2020

Annual Report

/NEIDL **Boston University** National Emerging Infectious Diseases Laboratories

BOSTON UNIVERSITY

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Boston University National Emerging Infectious Diseases Laboratories

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bu.edu/neidl

September 1, 2020

Letter from the Director

It is a strange and tragic twist of fate that while every year I start this letter commenting on the emerging infectious diseases outbreaks around the world, we now find ourselves in the midst of a true global pandemic. The WHO has for years listed an outbreak of "disease X", caused by a pathogen unknown to cause human disease, as a significant global public health risk. COVID-19, caused by the SARS-CoV-2 virus, represents a true validation of that concern. We first heard of the cluster of patients with a pneumonia of unknown origin in Wuhan, China, on January 1 of this year. Within a week, Chinese scientists had identified the virus responsible for this outbreak, a previously unknown Coronavirus related to the original SARS (severe acute respiratory syndrome) virus. We watched in horror as tens of thousands of citizens came down with the disease, and observed Chinese officials attempts to get control over this previously unknown pathogen. But in a globalized world, it was only a matter of time before the disease "traveled" to other countries, first in Asia, and then to the US and to Europe.

Potentially pandemic pathogens share several characteristics. First, they are easily spread, usually by the respiratory route. Second, they spread during the asymptomatic period, while the pathogen is incubating in the body, but before symptom onset, allowing for a silent spread of the disease. Third, there is little or no pre-existing host immunity to the pathogen, or to a closely related pathogen(s). And finally, the pathogens often have other characteristics that are intrinsic to them (like tricks up their sleeve) that help them better infect, or spread, within a population. Unfortunately, the SARS-CoV-2 virus has all of these characteristics. This particularly distinguishes it from the previous two known coronaviruses that cause sever disease, the original SARS coronavirus, and the virus called Middle East Respiratory Syndrome (MERS) coronavirus. MERS is poorly spread person-to-person. While the SARS outbreak did spread globally, it was contained within a few months through public health measure (identify, quarantine, contact trace). The original SARS virus was most easily spread after disease symptoms were detected, while asymptomatic spread is common with SARS-CoV-2. The global case count for SARS was just over 8,000 people infected, compared with over 24 million for SARS-CoV-2 today.

The University closed to protect its students, staff and faculty on March 11, and this forced us to end our seminar program for the remainder of the year. Tours and planned STEM experiences were also cancelled, and life in the NEIDL began to look very different. We resorted to zoom meetings, even with colleagues next door, some worked from home when they could. Nevertheless, the NEIDL was already planning its first SARS-CoV-2 experiments. We received the first isolate of the virus on February 27, after approval by our Institutional Biosafety Committee and the Boston Public Health Commission, and within 3 weeks had approved protocols to begin working on the virus, initially in our biosafety level -4 (BSL-4) suites. A number of faculty and staff have also entered the training program to expand the work to COVID-19 in the BSL-3 suites. The NEIDL now has 14 faculty (and many more collaborators) working on various aspects of the biology of the virus, determining how it causes disease, developing or testing of various therapeutics and vaccines, and clinical research, work which utilizes our BSL-2, BSL-3, and BSL-4 laboratories. Laboratories worked under social distancing and "shifts" to prevent overcrowding. Our faculty have also taken on some less conventional projects that have been prompted by the pandemic. These include working with several companies testing their products for their ability to inactivate the virus, including various surface treatments to increase safety in offices or for healthcare workers, and the testing of ultraviolet light to inactivate viruses, including SARS-CoV-2.

There is still much to be learned about the SARS-CoV-2 virus, and we expect to be studying it for the foreseeable future. That said, there are many different viruses that cause emerging infectious diseases in humans, and many of them remain high priority pathogens by the National Institutes of Health, as well as the WHO. The scientific staff continues to study many of these other viruses as well.

Throughout all of our ramp up to work on COVID-19, we continued our commitment to being completely transparent with the public about our work. We do so in partnership with our Community Relations staff, who are in open communication with our Community Liaison Committee, as well as with various community groups. A new web site was also developed to make it easier for the community to get news about the NEIDL, and our work.

None of the scientific response to COVID-19 would have been possible without the continued efforts of our operational support staff, facilities professionals, environmental health and safety officers, and our security staff. They have, along with the investigators and research staff, adapted to a new way of working by physical distancing, wearing masks, and decreasing the density of personnel in work areas. Everyone involved has been truly remarkable. We all recognize that responding in the times of a public health emergency caused by novel infectious diseases is exactly why facilities like the NEIDL exist, and an effective response requires a true team effort. I am proud that our staff has risen to the challenge.

Ronald B. Corley, Ph.D.
Professor of Microbiology
Director, National Emerging Infectious Diseases Laboratories

Mission Statement and Strategic Plan

The Boston University National Emerging Infectious Diseases Laboratories (NEIDL) mission is to generate and translate fundamental knowledge on high priority emerging infectious diseases for the benefit of the public health, locally, nationally and globally.

Emerging infectious diseases are defined as those that have newly appeared and been recognized in the population, or have existed but are rapidly increasing in incidence or in geographic range. To meet our missions the NEIDL will:

1. Perform innovative basic, translational and clinical research on emerging infectious diseases, especially those NIH/NIAID identifies as high **Priority Category A, B, and C pathogens**, in order to develop diagnostic tests, treatments and vaccines to promote the public's health.
2. Provide education and training in these areas of research, in order to develop the next generation of scientists in this field, and to support a national response in the event of a biodefense emergency.
3. Establish a research facility with the highest attention to community and laboratory safety and security.

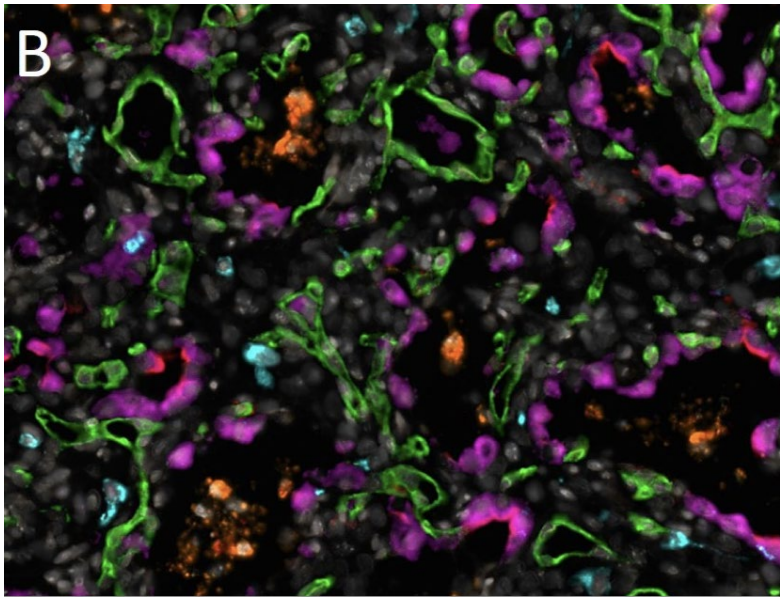
To successfully implement and achieve these goals, NEIDL has developed and is implementing a strategic plan to:

i. Partner with academic departments across the university to recruit a cadre of investigators, as well as to develop research staff with expertise in the scientific disciplines required to investigate the pathogenesis of emerging infectious diseases caused by category A, B and C agents. We encourage and support the development of national and international research collaborations in order to carry out our mission.
ii. Develop physiologically relevant models for the comparative study of these pathogens, mimicking as closely as possible the human disease process. Not only does this require that we recruit faculty with expertise in animal modeling and veterinarian pathology, but also develop the needed services to support these investigations.
iii. Move promising basic research as rapidly as possible to translational, preclinical and clinical research in animals and humans in partnership with appropriate collaborators.
iv. Create and establish the methodologies needed to advance the development and testing of vaccines, therapeutics and diagnostics for these agents.
v. Train scientists and related support personnel in the requirements to perform maximum containment research in a safe and secure environment.
vi. Maintain the flexibility needed to support a national response in the event of a biodefense emergency.
vii. Ensure a "safety first" environment for the conduct of all activities in the NEIDL

Highlights of FY2020

NCPL

During this year, the NEIDL established a Comparative Pathology Laboratory to support our emerging infectious diseases work, under the direction of Nicholas Crossland and Hans Gertje. This unit offers standard and advanced histotechnology imaging services, including multiplex fluorescence imaging (up to 9 probes simultaneously). It plays a critical role in our ability to understand disease pathogenesis.

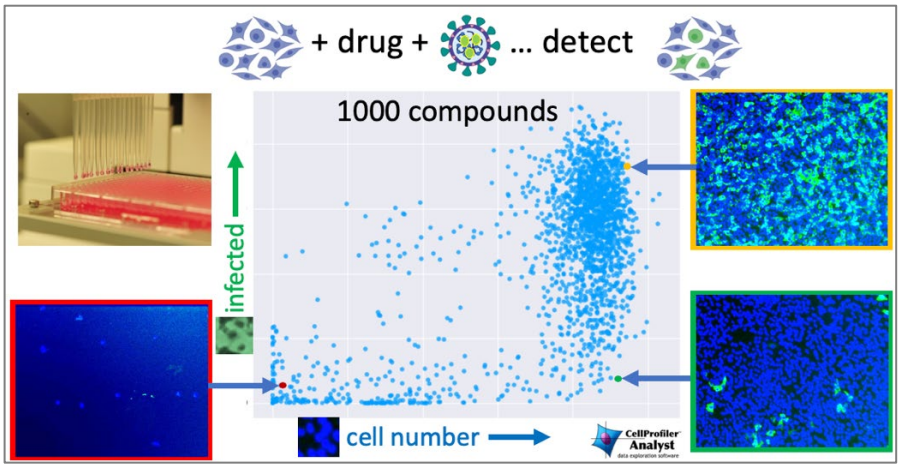


A representative multiplex fluorescent immunohistochemistry showing a lung infected with SARS-CoV-2 (40x): Teal- Macrophages in the lung (stain CD68); Magenta: Type II pneumocytes, the lung cell that is infected by the virus (prosurfactant C). Red: Angiotensin Converting Enzyme 2 (ACE2), the receptor for SARS-CoV-2. Green: Blood vessels (CD31). Orange: SARS-CoV-2 Nucleoprotein. Grey: a nuclear counterstain (DAPI). (Courtesy of Drs. F. Douam and N. Crossland)

Drug Screening

As reported in the news, Dr. Robert Davey has established a high throughput drug screening program, which is currently being used to screen for compounds that inhibit SARS-CoV-2 infection.

Schematic of outcomes of screening a small, 1000 compound library. Each image shows infected cells (green) and cell nuclei (blue) with image at upper right being unaffected by treatment (most compounds), lower right, a reduction in infection, lower left, the effect of a toxic compound, causing cell loss. Blue dots on plot show frequency of each outcome. Courtesy of Robert Davey



Faculty and Staff

Scientific Leadership

Ronald B. Corley, PhD
Professor and Chair, Department of Microbiology
Director, NEIDL
Director, Immunology Core

Dr. Corley's Research interests:
Innate and adaptive immunity to human pathogens

Gerald T. Keusch, MD
Professor of Medicine & International Health
Associate Director, NEIDL
Director, Collaborative Research

Dr. Keusch's research interests:
Global impact of infectious diseases on economic development and public health

Faculty

Nahid Bhadelia, MD, MA
Assistant Professor, Medicine / ID
Medical Director, SPU, BMC

Dr. Bhadelia' s research interests:
International pandemics strategy & policy
Disaster preparedness training for healthcare workers

Markus Bosmann, MD *
Associate Professor of Medicine, Pathology & Laboratory Medicine

Dr. Bosmann' s research interests:
Acute respiratory distress syndrome
Infection-associated inflammation
Macrophages, neutrophils, T cells, lung epithelial cells

Tonya Colpitts, PhD *
Assistant Professor, Microbiology

Dr. Colpitts' research interests:
Virus/Flavivirus pathogenesis
Virus-host-vector interactions
Transmission-blocking vaccines

John H. Connor, PhD
Associate Professor, Microbiology

Dr. Connor's research interests:
Virus-host interaction
Viral domination of protein synthesis
Novel approaches to virus detection

Nicholas Crossland, DVM ACVP
Assistant Professor, Pathology

Dr. Crossland's research interests:
Borrelia burgdoferi and mechanisms of persistence
Comparative pathology using animal models

Robert Davey, PhD
Professor, Microbiology

Dr. Davey's research interests:
Host factor-based therapy development
Infection mechanism for filoviruses and other high containment viruses

Florian Douam, PhD
Assistant Professor, Microbiology

Dr. Douam's research interests:
Viral immunogenicity and pathogenicity mechanisms in vivo
Advanced humanized mouse systems

Rachel Fearns, PhD
Associate Professor, Microbiology

Dr. Fearns' research Interests:
Negative strand RNA virus polymerase activities
Control of respiratory syncytial virus RNA synthesis

Horacio Frydman, PhD
Associate Professor, Biology

Dr. Frydman's research interests:
Niche tropism of insect endosymbionts
Mechanisms of Wolbachia-insect interactions

James Galagan, PhD
Associate Professor, Biomedical Engineering & Microbiology

Dr. Galagan's research interests:
Mycobacterium tuberculosis regulatory networks
Computational Biology and Genomics

Anthony Griffiths, PhD
Associate Professor, Microbiology
Director, Nonclinical Studies Unit

Dr. Griffiths' research interests:
Multiple aspects of filovirus biology
Development of vaccines and therapeutics

Rahm Gummuluru, PhD *
Professor, Microbiology

Dr. Gummuluru's research interests:
Multiple aspects of filovirus biology
Development of vaccines and therapeutics

Davidson Hamer, MD *
Professor, Global Health & Medicine

Dr. Hamer's research interests:
Tropical Infectious diseases
Multi-site disease surveillance
Molecular epidemiological studies to predict outbreaks

Tarik Haydar, PhD *
Assoc Professor, Anatomy & Neurobiology

Dr. Haydar's research interests:
Forebrain development and function
Cellular and molecular determinants influencing cognition

Anna Honko, PhD *
Research Assoc Professor, Microbiology
Assoc Director, Nonclinical Studies Unit

Dr. Honkos research interests:
Immunology and vaccine development
Caracterization infectious disease animal models using implantable radiotelemetry

Thomas B Kepler, PhD
Professor, Microbiology, Mathematics & Statistics

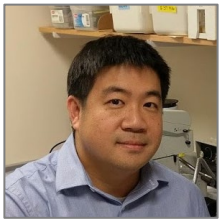
Dr. Kepler's research interests:
Quantitative Systems Immunology
Vaccine Development

Bang-Bon Koo, PhD
Assistant Professor, Anatomy & Neurobiology

Dr. Koo's research interests:
Biomedical in-vivo imaging
Multimodal magnetic resonance imaging and analysis

Igor Kramnik, MD, PhD
Associate Professor, Medicine and Microbiology

Dr. Kramnik's research interests:
Genes controlling host resistance and susceptibility to TB
Mechanisms of macrophage activation and differentiation



Nelson Lau, PhD *
Associate Professor, Biochemistry
Director, Genome Science Institute

Dr. Lau's research interests:
Transposable element regulation
RNAi
Regulatory RNAs
Gene silencing

Joseph Mizgerd, PhD *
Professor, Medicine, Microbiology & Biochemistry
Director, Biomolecule Production Core

Dr. Mizgerd's research interests:
Pulmonary immunity
Cell biology of the lung
Mechanismms of inflammation

Elke Mühlberger, PhD
Associate Professor, Microbiology
Director, NEIDL Virology Services

Dr. Mühlberger's research interests:
Host response to filovirus infection
Molecular mechanisms of filovirus replication and transcription

Jason Rock, PhD *
Associate Professor, Medicine
Principal Investigator, CReM

Dr. Rock's research interests:
Genetic, Molecular and Cellular therapies for the treatment of lung disease

Mohsan Saeed, PhD
Assistant Professor, Biochemistry

Dr. Saeed's research interests:
Role of viral proteases in shaping virus-host interactions

John C. Samuelson, MD, PhD
Professor of Molecular and Cell Biology
Professor of Microbiology

Dr. Samuelson's research interests:
Pathogenesis of protozoan parasites
Structures of parasite walls & glycoprotein

James Whitney, PhD
Assistant Professor, Medicine, HMS
PI, Center for Virology and Vaccine Research, BIDMC

Dr. Whitney's research interests:
Viral dynamics & the HIV-1/SIV viral reservoir
Development of novel HIV-1 eradication strategies

FY20 by the numbers

Faculty **27**

Staff **126**

Projects Funded **47**

Funds Awarded
$**22.4** MM

Publications **96**

BSL-4 Program faculty and staff **49**

BSL-3 Program faculty and staff **39**

NEIDL LABORATORIES

Colpitts Lab

Araujo, Ricardo *
Visiting Scientist, MCTI Brazil

Feitosa-Suntheimer, Fabiana
ACL3 Insectary Manager

Gold, Alexander
PHD Candidate, Microbiology

Mameli, Enzo
Visiting Researcher

Marquette, Megan
Visiting Researcher

Connor Lab

Devaux, Alexander
Research Study Technician

Seitz, Scott
Postdoctoral Fellow

Strampe, Jamie Michelle
Graduate Student, Bioinformatics

Turcinovic, Jacquelyn
Graduate Student, Bioinformatics

Crossland Lab

Gertje, Hans *
Lab Manager – Histotech

Rosenbloom, Raymond *
Graduate Student, Pathology

Davey Lab

Anantpadma, Manu *
Sr. Research Scientist

Donohue, Callie
PhD Candidate, Microbiology

Keiser, Patrick
Senior Research Technician

Geoghegan-Barek, Kathleen
Lab Manager

Patten, Justin
Research Technician

Mori, Hiroyuki
Postdoctoral Fellow

Douam Lab

Deengar, Aishwarya
Graduate Student

Hu, Alexander
Research Technician

O'Connel Aoife
Research Technician

Trachtenberg, Alexander
Lab Manager

Fearns Lab

Braun, Molly *
PhD Candidate, Microbiology

Breen, Michael
PhD Candidate, Microbiology

Cressey, Tessa *
PhD Candidate, Microbiology

Kleiner, Victoria
PHD Candidate, Microbiology

Ludeke, Barbara
Postdoctoral Fellow

Philip, Katherine
Undergraduate Student, Biology

Shareef, Afzaal
Research Study Technician

Shearer, Sarah
Senior Research Scientist

Griffiths Lab

Avena, Laura
Graduate Student, UTHS

Downs, Sierra
Research Technician

Honko, Anna
Assistant Research Professor

Johnson, Rebecca
Postdoctoral Fellow

Malsick, Lauren
Research Technician

McKay, Lindsay
Postdoctoral Fellow

Storm, Nadia
Postdoctoral Fellow

Koo Lab

Cheng, Chia Hsin
Research Technician

Kramnik Lab

Agrahari, Garima *
Postdoctoral Fellow

Brownhill, Eric
MD-PhD Candidate, Microbiology

Chatterjee, Sujoy *
Postdoctoral Research Associate

Dülsner-Seidel, Kirsten *
Postdoctoral Fellow

Gavrish, Igor
Research Study Technician

He, Xianbao
Research Instructor

Waligurski, Emily *
Postdoctoral Fellow

Yabaji, Shivaraj M
Postdoctoral Fellow

Ye, Harong
Graduate Student, Engineering

Muhlberger Lab

Heiden, Baylee *
Research Technician

Hume, Adam J
Research Scientist

Manhart, Whitney *
Postdoctoral Fellow

Olejnik, Judith
Senior Research Scientist

Pacheco, Jennifer R. *
Research Technician

Suder, Ellen Lee
PhD Candidate, Microbiology

White, Mitchell *
Lab Manager

Saeed Lab

Chen, Da-Yua
Postdoctoral Fellow

Conway, Hassahn
Research Technician

Kapell, Sebastian *
Postdoctoral Fellow

NEIDL Laboratory Operations

Broos-Caldwell, Aditi
Lab Operations Manager
BSL-2 & BSL-3

Koster, Jacob
Sr. NEIDL Core Technologist
Quality Control

Yen, Judy
Senior Lab Operations Manager
BSL-4

Animal Research Support

Diaz-Perez, Yulianela
Veterinary Research Technician

Furtado, Oscar M
Veterinary Research Technician

Gross, Sarah
Veterinary Research Technician

Grosz, Kyle *
Veterinary Research Technician

Hardcastle, Kath DVM *
DACLAM
ABSL Core Director

Harrington, Patrice
Veterinary Research Technician

Kurnick, Susanna *
Research Clinical Veterinarian

Nunes, Corey
Assistant Director, Operations

MacGregor, Nicolle
Veterinary Research Technician

Mclaughlin, Robert J
Veterinary Research Technician

Varada, Rao DVM PhD
ASC, Attending Veterinarian

Leadership

Ronald B Corley, PhD
Director, NEIDL

Thomas Daley
Director of Operations

Kevin Tuohey
Chief Safety Officer

Administration

Durkop, Betina A
Executive Coordinator

Trevino, Richard , MPH
Director, Finance & Research Administration

Forman, Lora
Administrative Manager, Operations

Spell, Virginia *
Research Contracts Manager

Community Relations

Britton, Valeda J JD
Executive Director
Community Relations

Idiokitas, Chimel
Assistant Director
Community Relations

Facility Maintenance and Operations

Amadio, Paul
Facilities Engineering Ops Manager

Ananian, David
General Mechanic

Baires, J Victoria
Custodian

Cardoso, Jonathan *
Control Center Tech II

Corbett, Joseph
Controls Manager

Cyr, Brandon *
Control Technician I

Fahey, Shaun *
General Mechanic

Galvao, Joao *
Control Technician II

Fonseca, Paulo
Control Technician I

Gendron, Jonathan
General Mechanic

Madden, Lance *
General Mechanic

Minacapilli, Salvatore *
General Mechanic

Mosca, Derek
Maintenance Mechanic

Murphy, James
General Mechanic

Nakhid, Nafisah *
Assistant Engineer

Rodriguez, Mario
Custodian

Rusk, Scott
Director, Facilities & Maintenance Operations

Sousa, Daniel
Shipping & Receiving

Tucker, Daniel
Maintenance Mechanic

Walsh, James
Maintenance Mechanic

Information Technology

John McCall
Director, Information Technology

Benjamin Slutzky
IT Operations Administrator

Environmental Health and Safety

Benjamin, Shannon MBA CBSP
Assoc Director, Research Safety for High Containment

Ellis, Andrew W
Sr. Research Safety Specialist

Flynn, Nick
Biocontainment Manager

Gilmartin, John
EHS Program Manager

Madico, Guillermo MD PhD
Scientific Safety Officer

Olinger, Gene PhD
Assoc Director, Maximum Containment Training

Randall-Hlubek, Deborah *
Quality Assurance Specialist(contractor)

Vinson, Aaron *
Program Manager, Emergency Response Planning

Wallenstein, Adam *
Sr. Research Safety Specialist

Yun, Nadezhda MD
Assoc Director, Research Safety for Maximum Containment

Public Safety

Management & Staff

Anderson, Eric
Sr. Operation Manager

Taverna, Michelle *
Personnel Suitability Specialist

Paparo, Scott
Building Security Systems Integrator

Tracy, Harris
Building Security Systems Integrator

Taranto, Stephen A., JD
Director of Public Safety BUMC

Public Safety Officers

Annese, Rae
Barros, Christopher L
Barros, Jeffrey P
Duffy, Joseph M
Estrella, Jesse *

Gallivan, John
Maldonis, Joseph
Phelps, Justin
Saad, Jacob
Salhi, Adil

Santos, Rayshawn *
Souza, Joshua *
Wynne, Paul M
Wynne, Sean C

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*Joined NEIDL in FY20

*Left NEIDL in FY20

Research Publications

Ebola in the DRC one year later - Boiling the frog?
McLellan S, Kortepeter MG, **Bhadelia N**, Shenoy ES, Sauer LM, Frank MG, Cieslak TJ. Int J Infect Dis. 2019 Aug;85:212-213. doi: 10.1016/j.ijid.2019.07.014. Epub 2019 Jul 19.PMID: 31330320

Coronavirus: hospitals must learn from past pandemics.
Bhadelia N. Nature. 2020 Feb;578(7794):193. doi: 10.1038/d41586-020-00354-4.PMID: 32047315

Making Emergency Use of Experimental Vaccines Safer.
Asundi A, **Bhadelia N.** AMA J Ethics. 2020 Jan 1;22(1):E43-49. doi: 10.1001/amajethics.2020.43.PMID: 31958390

Leveraging investments in Ebola preparedness for COVID-19 in Sub-Saharan Africa.
Ayebare R, Waitt P, Okello S, Kayiira M, Atim Ajok M, Nakatudde I, **Bhadelia N**, Lamorde M. AAS Open Res. 2020 Mar 18;3:3. doi: 10.12688/aasopenres.13052.1. eCollection 2020.PMID: 32500116

Early administration of interleukin-6 inhibitors for patients with severe COVID-19 disease is associated with decreased intubation, reduced mortality, and increased discharge.
Sinha P, Mostaghim A, Bielick CG, McLaughlin A, **Hamer DH**, Wetzler LM, **Bhadelia N**, Fagan MA, Linas BP, Assoumou SA, Ieong MH, Lin NH, Cooper ER, Brade KD, White LF, Barlam TF, Sagar M; Boston Medical Center Covid-19 Treatment Panel. Int J Infect Dis. 2020 Jul 25;99:28-33. doi: 10.1016/j.ijid.2020.07.023. Online ahead of print.PMID: 32721528

Marburg Virus Disease: a Summary for Clinicians.
Kortepeter MG, Dierberg K, Shenoy ES, Cieslak TJ; members of the Medical Countermeasures Working Group of the National Ebola Training and Education Center's (NETEC's) Special Pathogens Research Network (SPRN). Int J Infect Dis. 2020 Aug 3:S1201-9712(20)30586-5. doi: 10.1016/j.ijid.2020.07.042. Online ahead of print.PMID: 32758690

Pre-positioned Outbreak Research: The Joint Medical Emerging Diseases Intervention Clinical Capability Experience in Uganda.
Martins KA, Ayebare RR, **Bhadelia N**, Kiweewa F, Waitt P, Mimbe D, Okello S, Naluyima P, Brett-Major DM, Lawler JV, Millard M, Walwema R, Cardile AP, Ritchie C, Kwiecien A, Badu H, Espinosa BJ, Beckett C, Bavari S, Zaman S, Christopher G, Clark DV, Lamorde M, Kibuuka H. Health Secur. 2020 Mar/Apr;18(2):114-124. doi: 10.1089/hs.2019.0112.PMID: 32324070

Activated Endothelial TGFβ1 Signaling Promotes Venous Thrombus Nonresolution in Mice Via Endothelin-1: Potential Role for Chronic Thromboembolic Pulmonary Hypertension.
Bochenek ML, Leidinger C, Rosinus NS, Gogiraju R, Guth S, Hobohm L, Jurk K, Mayer E, Münzel T, Lankeit M, **Bosmann M**, Konstantinides S, Schäfer K. Circ Res. 2020 Jan 17;126(2):162-181. doi: 10.1161/CIRCRESAHA.119.315259. Epub 2019 Nov 21.PMID: 31747868

Neutrophil extracellular traps impair fungal clearance in a mouse model of invasive pulmonary aspergillosis.
Alflen A, Aranda Lopez P, Hartmann AK, Maxeiner J, **Bosmann M**, Sharma A, Platten J, Ries F, Beckert H, Ruf W, Radsak MP. Immunobiology. 2020 Jan;225(1):151867. doi: 10.1016/j.imbio.2019.11.002. Epub 2019 Nov 13.PMID: 31761474

Myeloid Cells Restrict MCMV and Drive Stress-Induced Extramedullary Hematopoiesis through STAT1.
Gawish R, Bulat T, Biaggio M, Lassnig C, Bago-Horvath Z, Macho-Maschler S, Poelzl A, Simonović N, Prchal-Murphy M, Rom R, Amenitsch L, Ferrarese L, Kornhoff J, Lederer T, Svinka J, Eferl R, **Bosmann M**, Kalinke U, Stoiber D, Sexl V, Krmpotić A, Jonjić S, Müller M, Strobl B. Cell Rep. 2019 Feb 26;26(9):2394-2406.e5. doi: 10.1016/j.celrep.2019.02.017.PMID: 30811989

Complement Activation during Critical Illness: Current Findings and an Outlook in the Era of COVID-19.
Bosmann M. Am J Respir Crit Care Med. 2020 Jul 15;202(2):163-165. doi: 10.1164/rccm.202005-1926ED.PMID: 32437622

Bacterial polyphosphates interfere with the innate host defense to infection.
Roewe J, Stavrides G, Strueve M, Sharma A, Marini F, Mann A, Smith SA, Kaya Z, Strobl B, Mueller M, Reinhardt C, Morrissey JH, **Bosmann M.** Nat Commun. 2020 Aug 12;11(1):4035. doi: 10.1038/s41467-020-17639-x.PMID: 32788578

Gut Microbiota Restricts NETosis in Acute Mesenteric Ischemia-Reperfusion Injury.
Ascher S, Wilms E, Pontarollo G, Formes H, Bayer F, Müller M, Malinarich F, Grill A, **Bosmann M**, Saffarzadeh M, Brandão I, Groß K, Kiouptsi K, Kittner JM, Lackner KJ, Jurk K, Reinhardt C. Arterioscler Thromb Vasc Biol. 2020 Jul 2:ATVBAHA120314491. doi: 10.1161/ATVBAHA.120.314491. Online ahead of print.PMID: 32611241

SARS-CoV-2 Infection of Pluripotent Stem Cell-derived Human Lung Alveolar Type 2 Cells Elicits a Rapid Epithelial-Intrinsic Inflammatory Response.
Huang J, Hume AJ, Abo KM, Werder RB, Villacorta-Martin C, Alysandratos KD, Beermann ML, Simone-Roach C, Olejnik J, Suder EL, Bullitt E, Hinds A, Sharma A, **Bosmann M**, Wang R, Hawkins F, Burks EJ, **Saeed M**, Wilson AA, **Mühlberger E**, Kotton DN. bioRxiv. 2020 Jun 30:2020.06.30.175695. doi: 10.1101/2020.06.30.175695. Preprint.PMID: 32637964

Correction: Type 1 IFN and PD-L1 Coordinate Lymphatic Endothelial Cell Expansion and Contraction during an Inflammatory Immune Response.
Lucas ED, Finlon JM, Burchill MA, McCarthy MK, Morrison TE, **Colpitts TM**, Tamburini BAJ. J Immunol. 2020 Feb 1;204(3):726-727. doi: 10.4049/jimmunol.1901400. Epub 2019 Dec 20.PMID: 31862709

Examining the Role of Niemann-Pick C1 Protein in the Permissiveness of Aedes Mosquitoes to Filoviruses.
Gold AS, Feitosa-Suntheimer F, Asad S, Adeoye B, **Connor JH**, **Colpitts TM.** ACS Infect Dis. 2020 Aug 14;6(8):2023-2028. doi: 10.1021/acsinfecdis.0c00018. Epub 2020 Jul 15.PMID: 32609483

One-step RT-qPCR assay for ZIKV RNA detection in Aedes aegypti samples: a protocol to study infection and gene expression during ZIKV infection.
Araujo RV, Feitosa-Suntheimer F, Gold AS, Londono-Renteria B, **Colpitts TM.** Parasit Vectors. 2020 Mar 14;13(1):128. doi: 10.1186/s13071-020-4002-x.PMID: 32171303 .

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FY20 Funded Research

The work which resulted in the publications outlined above would not have been possible without the ability of our faculty to competitively seek funding to support their research activities. NEIDL faculty members received over $ 22 MM in funding in FY20 for the following projects:

PI NAME	AWARD TITLE	SPONSOR (PRIME SPONSOR)	PROJECT START - END DATES	FUNDS IN FY20
NAHID BHADELIA	AUSTERE ENVIRONMENTS CONSORTIUM FOR ENHANCED SEPSIS OUTCOMES (ACESO) UGANDA	The H. M. Jackson Found. (DOD)	8/1/2019 - 06/30/2020	68,726
JOHN H. CONNOR	ADVANCEMENT OF A POXVIRUS INHIBITOR	NIH/NIAID	3/12/2020 - 02/28/2025	575,718
RONALD B. CORLEY	NATIONAL EMERGING INFECTIOUS DISEASES LABORATORIES OPERATIONS	NIH/NIAID	6/1/2016 - 05/31/2021	11,500,000
NICHOLAS A. CROSSLAND	VENTANA DISCOVERY ULTRA RESEARCH AUTOSTAINER: AN EX+ CORE SERVICE	NIH/Office of the Director	8/1/2019 - 07/31/2020	207,000
ROBERT A. DAVEY	MODELING FILOVIRUS INFECTION OF AND TRAFFICKING THROUGH SKIN	The University of Iowa (NIH/NIAID)	8/1/2018 - 07/31/2020	149,078
ROBERT A. DAVEY	STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF THE EBOLA VIRUS REPLICATION COMPLEX	The Washington University (NIH/NIAID)	7/1/2018 - 06/30/2020	292,000
ROBERT A. DAVEY	STRUCTURAL AND FUNCTIONAL CHARACTERIZATION OF THE EBOLA VIRUS REPLICATION COMPLEX (CORE C)	The Washington University (NIH/NIAID)	7/1/2019 - 06/30/2021	260,000
ROBERT A. DAVEY	ANTIVIRAL LEAD IDENTIFICATION TO TREAT FILOVIRUS INFECTIONS	Purdue University (NIH/NIAID)	8/12/2019 - 07/31/2023	138,423
ROBERT A. DAVEY	4-(AMINOMETHYL)BENZAMIDES AS NOVEL ANTI-EBOLA AGENTS	Chicago BioSolutions, Inc. (NIH/NIAID)	8/16/2019 - 07/31/2022	125,421
ROBERT A. DAVEY	ADVANCED DEVELOPMENT OF A VIRAL ENTRY INHBITOR AS A THERAPEUTIC FOR ARENAVIRUS HEMORRHAGIC FEVER	Kineta, Inc. (NIH/NIAID)	3/1/2020 - 12/31/2020	50,383
ROBERT A. DAVEY	SMALL MOLECULE INHIBITORS OF EBOLA VIRUS POLYMERASE FUNCTION	Georgia State University (NIH/NIAID)	8/1/2018 - 01/31/2021	205,901
RACHEL FEARNS/ JAY MIZGERD/ TOM KEPLER	THE B CELL REPERTOIRE AS A WINDOW INTO THE NATURE AND IMPACT OF THE LUNG VIROME	NIH/NHLBI	5/1/2019 - 04/30/2022	798,456
RACHEL FEARNS	DEVELOPING COMBINATION THERAPIES AGAINST PNEUMO- AND PARAMYXOVIRUSES CAUSING SEVERE RESPIRATORY INFECTION	Georgia State University (NIH/NIAID)	7/1/2018 - 06/30/2020	16,500

PI NAME	AWARD TITLE	SPONSOR (PRIME SPONSOR)	PROJECT START - END DATES	FUNDS IN FY20
RACHEL FEARNS	INTERPLAY BETWEEN RESPIRATORY SYNCYTIAL VIRUS AND NUCLEOTIDE BIOSYNTHESIS PATHWAYS	NIH/NIAID	2/7/2020 - 01/31/2022	255,651
JAMES E. GALAGAN	CHEMICAL AND BIOCHEMICAL DETERMINANTS OF PHOSPHOROTHIOATE STABILITY AND LOCATION IN BACTERIAL GENOMES	MIT (NSF)	8/1/2017 - 07/31/2020	60,801
ANTHONY GRIFFITHS	NATURAL HISTORY OF RHESUS MACAQUES INFECTED WITH *SUDAN EBOLAVIRUS* DISEASE	TBRI (BARDA)	3/22/2019 - 10/31/2019	136,522
ANTHONY GRIFFITHS	NATURAL HISTORY OF RHESUS MACAQUES INFECTED WITH *MARBURG* VIRUS	TBRI (BARDA)	3/22/2019 - 10/31/2019	144,362
ANTHONY GRIFFITHS	PILOT STUDY TO ASSESS PROTECTION AGAINST FILOVIRUS CHALLENGE BY AN INFUSED MONOCLONAL ANTIBODY	Leidos (NIH/NCI)	10/31/2019 - 09/23/2023	286,670
ANTHONY GRIFFITHS	RATIONALLY DESIGNED PAN-EBOLAVIRUS VACCINE	Integrated BioTherapeutics (NIH/NIAID)	12/1/2019 - 05/31/2022	98,038
ANTHONY GRIFFITHS	STTR PHASE II: BROADLY PROTECTIVE BISPECIFIC ANTIBODIES FOR TREATMENT OF EBOLA VIRUS DISEASE	Integrated BioTherapeutics (NIH/NIAID)	11/1/2019 - 06/30/2020	68,961
ANTHONY GRIFFITHS	INACTIVATION OF SARS COV-2 USING UV-C	Signify Corp	6/1/2020 - 07/15/2020	53,361
ANTHONY GRIFFITHS	EVALUATION OF THE EFFICACY OF CONVALESCENT ANTI-EBOLA VIRUS INTRAVENOUS IMMUNE GLOBULIN IN THE TREATMENT OF EBOLA VIRUS DISEASE IN A LETHAL MOUSE MODEL	Grifols Inc	5/1/2020 - 12/31/2020	441,071
ANTHONY GRIFFITHS	INACTIVATION OF SARS COV-2 USING UV-C	Crystal IS Inc.	6/1/2020 - 09/01/2020	67,885
ANTHONY GRIFFITHS	IMMUNOGENICITY AND EFFICACY TESTING OF MEDICAL COUNTERMEASURES AGAINST BSL-4 PATHOGENS IN NHPS	Battelle (NIH/NIAID)	6/23/2020 - 12/31/2021	318,106
RAHM GUMMULURU	CD1A VAGINAL DENDRITIC CELLS AND HIV-1 ACQUISITION IN THE FEMALE GENITAL TRACT	BMC Corp (NIH/NIAID)	5/15/2015 - 04/30/2020	77,870
RAHM GUMMULURU	MECHANISM OF CELL-ASSOCIATED HIV-1 TRANSMISSION	NIH/NIAID	12/01/2015 - 11/30/2020	412,500
RAHM GUMMULURU	GM3 NANOPARTICLES FOR SUSTAINED DELIVERY OF ANTI-RETROVIRALS TO LYMPHATIC TISSUES	NIH/NIAID	11/8/2017 - 10/31/2022	637,477
RAHM GUMMULURU	SIGNALS THAT ESTABLISH AND MAINTAIN HIV LATENCY	BMC Corp (NIH/NIAID)	5/8/2018 - 04/30/2023	62,060

PI NAME	AWARD TITLE	SPONSOR (PRIME SPONSOR)	PROJECT START - END DATES	FUNDS IN FY20
RAHM GUMMULURU	PERSISTENT HIV EXPRESSION INDUCED TYPE 1 IFN RESPONSES AND INFLAMMAGING	NIH/NIAID	8/1/2018 - 04/30/2023	742,299
RAHM GUMMULURU	SYNERGISTIC MECHANISMS OF CHRONIC INNATE IMMUNE ACTIVATION IN MICROGLIA BY OPIATES AND HIV INFECTION	NIH/NIAID	7/15/2020 - 04/30/2025	730,514
DAVIDSON HAMER	GEOSENTINEL- THE GLOBAL SURVEILLANCE NETWORK OF ISTM AND CDC	ISTM (HHS/CDC)	9/1/2016 - 08/31/2021	194,022
DAVIDSON HAMER	GEOSENTINEL- THE GLOBAL SURVEILLANCE NETWORK OF ISTM AND CDC	ISTM (HHS/CDC)	9/1/2016 - 08/31/2021	33,190
DAVIDSON HAMER	FOGARTY GLOBAL HEALTH TRAINING FELLOWSHIP PROGRAM	Harvard SPH (NIH/FIC)	7/1/2017 - 06/30/2022	18,080
DAVIDSON HAMER	FOGARTY GLOBAL HEALTH TRAINING FELLOWSHIP PROGRAM	Harvard SPH (NIH/FIC)	7/1/2017 - 06/30/2022	3,240
DAVIDSON HAMER	SYNBIOTICS FOR THE PREVENTION OF NEONATAL SEPSIS (SEPSIS)	The Hosp for Sick Children (Gates Fdn)	11/7/2018 - 08/31/2022	65,716
DAVIDSON HAMER	THE SUSTAINING HEALTH OUTCOMES THROUGH THE PRIVATE SECTOR PLUS (SHOPS PLUS) PROJECT	ABT Assoc, Inc. (USAID)	10/15/2018- 06/30/2020	20,614
THOMAS B. KEPLER	MODELING AFFINITY MATURATION AT MOLECULAR RESOLUTION	NIH/NIAID	4/15/2015 - 03/31/2020	358,525
THOMAS B. KEPLER	NEISSERIAL PORINS AND ANTIGEN PRESENTING CELLS	BMC Corp (NIH/NIAID)	9/1/2016 - 08/31/2020	134,327
THOMAS B. KEPLER	STRUCTURE-FUNCTION ANALYSIS OF INFECTION- AND VACCINE-INDUCED B-CELL REPERTOIRES	The Children's Hosp Corp (NIH/NIAID)	8/1/2017 - 07/31/2022	87,000
THOMAS B. KEPLER	HIV-1 VACCINE-ELICITED ANTIBODIES TARGET ENVELOPE GLYCANS	Duke University (NIH/NIAID)	6/1/2018 - 05/31/2020	18,072
THOMAS B. KEPLER	IMMUNE MECHANISMS OF PROTECTION AGAINST MYCOBACTERIUM TUBERCULOSIS CENTER (IMPAC-TB)	Harvard College (NIH/NIAID)	9/30/2019 - 03/28/2021	144,396
WHITNEY MANHART	INVESTIGATING THE PATHOGENICITY OF EBOLAVIRUS IN HUMAN IPSC-DERIVED HEPATOCYTES	NIH/NIAID	8/13/2019 - 08/12/2020	45,016
E. MUHLBERGER/ RACHEL FEARNS	MECHANISMS OF MARBURG VIRUS GENE EXPRESSION	NIH/NIAID	5/8/2018 - 04/30/2023	534,809

PI NAME	AWARD TITLE	SPONSOR (PRIME SPONSOR)	PROJECT START - END DATES	FUNDS IN FY20
ELKE MUHLBERGER	SARS-COV-2 INFECTION PLATFORMS AND DEVELOPMENT OF VIROLOGICAL TOOLS TO COMBAT THE COVID-19 PANDEMIC	Harvard College (China Evergrande)	5/1/2020 - 04/30/2021	250,000
ELKE MUHLBERGER	COVID FAST GRANTS	Mercatus Center	5/1/2020 - 10/31/2020	100,000
E. MUHLBERGER/ DANIEL CIFUENTES	DEEP CHARACTERIZATION OF THE BIOGENESIS AND FUNCTION OF EBOLA VIRUS MICRORNAS	NIH/NIAID	7/1/2019 - 06/30/2021	206,974
JASON R. ROCK	MYELOID LINEAGES AND TYPE 2 CYTOKINES IN LUNG HOMEOSTASIS AND REPAIR	NIH/NHLBI	7/1/2020 - 06/30/2024	485,478
JOHN SAMUELSON	THE BIOCHEMISTRY AND CELL BIOLOGY OF THE SPINDLY O-FUCOSYLTRANSFERASE OF TOXOPLASMA	NIH/NIGM	1/1/2020 - 11/30/2023	532,545
MOHSAN SAEED	PROBING PATHOMECHANISMS OF ENTEROVIRUS D68 INFECTION	Charles H. Hood Foundation	3/1/2020 - 02/28/2022	165,000
	Total funded in FY2020			**$ 22,378,778**

Additional Support for Research

The NEIDL is supported by Boston University, which also provides funding to the NEIDL Director and which is to be used to enhance the research activities in the NEIDL. This year, those funds were primarily used to further develop and enhance the research infrastructure. This included $183,000 for operational support and equipment purchases for the biosafety level 3 laboratories, which are critical to expanding our COVID-19 research. In addition, $141,000 was used for establishing the veterinary histopathology services that are crucial to understanding disease pathogenesis in studies carried out at all biosafety levels. In addition, $130,000 was used to support service contracts and purchase instrumentation for the Biosafety Level 2 laboratories, including establishing a laboratory that could be used for our collaborative studies with investigators in the Center for Regenerative Medicine. Finally, $49,000 was used to help set up the infrastructure needed to support “well documented” studies, which are systems required for studies that will support the licensure of products (therapeutics, vaccines) by the FDA.

Introducing New Faculty

Markus Bosmann, MD

Dr. Bosmann is an assistant professor of Medicine, Pathology & Laboratory Medicine and a faculty member at the School of Medicine's Pulmonary Center. His research interests include pulmonary disorders and their connections to innate immunity, host-pathogen interactions, and inflammation.

His research is focused on infection-associated inflammation, host-pathogen interactions and life-threatening complications of infections. His lab seeks to understand the molecular and cellular mechanisms of sepsis and acute lung injury. In the translational projects his lab uses transgenic mouse models to investigate the inflammatory responses in macrophages, polymorphonuclear neutrophils, lymphocytes, platelets and lung epithelial cells.

A major area of interest is the identification of novel genes with relevance to immunology and infections. So far, his lab has generated about 8 genetically engineered mouse strains using conventional ES cell targeting and CRISPR-Cas9 gene editing (unpublished work).

Dr Bosmann is participating in the collaborative research efforts on SARS-CoV-2 at Boston University and as a member of the Greater Boston Consortium on Pathogen Readiness. In collaboration with Dr. Mohsan Saeed, they plan to use iPSC-derived human lung epithelial cells, lung cell lines and K18-hACE2 overexpressing mice to study the immuno-pathogenesis of COVID-19 and test new therapeutic targets such as protease-activated receptors (PARs), the MAVS pathway and C5aRs.

Suryaram Gummuluru, PhD

Dr. Gummuluru is a scientist in HIV pathogenesis. His research primarily focuses on understanding how HIV-1 is captured and disseminated by cells of the innate immune system, including dendritic cells and macrophages. His work demonstrated the role of a novel, otherwise unknown, receptor-ligand pathway in HIV capture, a finding that has been replicated by a number of other laboratories since that time. He also has demonstrated that this pathway can be exploited for therapeutic delivery to select myeloid cell types in secondary lymphoid tissues.This latter work has been patented with his collaborator, B Reinhard. More recently, he has begun to dissect the mechanisms by which HIV continues to induce a chronic inflammatory state in infected individuals, even when HIV production is fully suppressed by combinatorial antiretroviral therapies, and contributes to numerous virus-associated co-morbidities. He is a regular member of NIH study sections, including chairing special emphasis panels on AIDS and AIDS-related applications. He is a sought-after invited speaker, has been session chair at Cold Spring Harbor meetings and serves as a member of the editorial boards of Virology and Frontiers in Virology.

Davidson Howes Hamer, MD, FACP, FIDSA, FASTMH, FISTM

Dr. Hamer is a board-certified specialist in infectious diseases with a particular interest in tropical infectious diseases. He holds the Certificate in Travel Medicine from the International Society of Travel Medicine and CTropMed certificate from the American Society of Tropical Medicine and Hygiene. Dr. Hamer is the co-Principal Investigator for the GeoSentinel Surveillance Network, a global network of 68 sites in 29 countries that conducts surveillance of emerging infectious diseases using returning travelers, immigrants, and refugees as sentinels of infection (www.istm.org/geosentinel). In addition to routine surveillance, the network is undertaking multi-site, multi-country evaluations of fever in travelers including pathogen discovery for individuals for whom no infectious etiology is identified; the long term impact of chikungunya, dengue and Zika on physical and psychosocial health of travelers; the impact of severe malaria on medium-term neurocognitive function of travelers and migrants; and evaluations of biomarkers for predicting severe disease in febrile travelers. Dr. Hamer is planning future molecular epidemiological studies of dengue and chikungunya to evaluate new outbreaks and patterns of disease spread.

Anna Honko, PhD

Anna Honko, PhD joined Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) in October of 2019 as a Research Associate Professor. In the Nonclinical Studies Unit, she'll be directing well-documented, Animal Rule and GLP studies to advance anti-viral medical countermeasure development. Dr. Honko's background is in immunology and vaccine development, with a later emphasis in biothreat and emerging infectious diseases. She has a focus on regulated studies as well a passion for radiotelemetry monitoring.

Nelson Lau, PhD

Dr. Lau's lab studies RNA interference (RNAi) mechanisms such as the PIWI/piRNA pathway which protects our genomes from the spread of transposable elements (TEs). Our DNA is inherently laden with TEs that have continued to infect our genomes. Over millions of years of evolution, TEs have filled up over 45% of our genome's content. If TEs are unchecked, their mobilization causes germ cell death, infertility, and genomic damage during cellular aging. Therefore, our cells depend on small regulatory RNAs and their associated PIWI and ARGONAUTE proteins to safeguard genomes from these mobilizing elements.

His lab applies functional and comparative genomics and biochemical approaches to dissect the molecular mechanisms for how PIWI / piRNA complexes silence genomic targets. By understanding the requirements and limitations of the PIWI/piRNA pathway, we may be able to uncover how TEs might evade suppression by these pathways to generate wide-spread TE landscape diversity across animal genomes. These mechanistic studies will also help Dr. Lau find situations to enhance TE control and link TE mis-regulation to etiologies of genome decline. We are collaborating with several other groups at BUMC to look at the impact of TEs in skin cells, macrophages, and neurons.

Recently, Dr. Lau's lab has also extended our piRNA studies to mosquito cells and animals to examine how pathogenic flaviviruses like Dengue, Zika and West Nile viruses can generate small RNAs including viral piRNAs. We created and are continuing to update a Mosquito Small RNA Genomics pipeline, the MSRG database, to enable broad comparative analysis of mosquito small RNAs that may repress viral mRNAs and TE RNAs. Since many TEs are genomic relics and related to retroviruses, the RNAi pathway represents an adaptive immunity response to both evolutionary and on going infection threats in insects. This work is conducted in close collaboration with the BU National Emerging and Infectious Disease Laboratory (NEIDL).

Jay Mizgerd, ScD

The major focus of work in Dr. Mizgerd's laboratory is on immunology in the lung and its influence on acute lower respiratory tract infections. Our research is illuminating the regulation and function of innate and adaptive immune cells and signals in the lung, and how variations in these parameters determine pneumonia susceptibility and outcome. Lung defense consists of immune resistance (the ability to eliminate microbes) and tissue resilience (the ability to prevent or withstand injurious stimuli from infection and inflammation). Both activities are accomplished by the coordinated activities of diverse cell types within the lung, involving some that are constitutively present (including diverse types of epithelial cells, macrophages, lymphocytes, and more) as well as others newly recruited to the infected tissue (including neutrophils plus additional myeloid or lymphoid cells). Effective and productive communication amongst these cells can efficiently destroy microbes without damaging the lung, maintaining respiratory health. Dysregulation of these pathways instead promotes infection (e.g., pneumonia), injury (e.g., the acute respiratory distress syndrome), and other pulmonary diseases. Elucidating factors that differentiate lung infection resistance and susceptibility will enable new approaches to preventing and treating respiratory infections like pneumococcal pneumonia, flu, and COVID-19.

NEIDL Faculty and Staff Recognition

An indication of the reputation of faculty is best exemplified by their selection as invited speakers in national and international forums, service on review panels and service on editorial boards of journals. Other forms of recognition include being sought after because of their experience and ability to use their expertise to explain a story to the news media about current events. NEIDL faculty continue to be recognized as summarized below.

Conference/Conference Session Chair

Jay Mizgerd

- "Lung Innate Immunity: On the Frontlines of Host Defense" Postgraduate Course, International Conference of the ATS (Co-Chair with Henry Koziel)
- "Bacterial and Viral Lung Infections and Pathogenesis," International Conference of the ATS
- "Infection and Immunity: the Virus and the Host," NHLBI Working Group on Viral LRTI in Infancy and Early Childhood – Immunological and Developmental Correlates
- "Bacterial Infections: Immunity and Basic Mechanisms," International Conference of the ATS (Canceled due to COVID-19)

Editorial Boards

Marcus Bosmann - American Journal of Respiratory and Critical Care Medicine

Anna Honko - Editorial board, MDPI Pathogens, section editor-in-chief of "Human Pathogens"

Honors

Florian Douam

- K22 NIAID Transition Award (Phase 1 successfully completed; Activation pending).
- 2019 Boston University's nominee for Searle Scholarship Program
- 2019- Peter Paul Career Development Award

David Hamer

- Recognition by the Editor-in-Chief of the Annals of Internal Medicine for high quality peer reviews
- Induction to the Confrérie des Chevaliers du Tastevin de Bourgogne, Sous-Commanderie du Massachusetts

Anna Honko

- National Institutes of Health NIAID Merit Award
- Planning Committee Member and Presenter, FANG Workshop on Filovirus Disease
- Member, Aerosol Challenge Executive Committee. DTRA Sponsored

Invited Lecturers (national & International)

John Connor

- Gordon Research Conference on polyamines (invited speaker)
- ASM Biothreats (Session convener for two sessions and invited speaker)
- Notre Dame research conference, invited keynote speaker, South Bend IN
- NanoString Tech Talks
- Cell Signaling Technologies (MA) invited subject matter expert talk

Nick Crossland

- Multiplexed biomarker panels and quantitative analysis: tools to decipher EBOV pathogenesis, brown bag, NIH IRF-Fredrick.

- Sparrow-Case Report: Ileocecocolic adenocarcinoma in an aged female rhesus monkey. Boston University Animal Science Center.
- Halo: An intuitive and versatile image analysis software. Invited Speaker. Annual ACVP meeting (San Antionio, TX).

David Hamer

- Chemotherapy and the 12th International Symposium on Antimicrobial Agents and Resistance. Geyongju, South Korea.
- "The Who, What, Why, When of the Geosentinel Surveillance Network" Meet the Professor session at IDWeek 2019, Washington, DC.
- "Diagnosis and treatment of Chagas disease" presented with Natasha Hochberg to the Division of Infectious Diseases, Cambridge Health Alliance, Cambridge, MA.
- 3/2/20 Panel participant "China Reforms, Pandemics and the Outlook". Cowan Health Care Conference, Boston, MA
- "COVID-19" webinar with Chinese physicians and patients organized by International Healthcare Leadership
- 3/16/20 "COVID-19 epidemiology and clinical manifestations" COVID-19 symposium organized by Boston College
- "COVID-19 and the Medical Perspective: Viewpoint from Front Lines, Outlook for Vaccines/Drugs, and Path Forward" panelist, webinar organized by Cowan Health Care
- Panel participant "China Reforms, Pandemics and the Outlook". Cowan Health Care Conference, Boston, MA

Thomas Kepler

- Keynote Speaker at BASEL LIFE: Showcasing Europe's Excellence in Life Sciences, Basel Switzerland, Sept 2019

Jay Mizgerd

- Lung Innate Immunity: On the Frontlines of Host Defense Postgraduate Course, International Conference of the American Thoracic Society (Dallas, TX)
- University of Florida, Gainesville, FL (Pulmonary, Critical Care and Sleep Medicine)
- NHLBI Working Group: NHLBI Working Group on Viral LRTI in Infancy and Early Childhood – Immunological and Developmental Correlates (Bethesda, MD)
- NIAID/BARDA Workshop: REducing Pathogenesis After Influenza Response (REPAIR) (Bethesda, MD)
- Louisiana State University School of Veterinary Medicine, Baton Rouge, LA (Department of Pathobiological Sciences) (Canceled due to COVID-19)
- Unlocking the Potential of Trained Immunity to Treat Respiratory Diseases Scientific Symposium, International Conference of the ATS (Delivered on-line for ATS2020 due to COVID-19)
- Unlocking Immunity to Fight Infection expert panelist in hosted discussion forum, International Conference of the ATS (interactive webinar for ATS2020)
- Keynote Address, Annual Symposium for NIH COBRE: LSU Center for Lung Biology and Disease – remote due to COVID-19
- Tulane University School of Medicine, New Orleans, LA (Department of Microbiology and Immunology) – remote due to COVID-19

Memberships

Markus Bosmann

- Member, Pathogenesis Working Group, Therapeutics Working Group, Greater Boston Consortium on Pathogen Readiness

Anna Honko

- Member, American Society for Microbiology
- Program Committee, American Society for Microbiology Biothreats annual meeting

Jay Mizgerd

- Planning Committee, PI-TB (ATS)

NIH Study Sections

John Connor

- Reviewer NIAID review panel SEP (conflict of interest panel)

Rachel Fearns

- *Ad hoc* grant reviewer for NIH Special Emphasis Panel, Non-coding RNAs, USA
- NIH Virology B study section, USA
- Standing member NIH Virology B study section, USA

Anthony Griffiths

- NIH study section 2019/10 ZRG1 IMM-R (50) R RFA-AI-18-054 U.S.-Brazil Collaborative Biomedical Research Program

Anna Honko

- Vaccines against Non-HIV Microbial Infections R21 Applications-ZRG1 IMM-R(50)

Jay Mizgerd:

- Conflict and Continuous Submission Special Emphasis Panel: Topics in Bacterial Pathogenesis and Virulence
- Emergency Awards: Rapid Investigation of SARS-CoV-2 and COVID-19 SEP, NIAID
- Respiratory Sciences Member Conflict and Continuous Submission Special Emphasis Panel (Host Defense) (Co-Chair)

Committee activities

David Hamer

- Ad hoc reviewer, GDS Giving (private foundation)
- Member, Search Committee for Traveler's Health Branch Chief, CDC Division of Global Migration and Quarantine
- Ad hoc reviewer, Agence Nationale de Recherche, French-German Call for Proposals on Preparedness and Rapid Response to Biological Threats, proposal "Universal diagnosis and treatment of highly pathogenic viruses"
- COVID-19 re-opening consultant – WBUR, Cambridge Tennis Club, Rosebud Sioux Nation, Major League Soccer, Bowdoin College, and Eagle Eye Institute
- 4/20 COVID-19 advisory role, Center for Humanitarian Dialogue (Kosovo, Luhansk and Donetsk People's Republic, Moldova, and Venezuela)
- 8/20 Reviewer, International Society of Infectious Diseases Research Grants for LMIC Scientists
- Temporary advisor, Global Malaria Programme, WHO, for Institutionalizing Integrated Community Case Management (iCCM) to End Preventable Child Deaths. Co-Chair Day 1 of the meeting and Chair, Service Delivery and Referral Working Group, Addis Ababa, Ethiopia
- Consultant for emergency COVID-19 contingency planning, Xenophon Strategies
- Member physician panel, oversight hearing testimony to Massachusetts legislature's Public Health Committee on Massachusetts' Preparedness and Response to the Coronavirus Outbreak
- 3/20 - Member, WBUR Coronavirus Task Force
- 6/20 - Member, Massachusetts Health Council Task Force on Large Events
- Member, Scientific Program Committee, CISTM 17

Nelson Lau

- 2019 National Science Foundation grant reviewer, MVB Genetic Mechanism Division

Jay Mizgerd

- Cystic Fibrosis Foundation; Infection Research Initiative Review Committee

PATENTS

John Connor

- U.S. Provisional Patent Application No.: 62/812,696; PCT/US20/20336 METHODS AND SYSTEMS FOR DETECTION OF FIBRIN FORMATION OR REMOVAL AT THE NANO-SCALE

REVIEW PANELS

John Connor

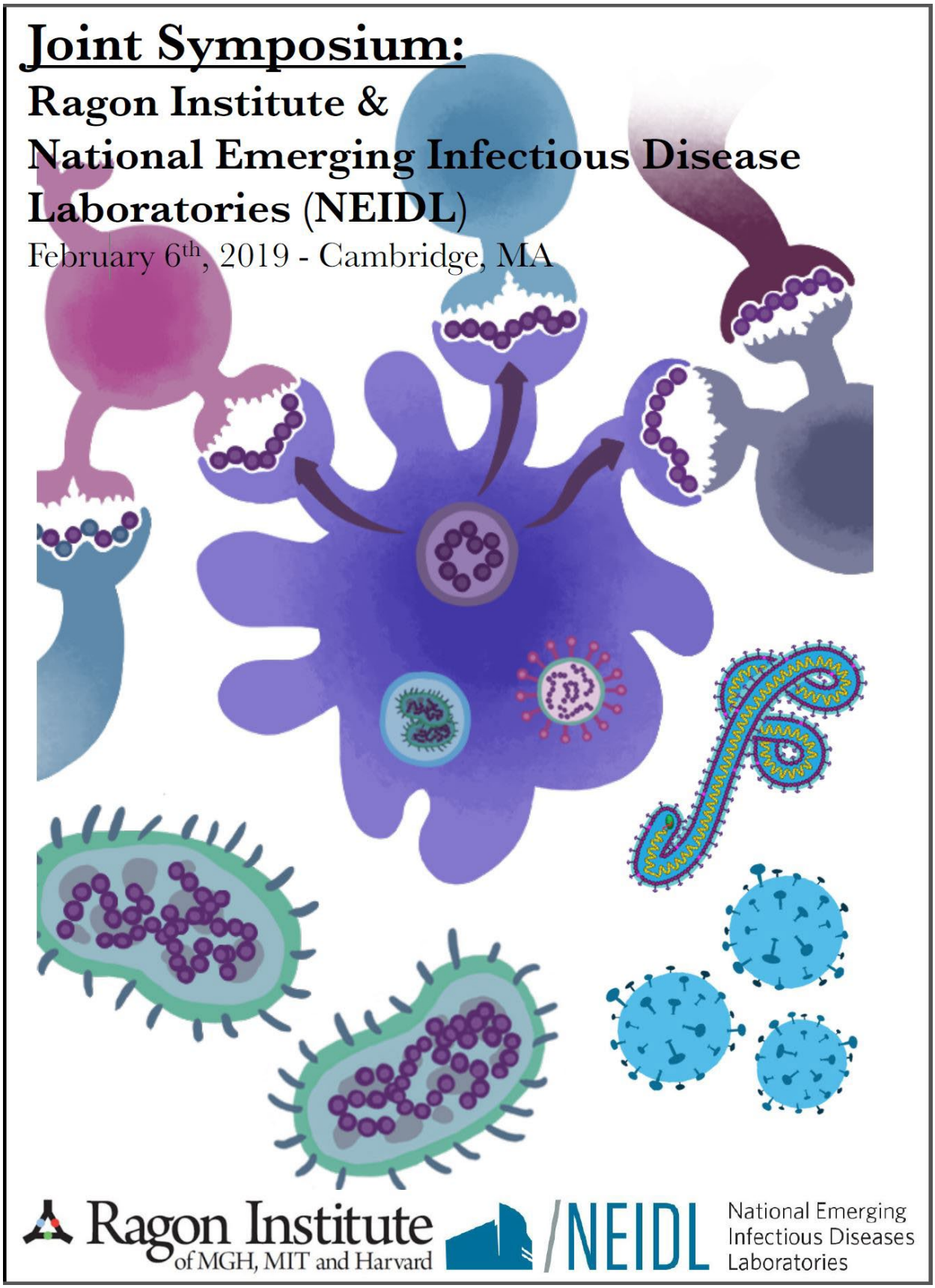
- Reviewer French National Research Agency (ANR) grant proposal
- Reviewer NCN:OPUS grant program National Science Center, Poland
- Reviewer for The Knowledge Foundation (Sweden) grant program

Education

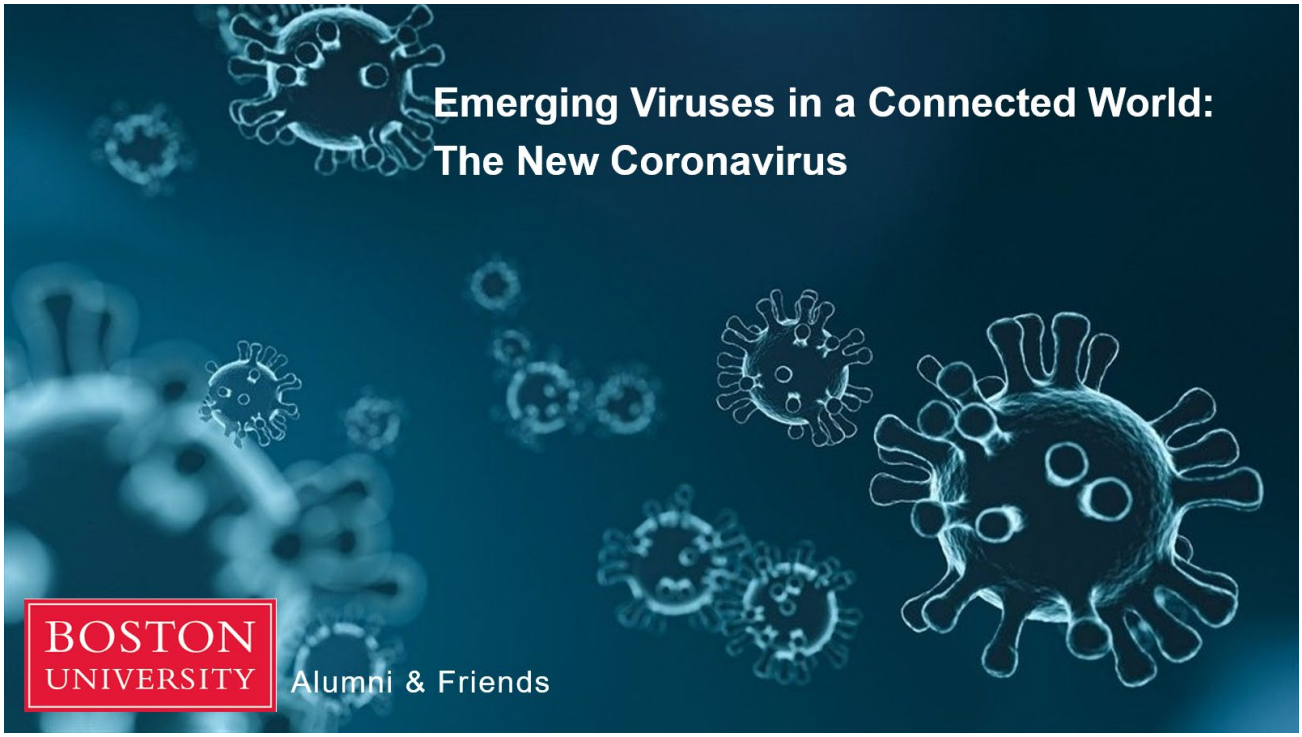
In partnership with the Department of Microbiology and the GMS Immunology Training Program, the NEIDL co-sponsors the Microbial Pathogenesis and Immunology Seminar Series. Below is a list of virology guest speakers who presented at the NEIDL.

Date	Guest Speaker	Title	Host
Sept 25, 2019	**Juan de la Torre, Ph.D.** Scripps Research Institute San Diego, CA	Bridging Basic and Translational Research to Combat Human Pathogenic Mammarenaviruses	Rob Davey
Oct 2, 2019	**Alexander Bukreyev, Ph.D.** University of Texas Medical Branch Galveston, TX	Subversion of cell-mediated responses by Ebola virus	Ron Corley
Oct 9, 2019	**Tijana Ivanovic, Ph.D.** Brandeis University Waltham, MA	Mechanism and Inhibition of Influenza Virus Membrane Fusion	Rachel Fearns
Oct 16, 2019	**Eric Calvo, Ph.D.** NIH/NIAID Rockville, MD	Mosquito salivary proteins as modulators of vertebrate vascular biology and pathogen transmission	Tonya Colpitts
Nov 20, 2019	**Catherine Adamson, Ph.D.** University of St Andrews St Andrews, Scotland, UK	Exploring Viral Interferon Antagonists as Novel Antiviral Targets	Rachel Fearns
Dec 4, 2019	**Stefan Kaufmann, Ph.D**. Max Planck Institute Berlin, Germany	Infection and Immunity: At the Bench, Computer and Bedside	Igor Kramnik
Dec 11, 2019	**Nancy Sullivan, Ph.D.** NIH Vaccine Research Center Bethesda, MD	Harnessing Immunity Against Ebola Virus	Anthony Griffiths
Jan 22, 2020	**Alejandro Balazs, Ph.D.** Ragon Institute/MGH Cambridge, MA	Escapability of HIV Broadly Neutralizing Antibodies is the Major Driver of Therapeutic Efficacy	Florian Douam
Feb 12, 2020	**Stacey Schultz-Cherry, Ph.D.** St. Jude Children's Research Hospital Memphis, TN	Impact of Obesity on Influenza: From Disease Severity to Vaccine Efficacy	Anthony Griffiths
Feb 26, 2020	**Ann Palmenberg, Ph.D.** University of Wisconsin-Madison Madison, WI	Rhinovirus C Isn't the Common Cold	Mohsan Saeed
Mar 4, 2020	**Anna Marie Pyle, Ph.D.** Yale University New Haven, CT	RNA Agonists for Activating RIG-I Antitumor and Antiviral Responses	Elke Mühlberger

Other Notable Events



Boston University Alumni Relations Hosts Dr. Corley for a Special Educational Alumni Event.



Boston University alumni and friends are invited to the Dahod Family Alumni Center for a special talk featuring Dr. Ronald B. Corley, Director of the National Emerging Infectious Diseases Laboratories (NEIDL). Dr. Corley will address the emergence of viruses, including coronavirus, and the challenges they pose in a connected world.

Date: February 20, 2020

Time: 6:00 PM to 8:00 PM

Location: Dahod Family Alumni Center

Guest Speaker:

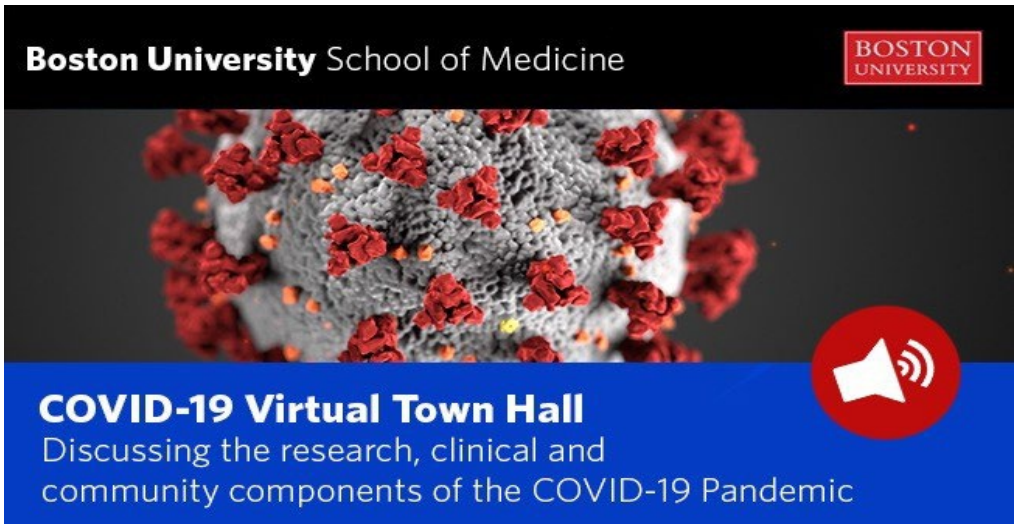
Ronald B. Corley, Ph.D.
Director, National Emerging Infectious Diseases Laboratories
Boston University
Professor and Chair, Department of Microbiology
Boston University School of Medicine

Pardee Center Hosts Livestreamed Seminar on Coronavirus and the Future of Infectious Disease

On April 1, the Frederick S. Pardee Center for the Study of the Longer-Range Future and the Center for the Study of Asia hosted a livestreamed seminar titled “Coronavirus and the Future of Infectious Disease.”

The seminar featured a panel discussion including **Nahid Bhadelia** (Associate Professor, Medicine/Infectious Diseases, BU School of Medicine), **Davidson Hamer** (Professor, Global Health & Medicine, BU School of Public Health & BU School of Medicine), and **Gerald T. Keusch** (Professor, Medicine & International Health, BU School of Medicine & BU School of Public Health). The discussion was moderated by Pardee School Dean Adil Najam.

The discussion, which was watched live on YouTube by an audience of nearly 200 people from around the world, focused on the actions that individuals can take to contain the contagion, as well as on the global implications of the pandemic. The panelists discussed the impacts of COVID-19 on the health systems of under-resourced countries and why even many of the most prosperous countries find themselves unprepared for this crisis.



Tuesday, April 7 | 1-2:30 p.m.

The BUSM Dean's Office is holding a Virtual Town Hall Meeting on the COVID-19 pandemic with BUSM faculty who are recognized experts in the areas of basic research, clinical activities and community efforts. These panelists will address your issues, concerns or questions.

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Moderator (Q&A for University/School Guidelines)

Karen Antman, MD

BUMC Provost and BUSM Dean

Panelists (Q&A Session)

Basic Research

Ronald Corley, PhD

Professor and Chair, Microbiology; Director of NEIDL

Robert Davey, PhD

Professor of Microbiology; NEIDL

Anthony Griffith, PhD

Associate Professor of Microbiology; NEIDL

Clinical Activities

Tamar Barlam, MD, MSc

Associate Professor, Medicine/Infectious Diseases; Chief Section of Infectious Diseases

Manish Sagar, MD

Associate Professor, Medicine/Infectious Diseases; Microbiology

Community Efforts

Nahid Bhadelia, MD

Associate Professor, Medicine/Infectious Diseases

Joshua Barocas, MD

Assistant Professor, Medicine/Infectious Diseases

Coronavirus Seminar Series

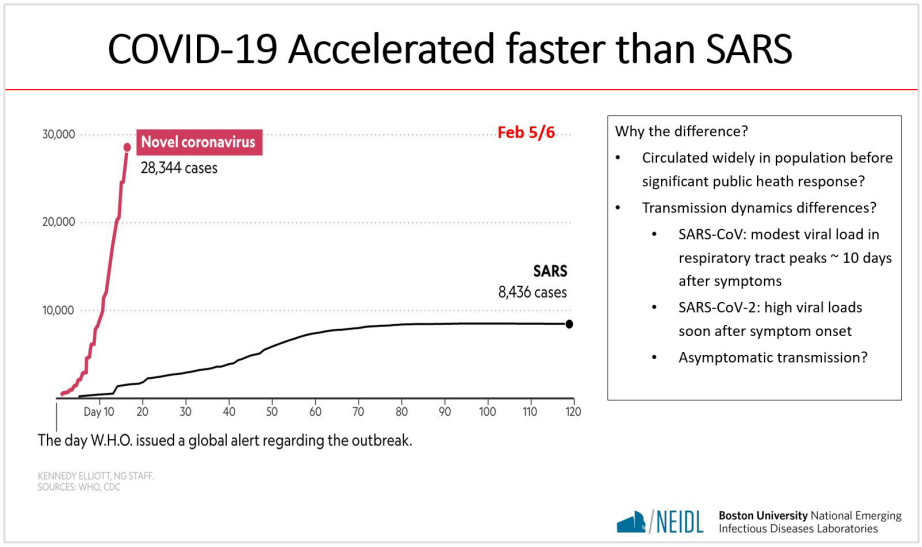
Boston University School of Public Health

Thursday, March 12, 2020 | 4:30–6 p.m. | Online

[Coronavirus: What Do We Know? What Do We Not Know? What Should We Be Doing?](#)

Rita Nieves, Boston Public Health Commission; **Davidson Hamer**, Boston University; **Nahid Bhadelia**, Boston University School of Medicine and NEIDL; **Ronald Corley**, Boston University School of Medicine, NEIDL; Wendy Mariner, Boston University School of Public Health; and moderator Pat Hibberd, Boston University School of Public Health.

We are currently in the middle of a worldwide outbreak of coronavirus (COVID-19). The disease was first identified in Wuhan, Hubei, China and has since spread over the world. More than 80,000 cases have been identified worldwide, including up to 3,000 deaths, surpassing the 2003 SARS epidemic. Facts are changing daily about the outbreak. This panel brings together experts in infectious disease as well as in ethics and human rights to discuss what we know, and perhaps as importantly what we do not know, while keeping an eye on what we should be doing as the outbreak evolves.



Wednesday, March 25, 2020 | 4–5 p.m. | Online

[The Coronavirus Epidemic: State of the Science](#)

Sandro Galea, Boston University School of Public Health; **Ronald Corley**, Boston University School of Medicine, National Emerging Infectious Diseases Laboratories (NEIDL); and Pat Hibberd, Boston University School of Public Health.

Research in the News

BU NEIDL's COVID-19 Work the Subject of a New Yorker Profile

"COVID was the raison d'être for creating NEIDL," director Ronald Corley tells the magazine

Original article from BU Today by BU Today. July 24, 2020

In a feature published Thursday on The New Yorker website, staff writer and physician Jerome Groopman profiles the painstaking research on COVID-19 at Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) and how its scientists are meticulously working to develop a vaccine for the virus that has claimed the lives of more than 630,000 people worldwide. In the piece, titled "The Long Game of Coronavirus Research," Groopman argues that while fast-developed vaccines make headlines, more calculated work is just as critical.

While the Trump administration has promised that a vaccine will be available by the end of the year, scientists aren't so sure. After all, it's been more than four decades since the emergence of HIV/AIDS, and no vaccine for that virus yet exists. Doctors are just beginning to understand the intricacies of the coronavirus (which only came to the world's attention in January)—how it affects patients, how it is transmitted, and who is at greatest risk of complications and death, as well as its long-term effects. NEIDL researchers, led by director Ronald Corley, a School of Medicine professor, have been working with live samples of the coronavirus since March and often collaborate with the wider research community.

"From the outset, [Corley] organized the center's COVID-19 research on the presumption that it would be, as recent evidence has borne out, an evolving target—and that progress would more likely come from a cluster of approaches than from a single breakthrough," Groopman writes. "Its approach represents the polar opposite of the 'warp speed' language popularized for the public."

"COVID was the raison d'être for creating NEIDL," Corley says. "The pandemic fulfills its mission."

Read the full article here.

MEDICAL DISPATCH

THE LONG GAME OF CORONAVIRUS RESEARCH

Warp-speed vaccine trials grab our attention, but more deliberate work is just as urgent.

By Jerome Groopman

July 23, 2020

Ticks and Mosquitoes, Infectious Disease Carriers, are Expanding their Range

Original article from The Brink by Jessica Colarossi. June 16, 2020

As the global pandemic of the novel coronavirus continues on—with cases on the rise in some countries and US states—the world also just experienced the hottest month of May ever recorded, and atmospheric levels of carbon dioxide reached unmatched heights at the Mauna Loa Observatory in Hawaii, which has been monitoring gases in the atmosphere since the 1950s.

But is there a relationship between the coronavirus pandemic and the increasing signs of climate change being detected?

SARS-CoV-2, the virus responsible for COVID-19, is believed to have spilled over from wildlife to humans—bats being the probable culprit. Besides the fact that both climate change and COVID-19 pose serious health risks, scientists have pointed out that some of the root causes of climate change also increase the risk of pandemics—such as rapid deforestation and urbanization, which can promote close contact between wildlife and people and increase the chances for viruses to cross over to humans. The origins of COVID-19 have prompted bold calls to reexamine how people and communities are encroaching on wilderness areas and how to prepare for the spread of diseases in a world increasingly altered by climate

change, which exacerbates the problem as different species—their territories shifting with the climate—intermingle in new ways.

"The pandemic has given me a new sense of urgency around big problems that take time to solve, and climate change is certainly a huge problem," says Gregory Wellenius, a Boston University School of Public Health professor of environmental health, who joined BU in January to establish a program dedicated to studying the impacts of climate change on human health. When it comes to parsing out the ways climate change affects human lives, according to Wellenius, often what first comes to mind are catastrophic natural events—wildfires, hurricanes, searing heat waves—which can lead to immediate injuries and traumatic losses of human life.

"Extreme weather events are increasing in frequency and severity over time," says Wellenius. But, he says, there are also many slower-moving, less direct ways that climate change—and the human-related activities that increase carbon and pollution in the atmosphere—can harm a person's well-being, such as displacement from sea level rise, breathing in smoggy air, worsened allergy seasons, as well as a rise in vector-borne illnesses from ticks and mosquitoes, species that have more room to roam north as a result of rising temperatures.

"In the US Northeast, we worry a lot about Lyme disease," says Wellenius. "Because of the warming temperatures, the ticks that are vectors for Lyme disease survive now further north in areas that they didn't used to be able to survive."

Deer ticks—tiny, blood-sucking arthropods that live in forests and grasslands across much of the United States—can carry bacteria responsible for Lyme disease. The disease is found in every state, and causes more than 300,000 illnesses each year, but is most highly concentrated in the Northeastern United States. Though it is considered treatable with antibiotics, it can cause serious, long-lasting, and debilitating symptoms. Michael Dietze, an ecologist at Boston University, also worries that Lyme disease–carrying ticks are quickly expanding their numbers and range.

"Warmer weather lets [ticks] increase reproductive capacity, and in general warming allows most insects to grow faster and expand northward," says Dietze, BU College of Arts & Sciences associate professor of earth and environment. Disease-carrying ticks, according to Dietze, thrive in warm, wet, forested environments. And as ecological patterns get altered by human activities—such as increasingly frequent wildfires due to global warming or from loggers and farmers chopping down trees—the abundance and spread of ticks will change along with them.

This trend is also true for disease-carrying mosquitoes, according to **Tonya Colpitts**, a virologist who studies dengue virus, yellow fever virus, Zika virus, and other mosquito-borne illnesses like Eastern Equine Encephalitis (EEE) at BU's National Emerging Infectious Diseases Laboratories (NEIDL). Global warming, observed by scientists for decades now, also allows mosquitoes accustomed to warmer, wetter weather in the Southern Hemisphere to gradually move north, where the climate would, under normal conditions, not be favorable to the tropical bugs.

"*Aedes aegypti* is the main human virus vector from those habitats in the Southern Hemisphere, which can steadily change [its territory] due to the climate warming," says **Colpitts,** a BU School of Medicine assistant professor of microbiology and director of the Arthropod Containment Laboratory, Level 3 (ACL-3)—an insect laboratory used for research on arbovirus transmission, some of which is currently being occupied for research on coronavirus.

Colpitts says *Culiseta* mosquitoes—a common species in the United States—are adapted to the seasonal changes and can adapt to cooler months with mechanisms to wait out the winter. But if winter months become warmer due to climate change, mosquitoes in the Southern Hemisphere can begin to migrate north and survive alongside species that already live there. According to **Colpitts**, different types of *Aedes* mosquitoes, which normally inhabit warm, tropical climates, have caused minor outbreaks of dengue in warmer states like Florida and Texas. In recent years, they've also been spotted as far north as Connecticut.

"Maine isn't suddenly going to be as hot as New Orleans, but it's a gradual effect that could affect future generations," says **Colpitts**. "At the rate we're going, it will happen eventually."

Vector control is currently the only viable solution to combating mosquito-borne illnesses, since vaccines haven't been developed to prevent diseases like Zika or EEE in humans. But **Colpitts** and her team are working to develop transmission-blocking vaccines to prevent diseases in mosquitoes—halting their ability to spread disease—as well as working to identify proteins in mosquito saliva that contribute to infection in humans.

"Vector control only works until mosquitoes develop resistance to it," she says. "We need to both develop vaccines and to control the mosquito population."

Along with climate change, land use patterns also greatly influence the spread of ticks. As a result of lands being cleared for agriculture and development, states in the Northeastern United States have been reforesting—a win for nature, and unfortunately a win for ticks. With his team of graduate researchers at the Ecological Forecasting Lab, Dietze and his team are working to better predict tick activity by accounting for all of these changes, with the goal of being able to more

precisely predict the abundance and activity of ticks on a week-by-week basis during peak season, typically summer months in the Northern Hemisphere.

“We need better methods of identifying tick-borne diseases that weren’t identified before in certain areas, in order to know how they are shifting,” he says. And even as preventive measures like stay-at-home orders were mandated as a way to control the spread of coronavirus, Dietze notes that one of the few activities that has remained acceptable throughout the pandemic is hiking or running outdoors.

”We might actually be exposing ourselves [to Lyme disease] even more as an unintended consequence of COVID-19,” he says.

As far as long-term solutions go, Wellenius encourages preparation for climate-induced phenomena at all levels of government, since the challenges and threats from climate change are unique from place to place.

“These climate hazards are not distributed equally across the country or across the world,” says Wellenius. “We need to certainly focus on the community-level factors, as well as the individual-level factors.”

And as global temperatures continue to rise, the impacts of climate change—whether it’s mosquitoes migrating as a result of warmer weather or stronger hurricanes or wildfires—will become increasingly difficult to ignore, he says. Wellenius is working to develop a program housed at BU’s School of Public Health to more fully understand and quantify the impacts of climate hazards in order to bring more complete, data-backed recommendations to local officials and policymakers.

“Climate change is not a problem of the future or of people far away—it’s here, right now,” says Wellenius. “It impacts our families and communities today and will continue to do so, and those effects will get more pronounced. Anything we can do to minimize future climate change is likely to have immediate health benefits now and in the future.”

Laboratory-grown lungs simulate coronavirus infection

No need to dissect or biopsy lungs of people who have been sick with COVID-19.

Original article from ABC News by Dr. Stephanie E. Farber. June 13, 2020

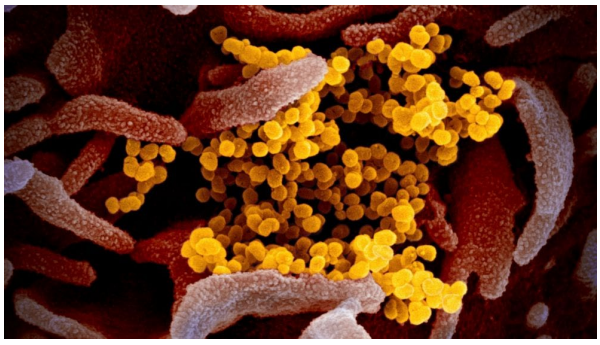
Previous reports have suggested that the lungs are the part of the respiratory system most severely impacted by COVID-19 infection. In Boston, scientists at the National Emerging Infectious Disease Laboratory have artificially created a lab-grown replica of the air passages and air sacs within the lung to investigate how COVID-19 infection wreaks havoc on the body.

The laboratory-grown lung models help scientists observe and learn how coronavirus attacks lung tissue without having to dissect or biopsy the lungs of people who have been sick with COVID-19.

According to Adam Hume, senior research scientist at NEIDL, "With this model, we are able to get a better idea of what is going on in the lungs, which are the primary targets of infection."

Hume said lab-grown organoids -- groups of cells that mimic structures within organs -- are an especially effective experimental model because of how similar they are to the actual cells in the human body.

To make lung organoids, Hume and his colleagues have collaborated with researchers at the Center for Regenerative Medicine in Boston, which has artificially engineered other organs, such as intestines and brains.



An electron microscope image made available by the U.S. National Institutes of Health in February 2020 shows the novel coronavirus SARS-CoV-2, yellow, emerging from the surface of cells, pink, cultured in the lab. Also known as 2019-nCoV, the virus causes COVID-19.

An electron microscope image made available by the U.S. National Institutes of Health in February 2020 shows the novel coronavirus SARS-CoV-2, yellow, emerging from the surface of cells, pink, cultured in the lab. Also known as 2019-nCoV, the virus causes COVID-19.

These organoids are carefully transported to NEIDL where researchers infect the tissue with coronavirus. Because the virus can be deadly, they conduct these experiments wearing a fully encapsulated suit with an air supply hose and three pairs of gloves.

With this scientific technique, Hume and his colleagues hope to evaluate how quickly the virus multiplies within the lung cells and how the cells respond to this infection to determine why certain patients develop such severe symptoms.

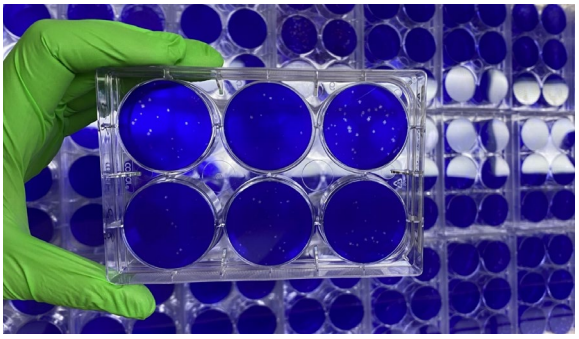
Although some patients will recover quickly from COVID-19, others will become extremely sick, requiring breathing assistance and possibly mechanical ventilation. Scientists still do not understand exactly what makes someone susceptible to severe disease -- but Hume is hoping these experiments will help.

"Right now, this is just a model system for looking at infection in the lungs," said Hume. "Next steps are to take these pathways and look at whether there are specific drugs that could target cellular pathways that might be important for virus replication."

Tiny, Decoy "Sponges" Attract Coronavirus Away from Lung Cells

New nanotechnology tested at BU's NEIDL stops SARS-CoV-2 from infecting cells and replicating

Original article from The Brink by Kat J. McAlpine. June 18, 2020



In cell culture studies at BU's National Emerging Infectious Diseases Laboratories, nanosponges containing fragments of lung cell membranes attracted and fused with the SARS-CoV-2 virus responsible for COVID-19 infections, preventing the coronavirus from infecting living lung cells. Photo courtesy of the Griffiths lab/BU NEIDL

Imagine if scientists could stop the coronavirus infection in its tracks simply by diverting its attention away from living lung cells? A new therapeutic countermeasure, announced in a *Nano Letters* study by researchers from Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) and the University of California San Diego, appears to do just that in experiments that were carried out at the NEIDL in Boston.

The breakthrough technology could have major implications for fighting the SARS-CoV-2 virus responsible for the global pandemic that's already claimed nearly 450,000 lives and infected more than eight million people. But, perhaps even more significantly, it has the potential to be adapted to combat virtually any virus, such as influenza or even Ebola.

"I was skeptical at the beginning because it seemed too good to be true," says NEIDL microbiologist Anna Honko, one of the first authors on the study. "But when I saw the first set of results in the lab, I was just astonished."

The technology consists of very small, nanosized drops of polymers—essentially, soft biofriendly plastics—covered in fragments of living lung cell and immune cell membranes.

"It looks like a nanoparticle coated in pieces of cell membrane," Honko says. "The small polymer [droplet] mimics a cell having a membrane around it."

Anna Honko mixes the nanosponges with live SARS-CoV-2 virus and lung cells at the NEIDL, evaluating how well the nanosponges can deter the novel coronavirus from infecting lung cells. Photo by Sierra Downs, courtesy of the Griffiths lab/BU NEIDL

The SARS-CoV-2 virus seeks out unique signatures of lung cell membranes and latches onto them. When that happens inside the human body, the coronavirus infection takes hold, with the SARS-CoV-2 viruses hijacking lung cells to replicate their own genetic material. But in experiments at the NEIDL, BU researchers observed that polymer droplets laden with pieces of lung cell membrane did a better job of attracting the SARS-CoV-2 virus than living lung cells.

By fusing with the SARS-CoV-2 virus better than living cells can, the nanotechnology appears to be an effective countermeasure to

coronavirus infection, preventing SARS-CoV-2 from attacking cells.

"Our guess is that it acts like a decoy, it competes with cells for the virus," says NEIDL microbiologist Anthony Griffiths, co-corresponding author on the study. "They are little bits of plastic, just containing the outer pieces of cells with none of the internal cellular machinery contained inside living cells. Conceptually, it's such a simple idea. It mops up the virus like a sponge."

That attribute is why the UC San Diego and BU research team calls the technology "nanosponges." Once SARS-CoV-2 binds with the cell fragments inside a nanosponge droplet—each one a thousand times smaller than the width of a human hair—the coronavirus dies. Although the initial results are based on experiments conducted in cell culture dishes, the researchers believe that inside a human body, the biodegradable nanosponges and the SARS-CoV-2 virus trapped inside them could then be disposed of by the body's immune system. The immune system routinely breaks down and gets rid of dead cell fragments caused by infection or normal cell life cycles.

There is also another important effect that the nanosponges have in the context of coronavirus infection. Honko says nanosponges containing fragments of immune cells can soak up cellular signals that increase inflammation. Acute respiratory distress, caused by an inflammatory cascade inside the lungs, is the most deadly aspect of the coronavirus infection, sending patients into the intensive care unit for oxygen or ventilator support to help them breathe.

But the nanosponges, which can attract the inflammatory molecules that send the immune system into dangerous overdrive, can help tamp down that response, Honko says. By using both kinds of nanosponges, some containing lung cell fragments and some containing pieces of immune cells, she says, it's possible to "attack the coronavirus and the [body's] response" responsible for disease and eventual lung failure.

At the NEIDL, Honko and Griffiths are now planning additional experiments to see how well the nanosponges can prevent coronavirus infection in animal models of the disease. They plan to work closely with the team of engineers at UC San Diego, who first developed the nanosponges more than a decade ago, to tailor the technology for eventual safe and effective use in humans.

"Traditionally, drug developers for infectious diseases dive deep on the details of the pathogen in order to find druggable targets," said Liangfang Zhang, a UC San Diego nanoengineer and leader of the California-based team, according to a UC San Diego press release. "Our approach is different. We only need to know what the target cells are. And then we aim to protect the targets by creating biomimetic decoys."

When the novel coronavirus first appeared, the idea of using the nanosponges to combat the infection came to Zhang almost immediately. He reached out to the NEIDL for help. Looking ahead, the BU and UC San Diego collaborators believe the nanosponges can easily be converted into a noninvasive treatment.

"We should be able to drop it right into the nose," Griffiths says. "In humans, it could be something like a nasal spray."

Honko agrees: "That would be an easy and safe administration method that should target the appropriate [respiratory] tissues. And if you wanted to treat patients that are already intubated, you could deliver it straight into the lung."

Griffiths and Honko are especially intrigued by the nanosponges as a new platform for treating all types of viral infections. "The broad spectrum aspect of this is exceptionally appealing," Griffiths says. The researchers say the nanosponge could be easily adapted to house other types of cell membranes preferred by other viruses, creating many new opportunities to use the technology against other tough-to-treat infections like the flu and even deadly hemorrhagic fevers caused by Ebola, Marburg, or Lassa viruses.

"I'm interested in seeing how far we can push this technology," Honko says.

This work was supported by the Defense Threat Reduction Agency Joint Science and Technology Office for Chemical and Biological Defense.

Lighting firm Signify says one of its ultraviolet lights can "degrade" the coronavirus in a matter of seconds.

Original article from CNBC by Sam Shead. June 17, 2020. April 15, 2020

The world's biggest lighting maker tested its latest technology with researchers at Boston University and found that the exposure of the virus to UV light helps eradicate it.

Signify hopes the product can be used to reduce the amount of Covid-19 in indoor areas and plans to make it available to other lighting companies.

Eric Rondolat, Signify CEO, told CNBC's "Squawk Box Europe" that UV light particles are capable of disrupting virus DNA chains, rendering them ineffective.

"We knew that it (UV light) was effective against viruses in general, but we didn't know if it was the case with Covid-19 so we worked with Boston University," Rondolat said. "We carried out the tests many, many times and the metrics are quite interesting."

Rondolat said the company's UV light is able to eradicate 96% of the coronavirus with three seconds of exposure. That goes up to 99% for six seconds of exposure.

"It's a preventive measure, meaning we are disinfecting objects, environments, surfaces, and the air," said Rondolat, adding that schools, offices, hospitals, warehouses and manufacturing plants will all need to be disinfected in the future.

Retailers could also use a UV light chamber to disinfect clothes after people have tried them on, he said. The discovery could provide a new revenue stream for Signify, which saw its revenues fall by 15% in the first quarter.

BU NEIDL Scientists Featured in NOVA's Special Coronavirus Episode

Nahid Bhadelia, Ronald Corley, and Robert Davey talk about COVID-19's spread, how they're studying it in the lab

Original article from The Brink by Kat J. McAlpine. May 14, 2020

An hour-long PBS *NOVA* episode—which aired May 13—about the coronavirus pandemic featured scientists from Boston University's **National Emerging Infectious Diseases Laboratories** (NEIDL), along with immunology and virus experts from across the United States, discussing the massive clinical and scientific response to the outbreak that has infected millions and killed more than 300,000 around the world.

"There are people who get this infection, shedding this virus before they get sick, and they may never have any symptoms," **Nahid Bhadelia**, director of infection control at BU's NEIDL, tells *NOVA* in its special "Decoding COVID-19" episode, which is now available to stream for free online. "This [pandemic] ends with most or all of us being immune to this virus, and ideally that's through a vaccine."

Bhadelia, who is also director of the Special Pathogens Unit at Boston Medical Center and was a frontline healthcare worker on the ground in West Africa during the 2014–2016 Ebola outbreak, says the research and medical community was worried about the novel coronavirus from the moment they first learned of the mysterious respiratory illness spreading in Wuhan, China. "I think all of us held our breath because the question was, could this be that combination of a virus that's both easy to transmit and perhaps maybe not as deadly as we might see with Ebola, but still have devastating impact on the resilience of our communities," **Bhadelia** tells *NOVA*.

In March 2020, when there were only 125 confirmed cases of COVID-19 in the United States, **Bhadelia** and **Ronald Corley**, an immunologist and the director of BU's NEIDL, released a detailed primer on the new SARS-CoV-2 virus.

Our ultimate goal is to have the designer molecule which will specifically attack the virus and do nothing to the rest of your body.

–Robert Davey, NEIDL

PBS **NOVA** *cameras went inside a Biosafety Level 4 laboratory at BU's National Emerging Infectious Diseases Laboratories (NEIDL) to learn how researchers are racing to find new treatments and cures for the novel coronavirus. Photo courtesy of PBS* **NOVA**

Days earlier, Corley had warned: "In many respects, this is what the World Health Organization would call 'pathogen x,' a pathogen that spreads through [the air]. Many people who have this virus cannot distinguish it from a severe cold or weak case of the flu. …That's what makes this a fundamentally different virus than, for example, the Ebola virus [which is transmitted through direct contact with bodily fluids]. That's why it's spreading the way that it is, and poses such a significant risk to public health."

In the *NOVA* episode, another NEIDL researcher, microbiologist **Robert Davey**, takes viewers inside his lab at the NEIDL, where he and his team are racing to find a treatment or cure for the novel SARS-CoV-2 coronavirus.

Since his lab started its coronavirus research in March, they've already made progress, leveraging glowing antibodies to get eyes on the SARS-CoV-2 virus' whereabouts inside the cells it infects. Now, the team is screening the first group of drug compounds—of which they eventually plan to test more than 20,000 potential therapeutics—to see if they are able to halt or block COVID-19 infections.

"Our ultimate goal is to have the designer molecule which will specifically attack the virus and do nothing to the rest of your body," **Davey** tells *NOVA.* "Something that stops the virus dead in its tracks, and doesn't affect you whatsoever."

Typically, Davey's team handles Ebola, one of the world's most lethal viruses, inside one of the NEIDL's Biosafety Level 4 (BSL-4) laboratories, which have the highest possible level of biosafety containment used for infectious agents that pose especially high risk to humans.

"Biosafety Level 4 is when you're in a bubble—a suit that looks like what the Michelin Man has on," Davey explains, as camera footage shows him zipping into a giant white suit. "It's inflated by air, so this is the highest level of protection."

BSL-4 is a full step of containment above the required BSL-3 that the Centers for Disease Control and Prevention (CDC) has said is required for working with live copies of SARS-CoV-2. But the personal protection equipment that researchers must wear for BSL-3 work is the same gear that is in short supply for hospital clinicians.

So, at the NEIDL, one of the few research facilities in the United States to have both BSL-3 and BSL-4 laboratories, many researchers—like Davey's team—are choosing to handle the SARS-CoV-2 virus while each wearing full, airtight biocontainment suits connected to an air hose, taking the virus up to the BSL-4 level of containment. Just hours before the *NOVA* episode aired, *The Brink* reported that several BU scientists, largely bolstered by the NEIDL's unique research capabilities, had received **$1.9 million in new funding** from the **Massachusetts Consortium on Pathogen Readiness** (MassCPR) to accelerate their coronavirus studies.

"[The NEIDL] is probably the safest place in the country to be right now," says Corley. "Any laboratory facility that studies emerging pathogens is designed around safety and security."

Despite the rapid scientific progress that's underway, **Bhadelia** cautions viewers that the global coronavirus outbreak will continue to impact life as we know it for quite some time. "Lifting the lockdown is not the end, it doesn't mean we go back to normal, it means our lives are altered at least in the medium term, and potentially forever," she says.

The *NOVA* special also featured virologists at the National Institutes of Health, the Ragon Institute, and Stanford University.

Hear more from **Bhadelia, Davey, Corley**, and other experts, and go inside one of NEIDL's BSL-4 labs to see how Davey is conducting coronavirus research, by watching **NOVA*'s "Decoding COVID-19" episode*** online while it's freely available, until mid-June 2020.

Needles in a Haystack: Could Existing Drugs treat COVID-19?

Original article from WGBH by Liz Neisloss. April 15, 2020

Getting a new drug on the market can sometimes take more than a decade. And that's why already existing drugs are being used in **hundreds of clinical trials** around the world, and in Boston, seeking a treatment for COVID-19.

Several Boston area hospitals are doing such trials with patients to test antiviral drugs — like one made for Ebola and another for influenza. At Boston University's National Emerging Infectious Disease Laboratories (NEIDL), researchers are quickly screening thousands of more familiar drugs to see if any might hold promise against COVID-19.

"The most sensible thing to do when you're dealing with a pandemic like this is to try and take what you already have on the shelf and see if it works," said microbiologist Robert Davey, who leads the research team at BU's NEIDL that specializes in screening pre-existing drugs.

Davey and his team are starting with a library of some 6,800 FDA approved drug compounds from the Broad Institute's **Drug Repurposing Hub.** These are all small molecule drugs — relatively inexpensive to produce and manufacture on a large scale. Many of them might be found in the average medicine cabinet.

"They're cholesterol, they're blood pressure, diabetes treatments, they're headache treatments, migraines treatments, anything you can imagine," said Davey.

His team usually works with viruses like Ebola, more deadly than SARS-CoV-2, the virus that causes COVID-19. It's work that requires wearing special biocontainment suits that include a space-like helmet to seal out any dangerous pathogens. Although such a specialized lab, known as Biosafety Level 4 (BSL4), wasn't required for work with the novel coronavirus, Davey says the existing lab was able to pivot quickly.

"Because I specialize in finding small molecule drug treatments, I said, 'Well, if I'm going to make the best impact on the pandemic, I should use the resources and the training of my staff and my equipment,'" he said. "That happens to be a BSL 4."

The lab is working with live virus grown from a sample taken from the first recorded U.S. COVID-19 patient — a man in Washington. The lab researchers then see what effect drug compounds are having on virus-infected human lung cells. This process may eventually screen as many as 20,000 drug compounds.

"It's like finding us a very small key to fit in a lock. And if that key fits just right into the lock," Davey said, "you're gumming up its works when that key goes into the lock of the virus and it can't make more viruses."

While it's possible they might find "the needle in a haystack" — a single drug to treat COVID-19 — Davey said it's more likely they'll find drugs with only a partial "hit" against the virus. A combination of drugs will likely be required.

"You then take those things that fit moderately well," Davey said, "stop the virus reasonably well and you improve them through chemistry."

Among the many drugs being tested by this lab is one made familiar by President Trump — hydroxychloroquine. Trump has advocated for the use of hydroxychloroquine to treat the virus, and has told the public, "What do you have to lose?" Medical experts and scientists have warned against it. It's a drug used to treat malaria and lupus, but so far unproven for treating COVID-19 and with potentially deadly side effects.

"There's real risk to taking drugs like that that can tip you over and kill you," said Arthur Caplan, director of the Division of Medical Ethics at NYU's Langone Medical Center. He also points out that the rush to buy hydroxychloroquine has created shortages for patients who need the drug for its proven uses.

"It's unethical in the extreme to take medicines known to work for people and divert them for long shot efforts to hope that something might happen," Caplan said. Careful testing like what's underway in the BU lab also helps weed out those who are looking to make a quick buck.

"Despite being in desperate times, a lot of people would like to think, 'Yeah, I have an agent that the world's going to take, and I'll make a fortune from it,'" Caplan said, "If you don't put science first, you're going to have the risk that ... greed might replace evidence."

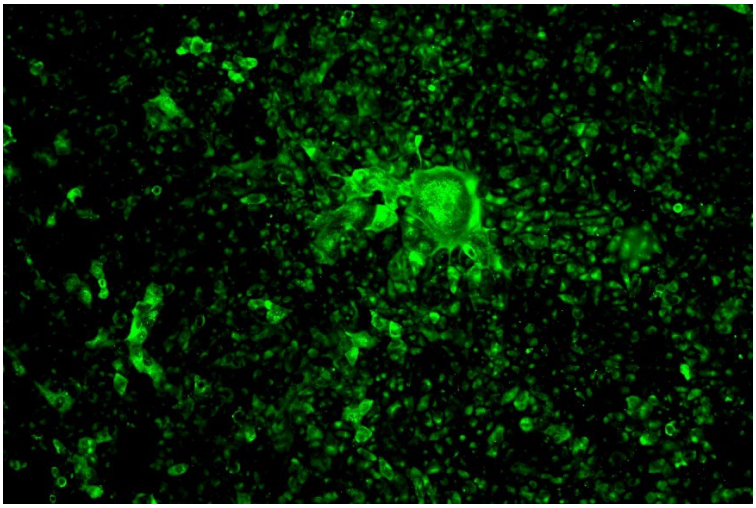
Gathering evidence with scientific rigor takes time, but in this crisis, Davey said, he was able to get up and running at "unprecedented speed" — three weeks instead of six months. It's a feat he said was possible only through collaboration among the many research institutions in Boston, as well the accelerated work of the Boston Public Health Commission.

Davey called it "the beauty of Boston." "I'm not saying that I'm going to solve this," Davey said, "but we need many shots at goal. And there are many good groups around the country that can contribute to fight to hopefully scoring that goal. I just felt we needed to be part of that."

BU NEIDL Scientists Can "See the Enemy", Making Headway on COVID-19 Research

"Everybody has dropped everything else" to work on the novel coronavirus

Original article from The Brink by Kat J. McAlpine. April 6, 2020



First things first: in order to take out an enemy, you've got to be able to see the enemy. But how do you "see" a seemingly invisible invader like SARS-CoV-2, the novel coronavirus responsible for more than a million COVID-19 infections around the world? Scientists at Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) have found a way to light up the SARS-CoV-2 virus using glowing antibodies, making it possible to detect the virus as it infects laboratory cell cultures.

BU NEIDL scientists have discovered how to make cells infected with the novel coronavirus glow green under blue light, making it easy to see the whereabouts of the SARS-CoV-2 virus responsible for the illness known as COVID-19. Photos courtesy of the Davey Lab

"We can now see the enemy—it's like switching on the lights in a dark room," says NEIDL microbiologist Robert Davey. It's the first major step forward in his team's SARS-CoV-2 research that began on March 19, 2020. They and other teams at NEIDL—including one group examining SARS-CoV-2 and the immune response it inflames in animals—are the only scientists in New England working with live copies of the novel coronavirus.

Davey's team specializes in pitting thousands upon thousands of drugs—small molecules made of different chemical concoctions—against lab cultures of cells infected with contagions, allowing them to rapidly detect which drugs are most effective at halting or reducing infection. Now that they've effectively got eyes on the SARS-CoV-2 virus' whereabouts inside the cells it infects, the team is ready to screen upwards of 20,000 drug compounds to test their efficacy in halting or reducing COVID-19 infections.

The number of compounds the team expects to test has more than doubled in the two weeks since news of their research gained national attention. "It seems like we have an almost infinite number of compounds to test," Davey says. "I've had an avalanche of email and telephone calls from biotech and pharma companies."

The antibodies that will allow Davey's team to see SARS-CoV-2 are made of the same parts and proteins as the antibodies the human immune system produces in response to COVID-19 infection. Like your own antibodies, they are designed to zero in on SARS-CoV-2 and interlock with a perfectly fitted keyhole, made of proteins, on the surface of the virus. In humans, antibodies glom onto viruses to flag them for disposal by killer immune cells, which patrol our bodies and destroy any foreign materials identified by antibodies.

Davey's team is using antibodies for a different purpose.

"You use one antibody that detects the presence of the virus—then on top of that you link another one that fluoresces under blue light," Davey says. "You end up with a little stack of antibodies attached to SARS-CoV-2, and the last antibody on the tower lights up the virus' location."

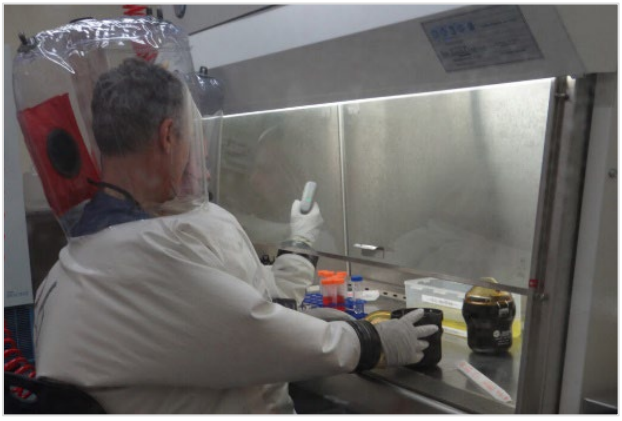
But to create that perfect interlocking stack of antibodies, Davey's team had to test a number of them. "We have very particular requirements—we need these antibodies to stick together really tight and give us a good signal [via fluorescence]," Davey says. "They act like Velcro or keys into locks; you want the key to fit really well into the lock."

When the key holds into its lock really well, Davey says, that allows them to speed up their drug testing process, which requires physical agitation of the virus and infected cells. With the flood of new compounds that Davey's team has been sent to screen, the ability to work quickly will make all the difference. To get ready, he called up lab equipment provider BioTek Instruments to order another cell-imaging machine. Instead, the company donated one without hesitation. "They said, 'OK, we're sending one.' They didn't even ask for money," Davey says. "It takes a village—we're all on the same team."

Typically, Davey's team handles some of the world's most lethal diseases, like Ebola or Marburg fevers, inside a Biosafety Level 4 (BSL-4) laboratory, which has the highest possible level of biosafety containment used for infectious agents that

pose especially high risk to humans. BSL-4 is a full step of containment above the required BSL-3 that's needed for working with live copies of SARS-CoV-2.

But the personal protection equipment that researchers must wear for BSL-3 work is the same gear that hospital clinicians are direly short of right now. So, at the NEIDL, one of the few research facilities in the United States to have both BSL-3 and BSL-4 laboratories, Davey and the members of his team will handle the SARS-CoV-2 virus while wearing full, airtight biocontainment suits, each with its own oxygen supply, taking the virus up to the BSL-4 level of containment.



NEIDL microbiologists Robert Davey and JJ Patten purify a batch of the novel coronavirus inside a BSL-4 laboratory.

Several airlocked chambers away from Davey's lab, another NEIDL team is gearing up to begin their own research on the novel coronavirus at BSL-4, too. "We've made a conscious decision to do our research in BSL-4 so that we're able to conserve the personal protection equipment that the first-line clinical workers and doctors need," says Anna Honko, a microbiologist on the team.

Together with fellow NEIDL microbiologist Anthony Griffiths and other teammates, they'll be studying the SARS-CoV-2 virus and watching it closely in animal models of the disease, which will allow the team to finally understand how exactly the virus is transmitted between hosts, infects them, and sometimes kills them. (It's not just humans that are vulnerable to SARS-CoV-2; the Bronx Zoo announced on April 5 that at least one of their big cats, a tiger, had tested positive for the novel coronavirus after showing some mild symptoms.)

"We'll be examining changes in the immune response, looking at how the immune system signals infection and mounts a response," Honko says. "Is anything [about SARS-CoV-2] producing a unique signature or fingerprint [in the immune response]? Why is this virus different from SARS or the common cold? We need to better understand the [COVID-19) disease to develop new therapeutics."

They'll be looking at the activity of cytokines, tiny proteins that cells emit to alert the body's larger immune network of a foreign invader's presence. That helps jump-start the process that eventually leads to generation of antibodies against a virus like SARS-CoV-2, which the body must produce in order to fight off infection. "If we know how SARS-CoV-2 triggers immune activation in a particular way, then that can tell us how effective vaccine candidates may be in a particular population," Honko says.

She adds that a major interest of the team is to understand how SARS-CoV-2 is so well adapted to spread through asymptomatic transmission, transferring infection from seemingly well people to others around them. Although more than one million people have officially tested positive for COVID-19 around the world, experts fear many more people are carrying the SARS-CoV-2 virus without showing any symptoms, making it extra difficult to contain the virus' spread.

"It's sad to say that we're enthusiastic about starting this work, but we're fortunate to be in a position where we can help," Honko says.

Honko, who lives within walking distance of the NEIDL in Boston's South End, says she and other researchers at the NEIDL have largely been working remotely and meeting online, except for when they need to suit up and conduct hands-on research inside their labs. Despite the NEIDL's proximity to Boston Medical Center, which is treating COVID-19 patients, Honko says the neighborhood's streets are eerily quiet. Inside the NEIDL, all research is now laser-focused on the novel coronavirus.

"Everybody has dropped everything else they were doing to help," she says.

Controversial BU lab is only one in New England with live coronavirus

It will test thousands of drugs in hopes of finding a treatment for the disease.

Original title from The Boston Globe, by Jonathan Saltzman, Updated March 24, 2020

Millions of people are doing everything possible to avoid the COVID-19 virus. Robert Davey couldn't wait to get his hands on it.

When he did last Thursday, the Boston University microbiologist was wearing heavy-duty rubber gloves and an air-tight pressurized biocontainment suit tethered to a coiled red tube that made him look like a B-movie spaceman. Inside the vial that he cracked open at a university laboratory was a pink-orange freeze-dried powder containing a sample of live coronavirus. It came from a blood specimen drawn from the first patient diagnosed with the disease in Washington state in late January. "We work with very dangerous things," said Davey, who has studied deadlier pathogens, including those that cause Ebola, Marburg virus disease, and Lassa fever. "We're not scared to work with this."

The high security South End laboratory is the only one in New England with a specimen of the virus that is sweeping the globe, according to Ronald B. Corley, director of the facility. Called the National Emerging Infectious Diseases Laboratories, or NEIDL, the lab won final approval in 2017 to research the world's most lethal microbes after more than a decade of controversy and failed lawsuits by neighbors who feared an escape of dangerous germs.

Scientists at the lab plan to begin testing thousands of approved and unapproved drugs next week on human cell lines that they have intentionally infected with COVID-19 in an attempt to come up with the first potential medicine for the disease.

They join dozens of other research efforts around the world aimed at determining whether existing compounds and others in development can treat the illness. Much of that work can be done initially without the actual virus by scientists synthesizing and cloning proteins.

But there's nothing like the real thing.

"There are lots of advances in the technology for trying to study inhibitors," said Corley, an immunologist. "But in the end, they require working with the live pathogen."

Scientists at the lab plan to test 15,000 to 20,000 compounds on the cells, Davey said. They're coming from a variety of sources, including Harvard University's Greater Boston Consortium on Pathogen Readiness, the Drug Repurposing Hub of the Broad Institute of MIT and Harvard, BU's Center for Molecular Discovery, teaching hospitals such as Massachusetts General Hospital, and biotechnology companies throughout New England.

Davey, 53, is a native of Australia who joined the lab in 2018 after overseeing the Department of Virology and Immunology at the Texas Biomedical Research Institute in San Antonio.

He said he's been overwhelmed with e-mails and phone calls offering compounds.

"People ask, 'Can you try this? Can you try this?'" Davey said. "At the moment, we are the only people in the whole Boston area that has the virus growing."

Scientists from the Harvard consortium will help the BU lab rank the most promising compounds so they can be tested first.

Researchers at the National Emerging Infectious Diseases Laboratories from left to right Callie Donahue, Ph.D. student, Hiroyuki More, DVM, Ph.D., Robert Davey, Ph.D., and Manu Anantpadma, Ph.D. CYDNEY SCOTT/BOSTON UNIVERSITY PHOTOGRAPHY

Davey said he would be happy to test compounds provided by major drug makers but has only heard from smaller operations. He couldn't identify them, he said, because of non-disclosure agreements. His lab also received a donation of a cell imaging reader and microscope from

BioTek Instruments, a privately held Vermont-based firm that sells scientific instruments and software used in life sciences research.

He is one of a half-dozen scientists at the lab who wear biocontainment suits while working with the coronavirus. Other researchers at the lab are expected to join them as the drug-testing effort expands.

Built with $200 million in federal money, the BU lab located near Boston Medical Center got final permission from the Boston Public Health Commission in 2017 to allow research on Biosafety Level 4 pathogens, the most dangerous microbes that have no treatment or vaccine.

Scientists at the lab had been doing research at Level 2 for five years and at Level 3 since 2014, as part of a national network of secure facilities that study emerging infectious diseases and develop diagnostic tests, treatments, and vaccines.

The novel coronavirus that emerged in Wuhan, China, late last year is considered a Level 3 pathogen, less dangerous than other microbes that researchers at the lab have studied. Ordinarily, the scientists could wear less restrictive personal protection equipment, or P.P.E. — masks, surgical gowns and eye gear — that is used by clinicians treating patients with COVID-19 at hospitals.

But because P.P.E. is in short supply and the BU lab scientists are accustomed to wearing the pressurized biocontainment suits, they are using the latter and acting as if the coronavirus were a Level 4 pathogen.

The lab received two packages containing coronavirus samples in late February from the Biodefense and Emerging Infections Research Resources Repository in Manassas, Va., and the University of Texas Galveston National Laboratory. A BU spokeswoman declined to say how the samples were delivered, citing security reasons.

Davey, Corley, and other lab employees worked closely for weeks with Boston public health officials to get the necessary approvals and permits before the coronavirus research could start.

Around 6 p.m. Thursday, after posing for a photograph while holding a container that held a vial with the virus, Davey broke open the ampule inside and added a little water to the powder with a pipette.

He and the other scientists then began growing the viruses on monkey cells that are used as a host before the virus is exposed to human cells. After human cells are infected, the scientists will test thousands of drugs on them in plates that each contain 384 tiny wells.

Davey said that he has worked with dangerous pathogens for at least 15 years and is eager to take on the challenge of studying COVID-19.

“There’s no psychological hurdle to jump over,” he said. “We’re highly trained. We’re very safe.”

Given how quickly the coronavirus has spread around the world and how many people it has killed, Davey welcomes multiple efforts to discover an effective medicine. No one knows which one will pay off. And there’s a big difference between testing a drug on a virus outside the human body and testing it on volunteers in a clinical trial, he said.

“If there are 20 groups working on it, we need that,” Davey said. “We probably need 100 groups working on it.”

He reveres Anthony Fauci, the immunologist who directs the National Institute of Allergy and Infectious Diseases and pioneered the understanding of HIV. Fauci has provided medical expertise as a member of the White House coronavirus task force. Davey said he embodies the best qualities of two characters from one of Davey’s favorite TV shows, “Star Trek.”

“Most people expect scientists to be like Mr. Spock, and many are like Spock,” Davey said. “We’re logical. But James Kirk is the captain. He’s impulsive. And it’s the combination of Spock and Kirk that makes it work.”

Clarification: After publication of this story, Yale University said that the Wilen Lab in the School of Medicine in New Haven, Ct., has also obtained a specimen of COVID-19.

CORONAVIRUS PANDEMIC

Live Coronavirus Research Gets Underway at BU NEIDL

Virologist Robert Davey will screen thousands of drugs for effectiveness against COVID-19 infection

Original article from The Brink by Kat J. McAlpine. March 19, 2020

Scientists at Boston University's National Emerging Infectious Diseases Laboratories (NEIDL), led by microbiologist Robert Davey, this week started suiting up to conduct research on live samples of the novel coronavirus, the first team in Boston to start such work on the global pandemic.

This type of emergency—a fast-spreading virus outbreak—is precisely what the NEIDL, now in its second year of full operation, was made for, Davey says. NEIDL's work will involve a number of studies scientists are planning related to SARS-CoV-2, the virus that causes the disease called COVID-19.

"As part of the Greater Boston Consortium on Pathogen Readiness (GBCPR), we have already started collaborating with teams of researchers in the Greater Boston area to better understand the way the novel coronavirus infects cells and leads to COVID-19, toward identifying effective treatments and vaccine candidates," says Ronald Corley, NEIDL's director.

Davey's team specializes in pitting thousands upon thousands of drugs—small molecules made of different chemical concoctions—against lab cultures of cells infected with contagions, allowing them to rapidly detect which drugs are most effective at halting or reducing infection.

They expect to test thousands of different drugs for their ability to curb COVID-19 infection—all within a matter of weeks. Their work comes as the number of coronavirus cases rises at an alarming rate in the United States, jumping by 40 percent in the 24 hours alone from Wednesday to Thursday. (There are now more than 11,000 cases across all 50 states.)

Typically, Davey's team handles some of the world's most lethal diseases, like Ebola or Marburg fevers, inside a Biosafety Level 4 (BSL-4) laboratory, which has the highest possible level of biosafety containment used for infectious agents that pose especially high risk to humans. At the NEIDL, that's how Davey and the members of his lab are set up to do their work—in full biocontainment suits, each with their own air supply—not unlike an earthly version of a spacesuit.

> Our goal is to find drugs that can reduce viral burden and alleviate the highest levels of infection.
>
> —Robert Davey

Although some people might find the suits claustrophobic, Davey's team has become more comfortable working inside the suits than outside. So, even though SARS-Cov-2 requires only a BSL-3 lab—no spacesuits needed—Davey and his team will treat it just as they would a far deadlier pathogen like Ebola.

BU microbiologist Robert Davey is thrilled about getting the green light to begin screening potentially life-saving drug candidates against live SARS-Cov-2, vials of which are carefully packed into the container he's holding in this March 19, 2020, photo. His BU NEIDL team is used to wearing full biocontainment suits for work on far deadlier viruses, like Ebola. So although the novel coronavirus can safely be worked on at a Biosafety Level 3 facility, they're researching it in the highest possible containment setting, the NEIDL Biosafety Level 4 lab. Photo by Callie Donahue

"We're going to be researching the virus at BSL-4 level, taking the virus to a higher level of containment than required," Davey says. "Our specialized equipment for doing the drug screening is set up in the BSL-4 and there is no equivalent at BSL-3. So it is mostly out of practical concern for doing things rapidly. Of course, [doing the work at BSL-4 also adds] an extra layer of safety."

And there's another silver lining to the way Davey's team is set up—their uniforms and gear are not in short supply. The personal protection equipment that researchers have to wear for BSL-3 work is the same that's used by clinicians in hospitals. In Boston and around the country, those precious resources are in short supply.

"Some other locations are having problems doing work because of this," Davey says. But the gear his team uses is uniquely designed for their level of work. "BSL-4 suits can only be used in BSL-4 labs," he says.

The NEIDL is among only a handful of facilities in the United States with both BSL-3—the type of lab facility required to work with pathogens that pose a danger if inhaled, like the novel coronavirus—and BSL-4 facilities. And so far, partly because of the shortage of BSL-3 gear, it's the only site in Boston that has the potential to work on live coronavirus.

It has taken Davey, Corley, and NEIDL's safety and operations teams weeks of working closely with the city's public health officials to get the necessary approvals and permits for the research on live coronavirus samples to get underway. The list of requirements that must be met for work to begin on any new pathogen is daunting—rightfully so—and the NEIDL team has been flying at breakneck pace since January to get its official letter of approval from the Boston Public Health Commission.

"To get to this point was a huge effort where many people went out of their way to make it happen," Davey says. "We did everything by the book to make sure we are working safely."

With that process finally behind them, he is thrilled to be heading into the NEIDL's BSL-4, coronavirus vials firmly gripped in his double-gloved hands. In the lab, he and his team will employ their unique drug screening setup, using small and efficient robots to bust through traditional bottlenecks and inefficiencies of working with live cultures, to help them simultaneously evaluate potential drug compounds on 384 different wells of human lung cells infected with SARS-Cov-2.

"Compounds stick to, or get in between, virus proteins like a wedge, blocking them from coming together and functioning properly," Davey says.

Inside the culture plates, the researchers will dose SARS-CoV-2–infected lung cells with a huge variety of compounds, he says. Some concoctions are derived from already-FDA-approved antiviral medications—which would make for an especially quick path toward approval for use in humans infected with COVID-19—and some are completely novel drug candidates designed by chemists working with John Porco, director of BU's Center for Molecular Discovery (BU-CMD).

"We maintain a chemical collection of thousands of compounds designed for a variety of biological uses," Porco says. "We've given the NEIDL—with which we've had a long-standing collaboration to develop antiviral agents—our entire collection to test against the novel coronavirus. We think there will be some interesting drug candidates that emerge from this screen."

Davey says his team will be watching the infected lung cell cultures closely to see how SARS-CoV-2 responds to each different compound from the BU-CMD. Some compounds are designed to block viruses from entering host cells, and others interfere with a virus' ability to replicate its genetic material. Still others scramble a virus' ability to assemble itself and proliferate infection after it's released from dead host cells.

"Our goal is to find drugs that can reduce viral burden and alleviate the highest levels of infection," Davey says. "The golden standard would be to find small molecules that halt COVID-19 in its tracks and prevent it from transmitting. To get there, of course, is hard. We have to be careful that these molecules don't otherwise affect a person's health or cause unintended side effects."

Yet Davey is optimistic, confident even, that good news is on the way. "Undeniably, we will identify something that has reasonable potency against the novel coronavirus," he says. "Getting something with high potency is harder, but that's where great chemists come into play."

Davey and Porco are collaborating on this front and plan to fine-tune promising compounds to increase their effectiveness against COVID-19, without causing side effects, however they can. Porco and his team at BU-CMD also specialize in small molecules called macrocycles—chemical compounds that fit into receptors on the surfaces of viruses like a key fits into a lock, blocking other molecular machinery from gaining entry as long as they stay fitted in place.

"Between basic chemistry and drug discovery efforts and the NEIDL, BU is in a great position to be working on COVID-19," Porco says.

Davey's team has a ton of experience identifying drug candidates from their work finding molecules that interrupt the Ebola virus from infecting and transmitting. Before joining the NEIDL at BU, Davey's team was stationed at Texas Biomedical Research Institute, another BSL-4 site in the United States, where they tested drug compounds against live Ebola virus. They were some of the first people to witness the efficacy of a compound called REGN-EB3, a triple-antibody cocktail made by pharmaceutical company Regeneron, which in a clinical trial last year reduced the mortality rate for the deadly Ebola virus from 70 percent to as low as 6 percent when given to patients early.

With work by Davey's team now underway, Corley says additional research efforts will soon launch at the NEIDL, including a study of the molecular mechanisms that the novel coronavirus uses to enter host cells and replicate itself.

NEIDL researchers will also seek to identify other cell types that are impacted following initial viral infection of the lungs, and will undertake other studies related to COVID-19's disease progression and spread. Meanwhile, other NEIDL teams will model the COVID-19 infection in mice with humanized immune systems, helping them understand the immune response to the virus, which will allow them to identify the best antibodies to use in a future vaccine.

"Many more studies involving BU scientists and others in the GBCPP are soon to follow," Corley promises.

And the herculean effort it took to get the live coronavirus research off the ground will pay off in future dividends, Davey adds. "Of course, we learned a lot about how we can improve the necessary approvals process, and we will be even better prepared if the unexpected occurs again in the future."

Federal scientific agencies are rolling out funding calls for COVID-19-related research. New opportunities from the Centers for Disease Control and Prevention, National Institutes of Health, Department of Defense, Department of Energy, Department of Health & Human Services, and the National Science Foundation can be found here.

BU SCIENTISTS AWARDED $1.9 MILLION TO ACCELERATE CORONAVIRUS RESEARCH

New funding will support studies at University's NEIDL and beyond

Original article from The Brink by Kat J. McAlpine. May 13, 2020

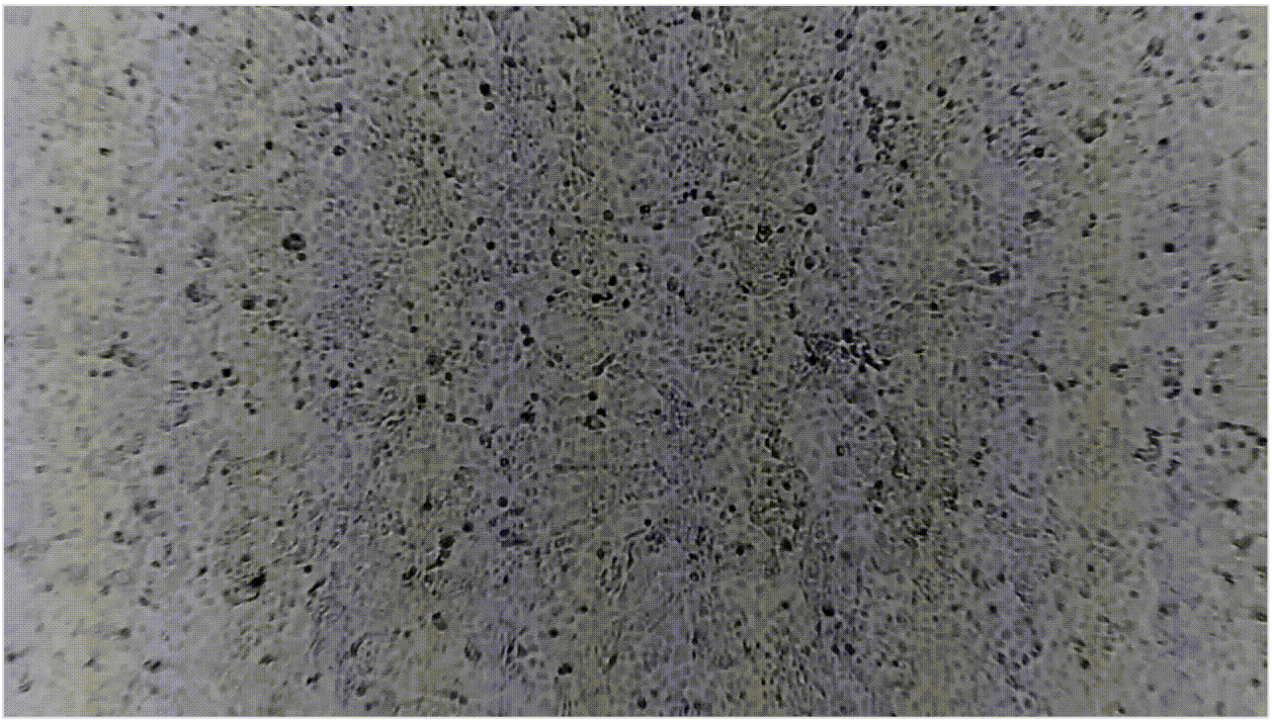
This story was updated on May 18 to clarify that $300,000, received by a joint Boston University-Boston Medical Center (BU-BMC) scientist, was awarded through BMC.

Since the novel and fast-spreading SARS-CoV-2 coronavirus first upended life in the United States and around the world, scientists at Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) have dropped nearly every other research project to focus on understanding and combating the virus. Now, BU scientists have received nearly $1.9 million in new funding from the Massachusetts Consortium on Pathogen Readiness (MassCPR) to further advance coronavirus research—much of that work made possible by the NEIDL's ability to safely house and work with live copies of the SARS-CoV-2 virus.

All told, on May 13 MassCPR announced it has awarded $16.5 million to 62 coronavirus research projects, many of those funds going to research teams in Greater Boston. Much of the funded work will be done in collaboration with scientists at the NEIDL, one of only a handful of facilities in Massachusetts currently capable of working with live, patient-derived samples of the coronavirus. MassCPR—which first convened on March 2, 2020—is buoyed by $115 million in funding, spread over the next five years, from Evergrande Group, a Fortune Global 500 company in China. Participating research collaborators include scientists and clinicians from Harvard University, Massachusetts Institute of Technology, BU, Tufts University, University of Massachusetts, and local biomedical research institutes, biotech companies, and academic medical centers.

Of the MassCPR funding that will support coronavirus research at BU, the largest chunk—a $600,000 award—stemmed from a conversation that Ronald Corley, microbiologist and director of the NEIDL, had with MassCPR about expanding NEIDL's bandwidth.

"Everyone who is currently in the NEIDL as an investigator has their own research programs that they support with their own funding mechanisms," Corley says. "So if someone else has really good [coronavirus research] ideas, and they can't collaborate with one of our investigators, they are out of luck. Our bandwidth, right now, is defined by what individual investigators in the building can do, but we recognize that there are a lot more meritorious ideas than we can possibly handle at this point in time. So, this [$600,000] funding will help the NEIDL hire additional scientific personnel to expand the NEIDL's research footprint and allow us to work with other investigators to bring these ideas to the [lab] bench."



This picture shows the novel coronavirus infecting cells in laboratory culture. BU NEIDL researcher Robert Davey and members of his lab first started growing the SARS-CoV-2 virus in cells for research purposes on March 19, 2020. Now, coronavirus research by Davey and other NEIDL investigators has received a boost from new MassCPR funding announced on May 13, 2020. Credit: Davey Lab

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Aside from that funding, which will support a broad number of future projects at the NEIDL, another roughly $1.3 million in awards has gone directly to BU principal investigators for SARS-CoV-2 research that's already underway.

Modeling coronavirus infections in lung organoids

Mohsan Saeed, a NEIDL biochemist and virologist is teaming up with Darrell Kotton, director of the Center for Regenerative Medicine (CReM) at BU's Medical Campus, to model COVID-19 infections in stem cell–derived human lung organoids. With help from the CReM team, Kotton, who has been serving on the front lines as an attending physician to COVID-19 patients in the medical intensive care unit at Boston Medical Center (BMC), BU's teaching hospital, will focus on scaling up production of stem cell–derived lung organoids to share those tissues with MassCPR researchers that seek to model COVID-19 infections or screen promising drug candidates.

In partnership with Saeed at the NEIDL, and with the support of $200,000 in MassCPR funding, Kotton's team will infect human lung organoids with SARS-CoV-2 and carefully analyze the molecular and genetic pathways that COVID-19 infection employs to spread through and overwhelm human lung tissue. Saeed, who specializes in the study of lung infections, says the research—seeking to discover which cell proteins are cleaved by the SARS-CoV-2 virus as it hijacks a cell—could help uncover new drug targets that would disrupt the SARS-CoV-2 virus from successfully infecting and spreading in humans.

Better, faster COVID-19 testing thanks to machine learning

Another CReM scientist, George Murphy, has received nearly $300,000 in MassCPR funds, awarded through BMC, to develop better and faster COVID-19 testing. In mid-March, Murphy—working closely with Christopher Andry, BU/BMC chief of pathology and laboratory medicine, and dozens of volunteer scientists and lab technicians from across BU's Medical Campus—helped rapidly convert part of the CReM from a tissue engineering facility into a full-scale, in-house COVID-19 testing center amidst test kit shortages and delays from state and federal agencies. Racing against the

blossoming number of coronavirus infections in the city of Boston, Murphy and Andry's team devised a unique and FDA-authorized test to get around supply chain barriers that blocked them from accessing traditional COVID-19 tests, and began processing same-day testing for all BMC patients suspected of COVID-19 infection.

Now, Murphy and Andry are spearheading a new project alongside CReM faculty researchers Kim Vanuytsel and Ruben Dries. With the new MassCPR funding, they hope to reduce the 3 percent false negative average associated with current COVID-19 tests by developing a machine learning algorithm that can more accurately—and more quickly—interpret test results than human experts. The team is also developing new methods for pooling samples to increase testing speed, and creating miniaturized versions of the testing process that require less equipment and human intervention.

Drug candidate screening and making SARS-CoV-2 research more accessible

Almost $200,000 in MassCPR funding has also been awarded to NEIDL virologist Elke Mühlberger, who switched gears from studying hemorrhagic fevers like Ebola to conduct coronavirus research in collaboration with NEIDL scientists and other MassCPR investigators. At the NEIDL, Mühlberger and her team will infect cell cultures with SARS-CoV-2 and carry out experiments and drug candidate evaluations in collaboration with MassCPR researchers who do not themselves have access to a laboratory capable of working with the live SARS-CoV-2 virus, which requires a Biosafety Level 3 (BSL-3) or higher containment environment.

Typically, Mühlberger's team handles some of the world's most lethal diseases, like Ebola or Marburg fevers, inside one of the NEIDL's Biosafety Level 4 (BSL-4) laboratories, which have the highest possible level of biosafety containment used for infectious agents that pose especially high risk to humans. BSL-4 is a full step of containment above the required BSL-3 that's needed for working with live copies of SARS-CoV-2.

But the personal protection equipment that researchers must wear for BSL-3 work is the same gear that hospital clinicians are direly short of right now. So, at the NEIDL, one of the few research facilities in the United States to have both BSL-3 and BSL-4 laboratories, many researchers—like Mühlberger's team—are choosing to handle the SARS-CoV-2 virus while each wearing full, airtight biocontainment suits connected to an air hose, taking the virus up to the BSL-4 level of containment.

Inside a BSL-4 lab, Mühlberger's team, which also recently received a $100,000 Fast Grant for their SARS-CoV-2 work, will modify the virus to enable safer versions of it to be used by researchers at lower biocontainment laboratories—because the more scientists that can safely do coronavirus research, the faster the pandemic can be brought under control. Coronaviruses like SARS-CoV-2 have extremely long genomes, making genetic modifications and cloning challenging. But Mühlberger has plenty of experience genetically modifying Ebola and Marburg viruses. To make it all happen, she is teaming up with her longtime collaborator and coronavirus expert Volker Thiel of the University of Bern, Switzerland, who has received $60,000 in additional MassCPR funding.

Screening thousands of compounds in search of new COVID-19 treatments

Inside another BSL-4 lab at the NEIDL, microbiologist Robert Davey's ongoing coronavirus work will be further supported with $400,000 in new MassCPR funding. Davey's team specializes in pitting thousands upon thousands of drugs—small molecules made of different chemical concoctions—against lab cultures of cells infected with viruses, allowing them to rapidly detect which drugs are most effective at halting or reducing infection.

Since getting started in March, they've already made progress on their COVID-19 research, leveraging glowing antibodies to get eyes on the SARS-CoV-2 virus's whereabouts inside the cells it infects. Now, the team is screening the first group of drug compounds—of which they eventually plan to test more than 20,000 potential therapeutics—to see if they are able to halt or block COVID-19 infections. Davey's efforts were highlighted in the May 13 PBS *NOVA* show "Decoding COVID-19", which is now available to watch online until mid-June.

Understanding why the novel coronavirus hits some harder than others

Across the BU Medical Campus quad, Joshua Campbell, a biostatician and cancer researcher, is pivoting to study SARS-CoV-2 with a team of clinical biologists—including co–principal investigators and BU faculty researchers Jennifer Beane, Elizabeth Duffy, and Sarah Mazzilli—to better understand the genetic factors that make some people more likely to experience severe COVID-19 infections than others.

Specifically, with the support of $185,000 in new MassCPR funding, they will research how genes are expressed across different cell types in the lungs, and how gene expressions vary across people of different ages and demographic backgrounds, and who have different environmental exposures and lung diseases. To do so, they will establish a BU-BMC biobank to collect samples from COVID-19 patients with a broad range of health histories, ethnicities, and socioeconomic status. Campbell and his team are in touch weekly with researchers from the NEIDL and the CReM, and will likely partner with NEIDL virologists to complete some lab work as they get further along in their SARS-CoV-2 research.

"The NEIDL was built to be able to study emerging infectious diseases and respond to national emergencies," says NEIDL director Corley. "This pandemic…[we've witnessed] the value of having a facility like the NEIDL and all the expertise that we've brought into it."

MassCPR will hold its first public briefing, via YouTube livestream, on Friday, May 15, 2020, at 8 am ET to discuss the progress its collaborators have made over the last few months. During the briefing, Ronald Corley will give a short presentation on the NEIDL's efforts.

NEIDL Health and Safety

NEIDL Safety functions include building specific oversight for Environmental Health & Safety (EHS), Occupational Health and Emergency Planning, are aligned with the University departments providing those functions and reports to the Office of Research Compliance (ORC).

Organization and Staffing

The organizational model of these NEIDL-specific services is represented in several ways:

- First, as described above, the organization is aligned with University functions and reports to ORC.
- Second, the organization combines leadership and expertise in the NIAID model defined as the "Environmental Health and Biosafety Regulations and Requirements Core". The core includes the specific areas mentioned above of Biosafety, Occupational Health and Emergency Planning.
- Finally, the organization, as a component of ORC and, as such, is responsible for coordination with regulators and the Office of Research Integrity, the review of protocols, adherence to the Comprehensive Emergency Management Plan and all other plans submitted as part of the permitting processes.

NEIDL Safety is led by the Chief Safety Officer who, along with the NEIDL Director (research) and the NEIDL Operations Director, are referred to as NEIDL Leadership and are responsible for the oversight of the NEIDL. This report will therefore provide information on both the specific areas of NEIDL Safety and the broader areas of NEIDL oversight.

NEIDL Safety includes three managers with staff reporting to them, three technical experts in (1) biosafety, (2) mentoring/training and (3) infectious diseases, and five program managers and technical staff. All technical staff participate in the BU/BMC-wide rotating on-call program with one person assigned at a time and provided with a vehicle and equipment for a one-week period. All management and expert staff are available to the on-call personnel when incidents require support or are reportable to a regulatory agency. Expertise provided by managers is as reflected on the BU EHS organization chart. A list of NEIDL Safety positions is included at the end of this report.

Within the past year NEIDL Safety has filled its last open position hiring a **Senior Specialist** to focus on biocontainment needs including decontamination and certification. Additionally, following the termination of the Emergency Planning Program Manager, NEIDL Safety, with EHS has hired a new Emergency Planning Program Manager from within the NEIDL and with extensive BSL-4 experience.

NEIDL Leadership, over the past year, had addressed fundamental organization issues to align responsibility and authority including the following;

- Alignment of formal and informal leadership responsibilities based on complementary skills and knowledge allowing for better outcomes to issues that arise on a regular basis. This shift in organizational dynamics was not always easy but the process was, and continues to be, productive and beneficial to the NEIDL organization.
- Recognition of the need for the development of job descriptions for Laboratory Managers to work with biosafety officers in BSL-4 and in BSL-2/3. These positions were determined to be essential for continued success and coordination of activities during a very busy period of growth during a pandemic. One position has been filled and the second will be shortly.

Significant Achievements and Challenges

The past year seen a significant increase in work being done as a result of new research teams coming on board and in response to the COVID-19 pandemic. This uptick in activity brought challenges as space, system, and operational issues became apparent. In summary the issues and resolutions included:

- Recognition that lab space, while only in use for a short time, is 10 years old. Biocontainment door seals, oxygen lines and other elements have failed due to age. These issues have largely been or are being addressed now.
- Recognition that annual maintenance and decontamination schedules that require closing space were flawed and did not align with the use of that space. Adjustments have been or are being made to BSL-3 and BSL-4 decontamination schedules.

- Recognition that the decontamination and certification processes required more staff than we had available and that qualified and affordable contract staff are difficult to find. This issue has been addressed through the hiring of another EHS employee and the selection and training of a vendor who can support these efforts.

Our BSL-3 programs were close to non-existent this time last year. We have established a BSL-3 Operations Meeting, a BSL-3 NEIDL Training Advisory Committee and have now trained multiple research, animal, safety and operations staff in BSL-3 work while creating a mentoring program based on the one at BSL-4.

A review of the Threat and Risk Assessment was conducted. The review was complimentary of the security plan and operational procedures and suggested attention to emerging cyber-security issues. Cyber-security issues were also identified in the annual Hazard Vulnerability Assessment and an exercise was recently conducted as part of the plan to mitigate that threat.

As the NEIDL enters the final year of the 5-year operations grant, NEIDL Leadership, primarily the Director, assembled the response to a limited renewal grant for the next 5-year period (2021-26). Doing so required the alignment of all non-research cores and the development of goals and anticipated outcomes. NEIDL Leadership wrote sections, reviewed each other's work and ensured that the proposal was consistent with the requirements, comprehensive and collaborative in nature.

Specific to COVID-19, the NEIDL, unlike many areas of BU, became busier with the arrival of the pandemic.

- NEIDL Safety worked with local regulators and internal committees to review and comment on related protocols. Issues were identified and addressed efficiently without compromising safety.
- City Council notifications for this work were provided in a single notice that addressed all coronavirus work as opposed to specific project notice.
- Research and biocontainment teams worked together to prove that NEIDL facilities and decontamination procedures would work to address the N95 shortage and then prepared to do so on a large scale if needed.
- Other work in the NEIDL was temporarily sidelined as a result of the need to focus on the current crisis.
- NEIDL Safety staff continue to work remotely approximately 40% of the time and adjust as necessary to meet research, operational and safety needs.
- Challenges include those related to the annual / unscheduled drug testing program which has been placed on hold since March of 2020. The Personnel Suitability Review Team has discussed the impact of this clearance element of the total PS&R process and will likely have a recommendation for the AVP, ORC by the end of August.

Professional Development

During the past year three members of EHS and one of ASC attended a weeklong training session on requirements to certify biosafety cabinets. As NEIDL EHS adjusted to the challenges above, these staff have spent time with the Biocontainment Program Manager getting hand-on experience certifying cabinets and will, hopefully, return for a second week long class in November to finish this program so that expertise can be brought in-house.

NEIDL EHS leadership has continued to be engaged with CDC, ABSA and CSHEMA professional development offerings and the Associate Director / BSL-3 Biosafety Officer has been invited to apply for appointment to the NSABB.

Budget Management

NEIDL Leadership was challenged to provide plans for budget reductions resulting from the impact of the pandemic while finalizing the year 5 budget for the existing NEIDL Operations Grant and developing the proposal for another 5-year grant cycle. When possible, budget decisions and funding allocations were developed using data and documented for future budget cycles.

While the total cost of the NEIDL is still subject to interpretation the development of budgets in the past year for EHS Safety and some aspects of Facilities and Public Safety were devised based on measurable activity that can be adjusted and replicated without starting over.

Regulatory Requirements

NEIDL Safety has hosted or participated in several inspections over the past year – all of which resulted in positive reports with respect to NEIDL Safety programs - including but not limited to:

- BPHC inspection of BSL-3 – June 2019
- BPHC Inspection of BSL-4 – October 2019
- CDC inspection of BSL-3 and BSL-4 – December 2019
- BPHC inspection of BSL-3 – February 2020
- BPHC inspection of BSL-3 – July 2020

Inspection Programs

NEIDL Safety continues to grow its involvement in BioRAFT with the objective of having all inspections except select agent inventories housed there. In the meanwhile, the use of BioRAFT includes BSL-2 inspections while BSL-3 and BSL-4 daily checklists and inspections are maintained within the NEIDL systems.

		Boston Emergency Management	Boston Emergency Medical Services	Boston Fire Department	Boston Police Department	Boston Public Health Commission	Boston Medical Center	EASCARE (EMT)
2016/17	Security Breach				X	X		
	SPU Medical Emergency		X	X		X		
	Fire Response Exercise					X		
2017/18	Terrorism Response (full scale)	X		X	X	X		
	Building System Failure Resulting in evacuation of BSL-4 labs Evacuation of BSL4 Labs (table top)					X		
	Lab Acquired Infection					X	X	X
2018/19	Workplace Violence Hostage					X		
	Tornado/Explosion		X	X	X	X		
	Potential Exposure / Activate SPU							
2019/20	Terrorism / IT Security Event					X		
	Earthquake / Loss of services (Sept 2020)							
	Scheduled Drill TBA							

Coordination with external community

NEIDL Safety has continued its process of ensuring transparency with regulatory agencies and continues to reap the benefits of that effort. Regulators and responders involved in incidents have learned to trust the diligence of EHS staff in responding to, resolving and reporting incidents.

NEIDL Safety also continues to work closely with the Boston Public Health Commission to ensure that BU is delivering all NEIDL commitments and requirements in a timely fashion. This effort was complicated over the past year due to the pandemic, but coordination has continued with NEIDL Safety hosting secure Zoom meetings monthly, coordinating small design teams including a BPHC representative for exercises (below) and with remote coordination and monitoring of transports that have occurred.

Additionally, NEIDL Safety has developed After Action Reports (AAR) following incidents or activities in which opportunities for improvement have been identified doing so in concert with BPHC and other response agencies. These AARs have addresses several topics including glove tears and transportation events.

NEIDL Safety staff

- Executive Director, NEIDL Research Compliance manages this core as the Chief Safety Officer and serves as a member of NEIDL leadership.
- Scientific Safety Officer serves as the Responsible Official and provides support to all biosafety, training and biocontainment functions.
- Associate Director, Research Safety / BSL-4 serves as the BSL-4 Biosafety Officer and as an Alternate Responsible Official and provides support to BSL-3 programs.
- Associate Director, Research Safety / BSL-3 serves as the BSL-3 Biosafety Officer and as an Alternate Responsible Official and provides support to BSL-4 programs.
- Biocontainment Program Manager oversees all certification and decontamination processes.
- EHS Program Manager coordinates all BU Environmental Health & Safety services supporting the NEIDL including environmental, radiation, chemical and occupational safety programs while supporting BSL-2 laboratory safety
- Emergency Planning Program Manager oversees emergency plan development, drills and exercises and related training programs involving internal and external responders.
- Senior Specialist (2) perform decontaminations, certifications and oversee contracted services supporting same.
- Director, Medical Response provides expertise in disease surveillance in support o the Research Occupational Health Program, serves as Medical Director of the BMC Special Pathogens Unit and chairs the Laboratory Acquired Infection Committee developing guidance for agent specific information sheets.
- Medical Director, ROHP, serves as the Occupational Health Officer, as required by the Boston Public Health Commission.

Health and Safety

We have established a BSL-3 Operations Meeting, a BSL-3 NEIDL Training Advisory Committee and have now trained multiple research, animal, safety and operations staff in BSL-3 work while creating a mentoring program based on the one at BSL-4.

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NEIDL training programs in support of high and maximum biocontainment

It is not only essential to train research science staff to safely work in high and maximum biocontainment, it is also important to establish and maintain capability of operational support staff (non-research) to safely enter high and maximum biocontainment while active research is ongoing. Properly trained professional staff from Facilities, Information Technology and EHS groups is necessary in order to provide critical real-time support and repair functions for the research teams as necessary. Regulatory oversight personnel have also been trained for safe entry into high and maximum containment. The number of non-science research personnel with BSL-3 and BSL-4 access has been

intentionally developed for this specific purpose. As such, the NEIDL now has highly trained individuals who can uniquely support research efforts in BSL-3 and BSL-4. These individuals are members of a very small club globally who are not researchers but are fully trained to safely enter and support needs of the science mission.
The NEIDL Training Advisory Committees for BSL-3 and BSL-4 utilize in-house qualification assessments and review processes and procedures related to steps and training criteria for all personnel to become authorized to work inside high and maximum containment.

We have a total of 44 NEIDL staff the BSL-3 access program:

- 28 Science Staff
- 6 EHS Staff
- 2 Information Technology Staff
- 6 Facilities/Maintenance Staff
- 2 Boston Public Health Commission regulator training

During FY2019 alone, 16 new trainees entered the program, and 10 staff completed their individual mentored training plans.

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Facility Maintenance and Operations Updates

The Facilities Engineering Unit continued maintaining the critical infrastructure and tracking performance of systems and components that are 10 years into operations. The combined efforts and management strategy of the Facilities Operations Group is to be proactive and responsive to maintain the unique and critical environments that sustains the NEIDL science mission. Biocontainment function of the facility is critical. Strong links and collaborations with EHS, Public Safety and Research teams provide a practice of continuous monitoring and facility performance assurances that enables best practice and regulatory compliance. Selected accomplishments in FY2020 include:

- The Building Automation System field panel upgrade was completed ahead of schedule. The replacement upgrade provides the latest technology and performance standards and enables continued vendor support. The Building Automation/Controls Group lead by Joe Corbet, assisted the panel replacement project to include testing and verification of the systems control and monitoring points and carefully managed the project to minimized disruption of research activities.
- Paul Amadio and Nafisah Nakhid lead efforts to greatly improve the Computerized Maintenance Management System for "Work Request" and "Work Order". The system is designed to be more efficient and more effective for generating maintenance activity data.
- Staffing levels for the Building Automation/Controls were established that provide 24 X 7 coverage and staffing levels for Maintenance Operations was increased to expand more operational hour coverage with full 24 X 7 expected upon filling approved vacancies.
- COVID-19 impacted the NEIDL. All Facilities Engineering Unit employees responded as "essential employees" to maintain the NEIDL for continuous biocontainment operations. COVID-19 drove the need to implement multiple responses to include increased cleaning and disinfection throughout the building, restricted space occupancies and circulation pathways were defined, and new signage for compliance with University guidelines were installed. Work practices changed to include social distancing and wearing of facemasks.
- The Facilities Engineering Unit continues to train personnel on biocontainment principles and practices that are essential for their safety. There are currently six staff who are participating in BSL-4 Suit training to allow improved response capability to address repair requirements while BSL-4 spaces are active. Currently nine staff have undergone Security Risk Assessments for the Federal Select Agent Program requirements.

NEIDL Cybersecurity Governance Committee

The NEIDL Cybersecurity Governance Committee was created this year to provide oversight of NEIDL IT operations as they relate to cyber security threats. The members include;

- Anthony Griffiths, NEIDL Principal Investigator
- Virginia Spell, NEIDL Contracts Manager
- Richard Trevino, NEIDL Director of Finance
- Judy Yen, NEIDL Senior Technologist
- Corey Nunes, NEIDL Animal Operations Manager
- Judith Olejnik, NEIDL Senior Research Scientist
- John McCall, NEIDL Director of Information Technology
- Eric Jacobsen, Executive Director of Information Security
- Kelly Nee, BU Chief of Police

The charter of this group is to provide oversight to NEIDL IT Operations as they relate to cyber security threats by providing the following responsibilities:

- Oversee regular risk assessments and penetration tests
- Review security metrics such as Vulnerability Management
- Help define risk tolerances by weighing risks versus impact of controls on business functions and providing input to roadmap
- Review and advise on security policies

BOSTON UNIVERSITY

/NEIDL

Boston University National Emerging Infectious Diseases Laboratories

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