] (b) (6) djtjr [REDACTED] (b) (6); larry.ellison [REDACTED] (b) (6) dducey [REDACTED] (b) (6) dougducey [REDACTED] (b) (6) bkemp [REDACTED] (b) (6) peternavarroi [REDACTED] (b) (6) peter.navarro [REDACTED] (b) (6) press [REDACTED] (b) (6) governorrn.desantis [REDACTED] (b) (6) bookbaby [REDACTED] (b) (6) info [REDACTED] (b) (6) press [REDACTED] (b) (6) kevin.mccarthy [REDACTED] (b) (6) m.alvarez [REDACTED] (b) (6) cruz\_press [REDACTED] (b) (6) mmakary1 [REDACTED] (b) (6) gostin [REDACTED] (b) (6) Murphy, Robert [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=8b58566af5934cd0b2e9c167a17d3cba-r-murphy.no]; dmilton [REDACTED] (b) (6) aneesh.mehta [REDACTED] (b) (6) jbl [jbl@princeton.edu]; seri [REDACTED] (b) (6) danielleallen [REDACTED] (b) (6) media [REDACTED] (b) (6) frazier [REDACTED] (b) (6) bilder [REDACTED] (b) (6) kotlikoff [REDACTED] (b) (6) rlimaye [REDACTED] (b) (6) rasmus\_nielsen [REDACTED] (b) (6) Secretary [secretary@hhs.gov] (b) (6) r.henry22 [REDACTED] (b) (6) noymer [REDACTED] (b) (6) Pope, Kristin (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=fb2f4231e6314dedbb1a87c9f1d0f2a6-KFP7]; Posner, Sam (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=4f397785778c478ebf0490384799be96-SHP5]; Messonnier, Nancy (CDC/DDID/NCIRD/OD) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=441f65db836c4a89a42aecb9a0d9b96c-NAR5]; barcelo [REDACTED] (b) (6) jwhyte [REDACTED] (b) (6) jeff.barker [REDACTED] (b) (6) andy.pavia [REDACTED] (b) (6).edu; lbouro [REDACTED] (b) (6) vicente.diaz [REDACTED] (b) (6) ayodola.adigun [REDACTED] (b) (6) joseph.vinetz [REDACTED] (b) (6) sachs [REDACTED] (b) (6) erin.bromage [REDACTED] (b) (6) derekchu [REDACTED] (b) (6) colleen.kraft [REDACTED] (b) (6) wme1 [REDACTED] (b) (6) Carlos del Rio [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=272a695aa9e84a7a99e888dc0d83c9-cdelrio.emo]; president [REDACTED] (b) (6) lchen [REDACTED] (b) (6) alleganzib [REDACTED] (b) (6); joshua.sharfstein [REDACTED] (b) (6) tinglesby [REDACTED] (b) (6) william.schaffner [REDACTED] (b) (6) =?ISO-8859-1?B?anVsaWFFbWFyY3Vz?= [REDACTED] (b) (6) hyder.22 [REDACTED] (b) (6) yshin [REDACTED] (b) (6) barbour [REDACTED] (b) (6) verr1 [REDACTED] (b) (6) mto [REDACTED] (b) (6) Collins, Francis (NIH/OD) [E] [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=410e1ca313f44ced9938e50d2ff0b6c2-collinsf]; sten.vermund [REDACTED] (b) (6) joshack [REDACTED] (b) (6) Sinha, Rajita [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=61abd5dad255450fa514edb6c1bf0df5-rajita.sinh]; ajha [REDACTED] (b) (6).edu; bneuman [REDACTED] (b) (6) Hamer, David (NIH) [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=3a3aabe3a95d44bfb42fee9a617bb271-dhamer.bu.e]; cjl [REDACTED] (b) (6) Lipsitch, Marc [/o=ExchangeLabs/ou=Exchange Administrative Group (FYDIBOHF23SPDLT)/cn=Recipients/cn=user9bbc2624]; john.brownstein [REDACTED] (b) (6) shassig [REDACTED] (b) (6) etoner1 [REDACTED] (b) (6) hotez [REDACTED] (b) (6) tedcruz [REDACTED] (b) (6) afleischer [REDACTED] (b) (6) rredfield [REDACTED] (b) (6) nbsaphier [REDACTED] (b) (6); saphiern [REDACTED] (b) (6) tfrieden [REDACTED] (b) (6) deborah.birx [REDACTED] (b) (6) birxd [REDACTED] (b) (6) scott.gottlieb [REDACTED] (b) (6) scott.gottlieb [REDACTED] (b) (6) tyler.olson [REDACTED] (b) (6)  
**Subject:** Wuhan; Russia Russia Russia, part iv: Green energy, political perspective  
**Attachments:** 1-global-warming.png; 2-dragon-force.png; 3-global-economic-deploy.png; 4-energy.png; 5-materials.png; 6-divide-conquer-carrot-stick.png; 7-divide-conquer-carrot-stick.png; 8-divide-conquer-carrot-stick.png; 9-russia-russia-russia.png

Dear Doctors & Politicians,

The Wuhan story is shocking. I thought the corona was formed in nature, in a bat. But I could be wrong.

#### Russia Russia Russia, part iv: Green energy, political perspective

From the previous discussion we know the controlled nuclear fusion energy or the quark energy could perpetually sustain the mankind, and it takes about 100 years to arrive at that point.

#### (1) Is green energy really good?

Solar energy and wind energy are insufficient, inefficacious, and unsteady, and can merely serve as the secondary and supplemental energy. At the end of the day, the so-called green energy is the same old fossil energy with a different new cloak, thus it produces the same amount of carbon dioxides, in term of the order of magnitude.

That said, the overall energy conversion of the green energy could potentially be more efficient, for instance due to batch operation. A traditional combustion engine converts chemical energy into kinetic energy at 25% efficacy in an urban setting and at 50% efficacy on highways. The energy conversion of green energy can be decomposed into that from the thermal to the electrical via recycled turbo machinery at 60% efficacy, that from the electrical to the chemical via a battery at 80% efficacy, that from the chemical back to the electrical via a battery at 80% efficacy, and that from the electrical to the kinetic via an electric motor at 99% efficacy. The concurrent overall green energy conversion efficacy nears 40%, and the futuristic efficacy could near 50%. Hence, green energy can reduce carbon dioxide emission, and in term of direction it is a right one.

However, a great deal of more research ought to be conducted, before massive-scale manufacturing. The energy storage technology need greatly get improved. Apart from the conversion efficacy aforementioned, the capacity, the conversion speed, and the safety of batteries must be greatly enhanced. The waste disposal technology need greatly get improved too. A massive-scale application of green energy will generate a massive-scale poisonous side effects. This issue must be fully addressed in advance.

#### (2) How long can fossil energy sustain?

At current consumption speed, oil & gas can sustain 50 years and coal can sustain 125 years. But oil & gas accounts for 50+% of total energy consumption, while coal accounts for 25+%. Thus, the fossil energy can sustain  $(50 \times 50 + 25 \times 125) / (50 + 25) = 75$  years.

With green energy technologies and possible new reserve, the fossil energy is expected to sustain for 100 years, in term of the order of magnitude.

Note that the so-called green energy can postpone the depletion of petroleum, the best fuel so far, but can't fully substitute it.

#### (3) Summary from a technical perspective

(i) US ought to ramp up research in controlled nuclear fusion and launch research in quark energy, the two highly probable ultimate solutions to the perpetual energy for the mankind.

(ii) US ought to ramp up research in so-called green-energy.

(iii) US ought to tentatively hold on massive governmental investment in so-called green energy.

(iv) US ought to start to preserve own fossil reserve, based on the time estimate.

#### (4) Political perspective

(i)

Please check out the attached first screenshot. Global warming is imminent. But how to knock out 5 birds with 1 stone?

Please check out the attached second screenshot, to get a basic idea of the magnitude of the challenge US faces.

Please check out the attached third screenshot. Globalization is a very bad idea, and hopefully we may get a chance in the future to elaborate on this topic. But withdrawing all US corporations is unrealistic. A much better approach is to re-direct many many US corporations to Central and South America, for multiple reasons including the issue of 30,000,000 illegals within US border, and to South and East Europe, for multiple reasons including the Russian matter.

(ii)

Please check out the attached fourth screenshot. US ought to smarten up and stop most oil & gas field exploitation on US territory, as well as the importation from Canada and Mexico. Instead, US ought to buy fossil fuel from Middle East including Persia, Russia, and Venezuela. And make sure to push up the oil price. Why?

(a) As aforementioned, US must smarten up and start to preserve own fossil fuels, and use others' first.

(b) US ought to make the importation a political tool, to control some other nations, Russia and Persia for instance.

(c) In this way, oil price can be pushed up. Thus, it reduces or helps reduce world's annual fossil consumption, to fight global warming. Actually this is one of the most effective ways to dip global temperature, since some nations never play by rules and they simply talk A but do B.

(d) High oil price can counter US' rivals.

(e) High oil price can raise US debt, thus counter DemocRatic destructive socialization. Of course, diminishing the debt is a medium-term goal, but it should not be a short-term focus. During these several crucial years, the extraordinary debt in fact serves as a powerful natural deterrent to the destructive socialization. Of course, pushing up the debt for nothing is silly, and while enjoying the protective high debt, Party Lincoln should keep vehemently condemning DemocRats on the debt & the inflation matter.

(iii)

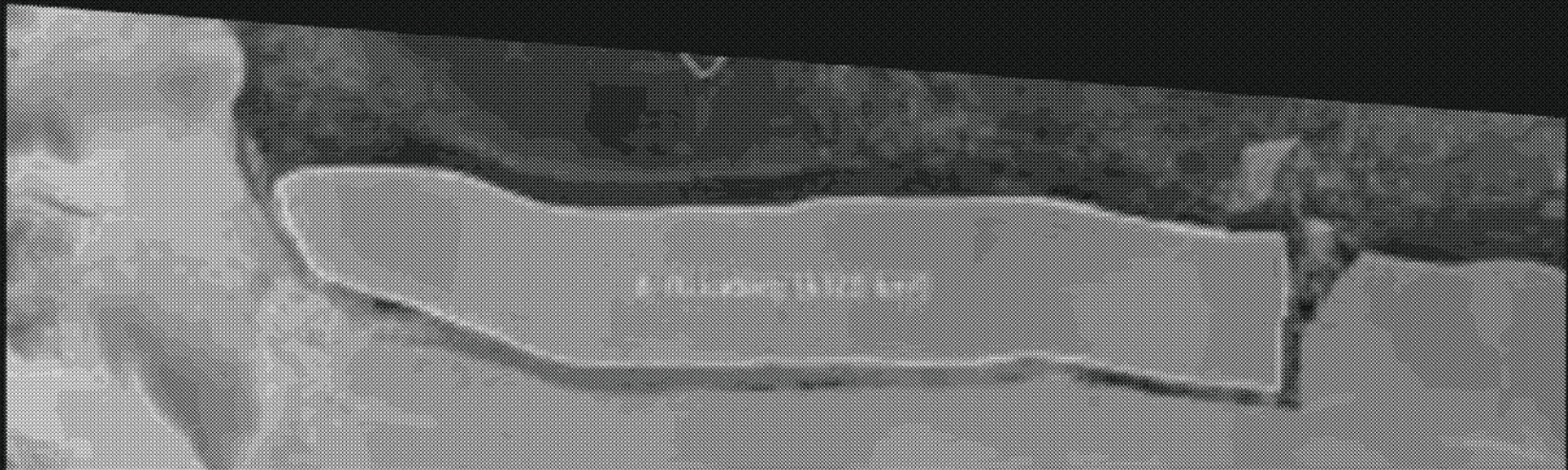


Please check out the attached fifth screenshot. Likewise, US ought to by default preserve own other natural resources, and seek importation first.

Please check out the attached remaining screenshots. Divide & Conquer is a common treatment, and morally neutral. Party Lincoln must frequently resort to it, otherwise would keep losing, losing, and losing. The most lethal tactic to defeat divide & conquer race cards is, to use divide & conquer race cards. Hopefully we could get into this topic in the future. Also, it is twisted, that a correct method in some framework could turn out to be wrong, if the framework is enlarged. Thus, a farsighted and surprising approach to the entangled international problems is to make Russia a strategic partner of America.

God bless America

***Global warming!!!  
But how to knock out 5 birds with 1 stone?***



SCIENCE

## **World's largest iceberg breaks off Antarctic shelf**



# Dragon Force



U.S.

**Navy charts new course for troubled ship-building operation as Chinese fleet now outnumbers America's**



# Opinion

**Sen. Josh Hawley: The China threat is real and big business is a sellout. Here's what Congress must do now**



Actually should move those corporations to US, South & East Europe, and Central & South America, strategically.



***Actually two correct moves.  
But green energy is certainly wrong!***





***Another correct move.  
But green energy is certainly wrong!***



MARKETS

**Biden looks abroad for electric  
vehicle metals, in blow to US  
miners**



***Wrong, actually.  
Divide & Conquer, Carrot & Stick.  
So, appease the #2, Russia.***



MEDIA

**Rep. Waltz slams Biden for  
appeasing Russia and China: 'Our  
adversaries smell weakness in  
the White House'**



***Sometimes America first could be shortsighted.  
Make Russia a strategic partner of America.***



POLITICS

**West Virginia AG Morissey:  
Biden energy policy amounts to  
Russia and China first, 'America  
last'**



# ***Make Russia a strategic partner of America!***



**DATE IS SET**

## **Biden, Putin to meet in early test of critical relationship off to rocky start**

CNN slams Cruz for 'pushing Russian propaganda,' ignores Biden lifting sanctions on Russian pipeline



***Get Russia more involved in Persia.  
Buy Russian oil to control Russia.  
Then focus on Asia and first solve N Korea.***



POLITICS

**Netanyahu, in front of Blinken,  
says US should stay away from  
Iran nuclear deal**