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ANNUAL REPORT
FY 2018

BOSTON UNIVERSITY

/NEIDL National Emerging Infectious Diseases Laboratories

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Boston University National Emerging Infectious Diseases Laboratories

620 Albany Street
Boston, Massachusetts 02118
bu.edu/neidl

September 1, 2018

Letter from the Director

Emerging Infectious Diseases, and the pathogens that cause them, continue to be in the headlines, almost on a daily basis. During the past year, the Centers for Disease Control released a report (https://www.cdc.gov/vitalsigns/vector-borne/index.html) noting that vector transmitted infectious diseases have increased 3-fold in the United States between 2004 and 2016, and included the discovery of 9 new pathogens transmitted by insect vectors. There have been two Ebola outbreaks in the Democratic Republic of the Congo, one of which is currently ongoing. Nigeria has experienced an unusually large Lassa virus outbreak, the result of spillover of the virus from its rodent reservoir to humans. Madagascar suffered through an unprecedently large plague epidemic, with over 2300 patients becoming infected by the disease caused by the bacterium *Yersinia pestis*. The Nipah virus, a virus transmitted through a species of bat, caused an epidemic in southwest India, about 2,000 km from where the virus was known to exist. The Middle East respiratory syndrome (MERS), a coronavirus (MERS-CoV) transmitted to humans from Dromedary camels, continues to percolate throughout the Arabian Peninsula. Emerging infectious diseases are, of course, not restricted in geographic distribution to areas outside the United States. We see episodic cases of Bourbon virus and Powassan virus, both tick borne viruses. Other vector transmitted pathogens, like West Nile Virus, continue to infect humans; a 4th case was recently confirmed in Massachusetts. West Nile virus was first brought to the United States in 1999, and now is endemic in the US. No matter where an emerging pathogen exists, it is only a plane-ride away from the US, which is why we remain committed to studying these pathogens and the diseases they cause, no matter where they currently exist.

The study of emerging infectious diseases often requires uniquely designed containment laboratories, facilities that are designed, along with enhanced personal protective equipment, to keep laboratory workers safe while working with these pathogens. We have been permitted by both the Centers for Disease Control, and the Boston Public Health Commission, our main external regulators, to study pathogens that require biosafety level 3 (BSL-3 containment) for almost 3 years. We earned the permit from the CDC for BSL-4 in December, 2016 as we announced in last year's annual report. We were finally awarded the BPHC's permit for BSL-4 in December, 2017. We received our first shipment of these pathogens, filoviruses, this summer. Filoviruses include two significant human pathogens, Ebola virus and Marburg virus, and can now be studied in the NEIDL. Over the next year, we hope to be able to import a number of other BSL-4 pathogens for study. Understanding the diseases these pathogens cause, and developing and testing improved diagnostics, therapeutics and vaccines are a major focus of the NEIDL and its investigators.

We added two new investigators to our NEIDL team this past year. Nicholas Crossland, a board certified veterinary pathologist, joined as an Assistant Professor of Pathology and will have a role in helping understand and document disease pathogenesis. Pathology services are crucial to understanding the underlying disease pathogens cause. Tonya Colpitts, Assistant Professor of Microbiology, is an expert in mosquito transmitted viruses. As part of her recruitment, we also outfitted one of the insectary spaces in the NEIDL so that she can safely raise mosquitoes that carry and transmit human pathogens such as Dengue virus, Zika virus and West Nile virus, among others. This space is now functional and work has been ongoing. This summer and fall, two additional faculty, Robert Davey and Anthony Griffiths will be joining the NEIDL. Both are expert virologists who focus on viruses including Ebola virus and Lassa virus, among other significant human pathogens. The scientific achievements of our faculty and staff during this year have been truly outstanding, as evidenced by the significant funding that supports their work, their publication record, record of invited presentations at other institutions and at scientific forums, and

participation with organizations in developing policies that impact how we approach work in the emerging infectious diseases arena internationally.

We remain committed to performing studies in the NEIDL in a safe and secure manner. Thus, we were particularly excited about recruiting two additional safety specialists to our NEIDL Environmental Health and Safety Group, Shannon Benjamin and Nadezhda (Nadya) Yun. These two professionals bring many years of experience in Biosafety level three (Benjamin) and Biosafety level 4 (Yun) environments, and they will help ensure that we remain at the forefront of safety practices as we carry out our work.

We also remain committed to being completely transparent about our work with the public. We do so in partnership with our Community Relations staff, Valeda Britton and Chimel Idiokitas by communicating with various community groups, giving tours of the facility, keeping our website current, and through interactions with our expanded Community Liaison Committee. The CLC has members drawn from a number of backgrounds and they help advise us on strategies for communicating what we do, as well as helping us be innovative in how we can approach educational opportunities, including science, technology, engineering and math (STEM) education opportunities, in our neighborhoods.

STEM education is but one part of a major mission of the NEIDL. As a center within a major research university, we not only contribute to the academic mission of Boston University, but participate actively in teaching, education, and mentoring. We are fortunate in being able to continue to attract outstanding graduate students from a variety of fields within the university but also postdoctoral fellows to our faculties' research teams. Interestingly, given the complex nature of what we do in the NEIDL, there are other significant educational opportunities for students. As outlined in this report, our facilities and information technology groups provide training and internship opportunities for undergraduate students in our school of engineering. This has proven to be a recurring training opportunity and we hope to be able to expand it in the future.

We have had an excellent year, and look forward to this next year. There is more to be done, but we are closer to being able to fulfill our mission.

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 identified as high priority category A, B, and C agents (http://www.niaid.nih.gov/topics/biodefenserelated/biodefense/pages/cata.aspx), 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:

1. 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.
2. 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.
3. Move promising basic research as rapidly as possible to translational, preclinical and clinical research in animals and humans in partnership with appropriate collaborators.
4. Create and establish the methodologies needed to advance the development and testing of vaccines, therapeutics and diagnostics for these agents.
5. Train scientists and related support personnel in the requirements to perform maximum containment research in a safe and secure environment.
6. Maintain the flexibility needed to support a national response in the event of a biodefense emergency.
7. Ensure a "safety first" environment for the conduct of all activities in the NEIDL.

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*
- *Innate-adaptive interface*
- *Molecular pathogenesis of infectious diseases*

Gerald T. Keusch, MD
Professor of Medicine, Section Infectious Diseases
Professor of International Health
Associate Director, NEIDL
Director, Collaborative Research Core
Dr. Keusch's research interests:

- *Global science and health collaborations*
- *Global impact of infectious diseases*

Principal Investigators

Nahid Bhadelia, MD, MA
Assistant Professor of Medicine
Section Infectious Diseases
Medical Director, Special Pathogens Unit, NEIDL
Dr. Bhadelia's research interests:

- *International pandemics strategy and policy*
- *Healthcare worker disaster preparedness*

Tonya Colpitts, PhD
Assistant Professor of Microbiology
Dr. Colpitts' research interests:

- *Virus/Flavivirus pathogenesis*
- *virus-host-vector interactions*
- *dengue, Zika, arbovirus*
- *mosquito-human immune cross-talk 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, Anatomy and Laboratory Science
Dr. Crossland's research interests:

- *Borrelia burgdoferi and mechanisms of persistence*
- *Comparative pathology using animal models*

Paul Duprex, PhD
Professor, Microbiology & Pathology
Director, Cell & Tissue Imaging Core
Dr. Duplex's research Interests:

- *Paramyxovirus pathogenesis*
- *Virus-cell interactions*
- *Zoonosis; cross-species infection*

Rachel Fearns, PhD
Associate Professor, Microbiology
Dr. Fearns' research Interests:

- *Negative strand RNA virus nucleocapsid organization*
- *Negative strand RNA virus polymerase activities*
- *Mechanisms of action of polymerase inhibitors*

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 Eng
Associate Professor, Microbiology
Dr. Galagan's research interests:

- Systems biology
- Infectious Diseases; Tuberculosis
- Computational Biology and Genomics

Tarik Haydar, PhD
Associate Professor, Anatomy and Neurobiology
Dr. Haydar's research interests

- Forebrain development and function
- Cellular and molecular determinants influencing cognition

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:

- *Neuroimaging*
- *Multi-modal 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*
- *Biology of TB granulomas*
- *Mechanisms of macrophage activation and differentiation*

Elke Mühlberger, PhD
Associate Professor, Microbiology
Director, Biomolecule Production Core
Dr. Mühlberger's research interests:

- *Host response to filovirus infection*
- *Molecular mechanisms of filovirus replication and transcription*

John C. Samuelson, MD, PhD
Professor of Molecular and Cell Biology
Professor of Microbiology
Dr. Samuelson's research interests:

- *Mechanisms of pathogenesis of protozoan parasites*
- *Structures of parasite walls and glycoprotein*

Scientific Staff and Trainees

Adeoye, Bukola * *
Grad Student, Biomedical Sciences
Mühlberger and Colpitts Labs

Agrahari, Garima *
Postdoctoral Fellow
Kramnik Lab

Asad, Sultan *
Sr Research Scientist
Colpitts Lab

Baer, Cooper R
PhD Candidate
Microbiology, Galagan Lab

Braun, Molly
PhD Candidate
Microbiology, Fearns Lab

Breen, Michael
PhD Candidate
Microbiology, Fearns Lab

Broos-Caldwell, Aditi
Research Technician
NEIDL Repository

Brownhill, Eric
MD-PhD Candidate
Microbiology, Kramnik Lab

Chatterjee, Sujoy
Postdoctoral Research Associate
Kramnik Lab

Cressey, Tessa
PhD Candidate
Microbiology, Fearns Lab

Devaux, Alexander
Research Study Technician
Microbiology, Connor Lab

Dülsner-Seidel, Kirsten *
Postdoctoral Fellow
Kramnik Lab

Feitosa-Suntheimer, Fabiana *
Postdoctoral Fellow
Colpitts Lab

Gavrish, Igor *
Research Study Technician
Kramnik Lab

Gold, Alexander *
PhD Candidate
Microbiology, Colpitts Lab

Hirsch, Daniel **
Graduate Student
Connor Lab

Ho, Gregory
Research Technician
Microbiology, Duprex Lab

He, Xianbao
Research Instructor
Medicine, Kramnik Lab

Hume, Adam J
Research Scientist
Microbiology, Mühlberger Lab

Jalloh, Chernoh Sallieu **
Graduate Student, Biomedical
Sciences, Kramnik Lab

Koster, Jacob
Sr. NEIDL Core Technologist
Quality Control

Lei, Maohua Lei *
Research Study Technician
Microbiology, Connor Lab

Ludeke, Barbara *
Postdoctoral Research Associate
Microbiology, Fearns Lab

Malsick, Lauren *
Undergraduate Student
Biology, Fearns Lab

Manhart, Whitney
PhD Candidate, Microbiology
Mühlberger & Mostoslavsky' s Lab

Maurer, Jerffrey **
Graduate Student, Biomedical
Sciences, Connor Lab

Mina, Michael *
Research Study Technician
Microbiology, Duprex Lab

Murphy, Linda J.
Senior Research Scientist
Microbiology, Duprex Lab

Nambulli, Shamkumar (Sham)
Research Scientist and Lab Manager
Microbiology, Duprex Lab

Ning, Boting **
Graduate Student, Biostatistics,
Connor Lab

Odom, Christine *
Graduate Student
Microbiology, Connor Lab

Olejnik, Judith
Senior Research Scientist
Microbiology, Mühlberger Lab

Olsen, Michelle T.
Postdoctoral Research Assoc.
Microbiology, Connor Lab

O'Neil, Nicholas
Graduate Student
Connor Lab

Pacheco, Jennifer R.
Research Technician
Microbiology, Mühlberger Lab

Pavlovich, Stephanie
MD-PhD Candidate
Microbiology, Kepler Lab

Ruedas, John
Postdoctoral Research Assoc.
Microbiology, Connor Lab

Schultz, Michaela Smith *
PhD Student, Biology & Biochemistry
Frydman & Connor Labs

Shafik, Andrew *
Postdoctoral Fellow
Connor Lab

Shareef, Afzaal *
Research Study Technician
Microbiology, Fearns Lab

Shearer, Sarah
Senior Research Scientist
Microbiology, Fearns Lab

Soucy, Alexandra
Research Study Technician
Microbiology, Connor Lab

Speranza, Emily *
PhD Candidate, Bioinformatics
Connor Lab

Strampe, Jamie *
Graduate Student
Microbiology, Connor Lab

Tilston-Lunel, Natasha
Postdoctoral Research Assoc.
Microbiology, Duprex Lab

Tang, Edward **
BU RISE Student
Colpitts Lab

Tashjian, Joseph **
Graduate Student, Pathology & Lab Sciences, Connor Lab

Waligurski, Emily *
Research Study Technician
Kramnik Lab

Yen, Judy Yung-Ju *
Sr. NEIDL Core Technologist
BSL4 Operations

Animal Research Support

Diaz-Perez, Yulianela
Veterinary Research Technician

Furtado, Oscar M
Veterinary Research Technician

Gonzalez, Aaron *
Graduate Student

Gross, Sarah
Veterinary Research Technician

Hardcastle, Kath DVM DACLAM
Core Director, Animal Services

Harrington, Patrice *
Veterinary Research Technician

Nunes, Corey
Operations Manager, NEIDL ASC

MacGregor, Nicolle *
Veterinary Research Technician

Mclaughlin, Robert J *
Veterinary Research Technician

Varada, Rao DVM PhD *
ASL, Attending Veterinarian

* Left NEIDL during FY18

* Joined NEIDL during FY18

Operations Leadership

Thomas Daley
Director, NEIDL Operations

J Scott Rusk
Core Director, Facilities & Biocontainment Ops

Kelly Nee
Core Director, Biosecurity
Chief, BU Police

Kevin Tuohey
Interim Chief Safety Officer, EH&S

Administration

Corley, Ronald B PhD
Director, NEIDL

Daley, Thomas
Director, Operations

Durkop, Betina A
Executive Coordinator

Forman, Lora
Administrative Manager, Operations

Trevino, Richard P MPH
Director, Finance & Research Administration

Community Relations

Britton, Valeda J JD
Executive Director, Community Relations
Boston University Government Affairs

Idiokitas, Chimel
Assistant Director, Community Relations
Boston University Government Affairs

Facilities Maintenance & Operations

Amadio, Paul
Facilities Engineering Ops Manager

Ananian, David
General Mechanic

Baires, J Victoria
Custodian

Bolger, Eileen *
Control Center Technician I

Corbett, Joseph
Controls Manager

Ercolino, Elijah
Director, Building Automation Svces

Fonseca, Paulo *
Control Technician II

Galloway, William S *
General Mechanic

Gendron, Jonathan
General Mechanic

Kjersgard, Eric
Control Center Technician II

Leblanc, John M
Grounds Supervisor

Lorimer, Reed **
Undergraduate Student
BU, Biomedical Engineering

McCall, John
Director, Information Technology

Moody, Donald
Grounds Worker

Morahan, Richard
Mechanic

Mosca, Derek
Maintenance Mechanic

Munroe, James
Director, BU Facility Ops

Murphy, James *
General Mechanic

Rodriguez, Mario
Custodian

Rusk, Scott
Director, Biocontainment Ops

Sousa, Daniel
Shipping & Receiving

Slutzky, Benjamin *
IT Administrator

Tucker, Daniel *
Maintenance Mechanic

Tupe, Michael
Maintenance Mechanic

Viera, Jesus *
Grounds Worker

Walsh, James *
General Mechanic

Environmental Health & Safety

Banh, Daniel *
Program Manager, NEIDL EH&S

Benjamin, Shannon *
Associate Director, Research Safety for High Containment

Mariani, Nicholas
NEIDL Research Safety Specialist

Madico, Guillermo
Scientific Safety Officer

Malmberg, Michael *
Senior Research Safety Specialist

Olinger, Gene PhD
Associate Director, Maximum Containment Training

Tuohey, Kevin M
Interim CSO; Executive Director, Research Compliance

Vinson, Aron J
Program Manager, Emergency Response Planning

Yun, Nadezhda *
Associate Director, Research Safety for Maximum Containment

Public Safety

Management & Staff

Gibbons, William
Director, Public Safety, BUMC

Paparo, Scott
Public Safety Systems Integrator

Puleo, Matthew R *
Public Safety Systems Integrator

Taranto, Stephen L
Public Safety Operations Supervisor

Tracy, Harris
Public Safety Systems Integrator

Zarth, Melody L
Personnel Suitability Specialist

Public Safety Officers

Annese, Rae
Barros, Christopher L
Barros, Jeffrey P
Duffy, Joseph M
Gallivan, John

Granados, David J
Justen, Ann *
Maldonis, Joseph
O'Hara, Sean R
Phelps, Justin

Saad, Jacob
Salhi, Adil
Spellman, David F
Tupe, Michael T
Wynne, Paul M
Wynne, Sean C

* Left NEIDL during FY18

* Joined NEIDL during FY18

Research

The research activities of the NEIDL faculty focus on pathogenesis of emerging viral, bacterial, and protozoan parasitic pathogens and continue to be supported by significant external grant funding (see below). The faculty come from four Schools of Boston University (Medicine, Dental Medicine, Engineering, and Arts and Sciences), as is appropriate for a University Center. Most of these faculty have developed multidisciplinary programs that engage the expertise of faculty, staff and trainees with diverse backgrounds across the university. These collaborations include scientists not only in the faculty's home departments (Microbiology, Medicine, Molecular and Cell Biology, Biomedical Engineering, Biology, Anatomy and Neurobiology) but also from the Center for Regenerative Medicine, the Photonics Center, and from Engineering and Chemistry. Many NEIDL investigators collaborate actively with faculty external to Boston University, including from both US and international institutions. Research programs have also engaged a wide array of undergraduate and graduate students, including graduate students from programs in Microbiology (Host Pathogen Interactions), Immunology, Bioinformatics, MCBB (Molecular Biology, Cell Biology and Biochemistry) and Engineering. These types of collaborative programs and training activities exemplify the "research style" that has become a hallmark of the NEIDL.

NEIDL investigators have successfully competed for over $20M in research and support during FY18 year. Funding comes from a variety of competitive sources, including the National Institutes of Health, the Department of Defense, the pharmaceutical industry, and private foundations, as well as subcontracts with faculty at collaborating institutions.

The funding diversity reflects the research mission of the NEIDL, which encompasses everything from basic research to understand the nature of pathogens and their interactions with a host during infection, to more translational and applied research to develop diagnostics, therapeutics and vaccines. These research programs continue to attract outstanding graduate students, postdoctoral researchers and staff scientists into NEIDL faculty laboratories.

Publications resulting from our research efforts during this past fiscal year are detailed below.

Publications

CDC Safety Training Course for Ebola Virus Disease Healthcare Workers.
Narra R, Sobel J, Piper C, Gould D, **Bhadelia N**, Dott M, Fiore A, Fischer WA 2nd, Frawley MJ, Griffin PM, Hamilton D, Mahon B, Pillai SK, Veltus EF, Tauxe R, Jhung M. Emerg Infect Dis. 2017 Dec;23(13). doi: 10.3201/eid2313.170549. PMID: 29154748

Providing palliative care and pain relief during the Ebola epidemic and the Haiti earthquake: a false dichotomy between survival and comfort during humanitarian emergencies and crises .
Bhadelia, N. Alleviating the access abyss in palliative care and pain relief—an imperative of universal health coverage: the Lancet Commission report. Knaul FM, Farmer PE, Krakauer EL, De Lima L, Bhadelia A, Jiang Kwete X, Arreola-Ornelas H, Gomez-Dantes O, Rodriguez NM, Alleyne GAO, Connor SR, Hunter DJ, Lohman D, Radbruch L, Del Rocio Saenz Madrigal M, Atun R, Foley KM, Frenk J, Jamison DT, Rajagopal MR, Lancet Commission on Palliative Care and Pain Relief Study Group. Lancet. 2018 Apr 7;391(10128):1391-1454. doi: 10.1016/S0140-6736(17)32513-8. Epub 2017 Oct 12. PMID: 29032993

Arthropod EVs mediate dengue virus transmission through interaction with a tetraspanin domain containing glycoprotein Tsp29Fb.
Vora A, Zhou W, Londono-Renteria B, Woodson M, Sherman MB, **Colpitts TM**, Neelakanta G, Sultana H.
Proc Natl Acad Sci U S A. 2018 Jun 26. pii: 201720125. doi: 10.1073/pnas.1720125115. [Epub ahead of print] PMID: 29946031

Serosurvey of Human Antibodies Recognizing Aedes aegypti D7 Salivary Proteins in Colombia.
Londono-Renteria BL, Shakeri H, Rozo-Lopez P, Conway MJ, Duggan N, Jaberi-Douraki M, **Colpitts TM**.
Front Public Health. 2018 May 18;6:111. doi: 10.3389/fpubh.2018.00111. eCollection 2018. PMID 29868532

A relevant in vitro human model for the study of Zika virus antibody-dependent enhancement.
Londono-Renteria B, Troupin A, Cardenas JC, Hall A, Perez OG, Cardenas L, Hartstone-Rose A, Halstead SB, **Colpitts TM**. Gen Virol. 2017 Jul;98(7):1702-1712. doi: 10.1099/jgv.0.000833. Epub 2017 Jul 8.PMID:28691657

"Polyamines and Hypusination Are Required for Ebolavirus Gene Expression and Replication".
Olsen ME, Filone CM, Rozelle D, Mire CE, Agans KN, Hensley L, **Connor JH**. MBio. 2018 Jun 5;9(3). pii: e01065-18. doi: 10.1128/mBio.01065-18. PMID: 29871921

Wolbachia wStri Blocks Zika Virus Growth at Two Independent Stages of Viral Replication.
Schultz MJ, Tan AL, Gray CN, Isern S, Michael SF, **Frydman HM**, **Connor JH**. MBio. 2018 May 22;9(3). pii: e00738-18. doi: 10.1128/mBio.00738-18. PMID: 29789369

Dual Insect specific virus infection limits Arbovirus replication in Aedes mosquito cells.
Schultz MJ, **Frydman HM**, **Connor JH**. Virology. 2018 May;518:406-413. doi: 10.1016/j.virol.2018.03.022. Epub 2018 Apr 3. PMID: 29625404

A conserved transcriptional response to intranasal Ebola virus exposure in nonhuman primates prior to onset of fever.
Speranza E, Bixler SL, Altamura LA, Arnold CE, Pratt WD, Taylor-Howell C, Burrows C, Aguilar W, Rossi F, Shamblin JD, Wollen SE, Zelko JM, Minogue T, Nagle E, Palacios G, Goff AJ, **Connor JH**. Sci Transl Med. 2018 Mar 28;10(434). pii: eaaq1016. doi: 10.1126/scitranslmed.aaq1016. PMID: 29593102

Group B Wolbachia Strain-Dependent Inhibition of Arboviruses.
Schultz MJ, **Connor JH**, **Frydman HM.** DNA Cell Biol. 2018 Jan;37(1):2-6. doi: 10.1089/dna.2017.4025. Epub 2018 Jan 3. PMID:29297702

Comparison of Transcriptomic Platforms for Analysis of Whole Blood from Ebola-Infected Cynomolgus Macaques.
Speranza E, Altamura LA, Kulcsar K, Bixler SL, Rossi CA, Schoepp RJ, Nagle E, Aguilar W, Douglas CE, Delp KL, Minogue TD, Palacios G, Goff AJ, **Connor JH**. Sci Rep. 2017 Nov 7;7(1):14756. doi: 10.1038/s41598-017-15145-7. PMID: 29116224

HoTResDB: Host Transcriptional Response Database for Viral Hemorrhagic Fevers.
Lo J, Zhang D, Speranza E, Negron JA, **Connor JH**. Bioinformatics. 2017 Sep 22. doi: 10.1093/bioinformatics/btx599. [Epub ahead of print] PMID: 29028885

Host Transcriptional Response to Ebola Virus Infection.
Speranza E, **Connor JH**. (2017) Vaccines; Sep 20;5. pii: E30. doi: 10.3390/vaccines5030030. PMID: 28930167

Polyamines and Their Role in Virus Infection.
Mounce BC, Olsen ME, Vignuzzi M, **Connor JH**. Microbiol Mol Biol Rev. Sep;81(4). pii: e00029-17. doi: 10.1128/MMBR.00029-17. Print 2017 Dec. PMID: 28904024

Pneumonia in a Captive Central Bearded Dragon With Concurrent Detection of Helodermatid Adenovirus 2 and a Novel Mycoplasma Species.
Crossland NA, DiGeronimo PM, Sokolova Y, Childress AL, Wellehan JFX Jr, Nevarez J, Paulsen D. Vet Pathol. 2018 Jan 1:300985818780451. doi: 10.1177/0300985818780451 PMID: 29940815

Pathology in Practice.
St Blanc A, **Crossland NA**, DiGeronimo PM, Cianciolo RE, Pirie GJ Jr, Thiessen AE, Wakamatsu N. J Am Vet Med Assoc. 2018 Jul 1;253(1):53-56. doi: 10.2460/javma.253.1.53. PMID: 29911950

Diabetes Mellitus With Concurrent Cerebellar Degeneration and Necrosis in a Domestic Goose (Anser anser domesticus).
DiGeronimo PM, **Crossland NA**, Jugan A, Nevarez JG, Tully TN Jr, Evans DE. J Avian Med Surg. 2018 Jun;32(2):122-127. doi: 10.1647/2017-255. PMID: 29905099

Pathology in Practice.
Warshaw M, **Crossland NA**, DiGeronimo PM, Jarvi SI, Pirie GJ Jr, Evans DE. J Am Vet Med Assoc. 2018 Mar 1;252(5):545-548. doi: 10.2460/javma.252.5.545. PMID: 29461163

Late Disseminated Lyme Disease: Associated Pathology and Spirochete Persistence Post-treatment in Rhesus Macaques.
Crossland NA, Alvarez X, Embers ME. Am J Pathol. 2018 Mar;188(3):672-682. doi: 10.1016/j.ajpath.2017.11.005. Epub 2017 Dec 12. PMID:29242055

Macrophages and Dendritic Cells Are the Predominant Cells Infected in Measles in Humans.
Allen IV, McQuaid S, Penalva R, Ludlow M, **Duprex WP**, Rima BK. mSphere. 2018 May 9;3(3). pii: e00570-17. doi: 10.1128/mSphere.00570-17. eCollection 2018 May-Jun. PMID:29743202

Whether you are a virus or a learned society-based virology journal, evolution is critical for success!
Harris M, **Duprex WP.** J Gen Virol. 2018 Jan;99(1):1-2. doi: 10.1099/jgv.0.000997. PMID: 29347999

Needle-free delivery of measles virus vaccine to the lower respiratory tract of non-human primates elicits optimal immunity and protection.
de Swart RL, de Vries RD, Rennick LJ, van Amerongen G, McQuaid S, Verburgh RJ, Yüksel S, de Jong A, Lemon K, Nguyen DT, Ludlow M, Osterhaus ADME, **Duprex WP**. NPJ Vaccines. 2017 Aug 1;2:22. doi: 10.1038/s41541-017-0022-8. eCollection 2017. PMID: 29263877

Idiosyncratic Mòjiāng virus attachment glycoprotein directs a host-cell entry pathway distinct from genetically related henipaviruses.
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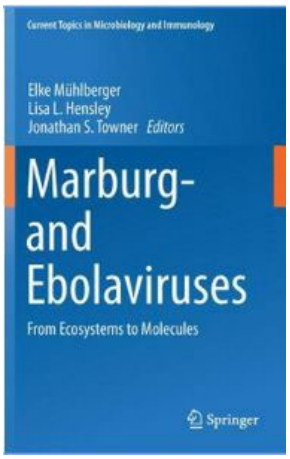

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FY18 Funded Research

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 $20 MM in funding in FY18 for the following projects:

PI	SCHOOL-DEPT	TITLE	SPONSOR	PROJECT PERIOD	FUNDS IN FY18
The following are faculty whose work is carried out within the NEIDL facility:					
BHADELIA	MED NEIDL GRANTS	BU-UL PARTNERSHIP TO ENHANCE EMERGING EPIDEMIC VIRUS RESEARCH IN LIBERIA (BULEEVR)	NIH/FOG	8/31/2018-9/8/2017	50,000
COLPITTS	MED MICRO NEIDL GRANTS	EFFECTS OF PRE-EXISTING DENGUE VIRUS IMMUNITY ON ZIKA VIRUS INFECTION	NIH/NIAID	8/7/2017-07/31/2018	246,750
CONNOR	MED MICRO NEIDL GRANTS	GENETIC PROBING OF RESIDUES INVOLVED IN EBOLAVIRUS GLYCOPROTEIN ENTRY	NIH/NIAID	7/1/2018-6/30/2020	247,500
HAYDAR (50% CONNOR)	ANAT & NEURO	ASSESSMENT OF INFECTION ROUTE AND VULNERABILITY OF NEURAL PRECURSOR CLASSES TO ZIKA VIRUS	NIH/NINDS	9/30/2016-8/31/2018	205,279
KUOHUNG (50% CONNOR)	CLIN-OBGYN	PLACENTAL DEFENSES AGAINST ZIKA VIRUS INFECTION	NIH/NIAID	7/25/2017-6/30/2018	258,196
CORLEY	NEIDL	NATIONAL EMERGING INFECTIOUS DISEASES LABORATORIES OPERATIONS	NIH/NIAID	6/1/2016-5/31/2018	9,500,000
DUPREX	MED MICRO NEIDL GRANTS	DIVA: VANQUISHING ACUTE VIRAL INFECTIONS BY FINDING THE TIPPING POINT	DOD/DARPA	3/1/2017-2/28/2019	740,514
FEARNS	MED MICRO NEIDL GRANTS	TREATING RESPIRATORY SYNCYTIAL VIRUS INFECTION BY TARGETING A VIRUS-ASSOCIATED KINASE	HARTWELL FDN	4/1/2015-3/31/2018	100,000
FEARNS	MED MICRO NEIDL GRANTS	MECHANISM OF ACTION OF AN RSV N PROTEIN INHIBITOR	ENANTA Pharma	4/1/2018-10/1/2018	66,916
FEARNS	MED MICRO NEIDL GRANTS	DEVELOPMENT OF AN IN VITRO ASSAY FOR PARAMYXOVIRUS POLYMERASES	ALIOS Pharma	5/16/2014-5/15/2019	95,157
FEARNS	MED MICRO NEIDL GRANTS	MECHANISMS OF MARBURG VIRUS GENE EXPRESSION	NIH/NIAID	5/8/2018-4/30/2023	563,009

FEARNS	MED MICRO NEIDL GRANTS	INITIATION AND REGULATION OF RSV MRNA TRANSCRIPTION AND GENOME REPLICATION	NIH/NIAID	7/31/2018-8/7/2014	415,000
GALAGAN	BIOMED ENG	SYSTEMS BIOLOGY OF THE CIRCADIAN CLOCK OUTPUT NETWORK	NIH/NIGM	1/1/2018-12/31/2018	120,000
GALAGAN	BIOMED ENG	GLOBAL MAPPING AND ANALYSIS OF BACTERIAL TRANSCRIPTIONAL REGULATORY NETWORK	NIH/NIGM	6/1/2018-5/31/2019	452,898
GALAGAN	BIOMED ENG	IDENTIFYING MOLECULAR SIGNATURES OF DRUG SUSCEPTIBILITY IN ENTEROCOCCUS FAECIUM	PHILIPS	7/1/2017-7/31/2018	494,167
GALAGAN	BIOMED ENG	CHEMICAL AND BIOCHEMICAL DETERMINANTS OF PHOSPHOROTHIOATE STABILITY AND LOCATION IN BACTERIAL GENOMES	NSF	8/1/2017-7/31/2018	74,882
KOO (50%)	ANAT & NEURO	COMPUTER AIDED DECODING OF BRAIN-IMMUNE INTERACTIONS IN GULF WAR ILLNESS (GWI): A JOINT EMBEDDING ON BRAIN CONNECTOMIC AND IMMUNOGENETIC MARKERS	USAMRIID	9/1/2017-8/31/2020	666,189
KRAMNIK	MED NEIDL GRANTS	ABERRANT IMMUNE ACTIVATION IN THE TUBERCULOUS GRANULOMA: A PIVOTAL ROLE IN NECROSIS	NIH/NHLBI	7/15/2016-6/30/2018	737,411
KRAMNIK	MED NEIDL GRANTS	NECROSIS IN PULMONARY TB GRANULOMAS: DYNAMICS, MECHANISMS, THERAPIES	NIH/NHLBI	5/1/2016-4/30/2020	714,449
MUHLBERGER	MED MICRO NEIDL GRANTS	DECIPHERING THE PATHOGENIC POTENTIAL OF LLOVIU VIRUS, A NOVEL FILOVIRUS	NIH/NIAID	2/13/2018-1/31/2020	205,990
MUHLBERGER	MED MICRO NEIDL GRANTS	THE ROLE OF TLR4 SIGNALING IN THE PATHOGENESIS OF FILOVIRUS INFECTION	NIH/NIAID	5/10/2018-4/30/2020	247,375
Total NEIDL Investigators					**$ 16,201,682**
The following are affiliated NEIDL investigators whose labs are located outside the NEIDL					
HAYDAR	ANAT & NEURO	MECHANISMS OF WHITE MATTER DEVELOPMENT IN DOWN SYNDROME	NIH/NINDS	4/1/2018-3/31/2023	643,018
HAYDAR	ANAT & NEURO	HETEROGENEITY OF FOREBRAIN NEURAL PRECURSORS	NIH/NINDS	9/30/2015-6/30/2018	673,080
KEPLER	MICRO	MODELING AFFINITY MATURATION AT MOLECULAR RESOLUTION	NIH/NIAID	4/15/2015-3/31/2020	1,557,612

KEPLER	MICRO	THE B CELL REPERTOIRE AS A WINDOW INTO THE NATURE AND IMPACT OF THE LUNG VIROME	NIH/NIAID	5/1/2017-4/30/2019	279,993
KEPLER	MICRO	STATISTICAL METHODS FOR HDX-MS AND OTHER PROTEIN-DYNAMIC ASSAYS	NIH/NIAID	5/1/2018-4/30/2019	78,500
KEPLER	MICRO	HIV-1 VACCINE-ELICITED ANTIBODIES TARGET ENVELOPE GLYCANS	NIH/NIAID	6/1/2016-5/31/2018	18,071
KEPLER	MICRO	IMMUNE SIGNATURES OF DIFFERENTIAL NHP GRANULOMA STATES	GATES FDN	7/1/2017-12/31/2017	10,170
KEPLER	MICRO	IMMUNE SIGNATURES OF DIFFERENTIAL NHP GRANULOMA STATES	GATES FDN	7/1/2017-12/31/2018	17,020
KEPLER	MICRO	CHAVI-SRSC J COMPUTATIONAL BIOLOGY	NIH/NIAID	7/15/2012-6/30/2018	245,550
KEPLER	MICRO	STRUCTURE-FUNCTION ANALYSIS OF INFECTION- AND VACCINE-INDUCED B-CELL REPERTOIRES	NIH/NIAID	8/1/2017-7/31/2018	87,045
KEPLER	MICRO	NEISSERIAL PORINS AND ANTIGEN PRESENTING CELLS	NIH/NIAID	9/1/2016-8/31/2018	134,173
SAMUELSON	SDM MOL & CELL BIO	GENETIC MODIFICATION OF CULTURED CRYPTOSPORIDIUM TO TEST THE AUTOINFECTION MODEL	NIH/NIAID	2/1/2017-1/31/2019	205,990
SAMUELSON	SDM MOL & CELL BIO	STRUCTURE AND DEVELOPMENT OF OOCYST AND SPOROCYST WALLS	NIH/NIAID	8/1/2015-1/31/2020	407,834
Total NEIDL Affiliated Investigators					**$ 4,358,056**
Total NEIDL and AFFILIATED Investigators					**$ 20,559,738**

Seed Funding, 2017 - 2018

The NEIDL is fortunate to be able to provide financial support for pilot programs to investigators to develop new innovative science initiatives to further the NEIDL mission, to support proof-of-principle studies, and to provide infrastructure support through new instrumentation. Funds are also used for operational support for anticipated future programs in the NEIDL, for attending scientific meetings and forums, and for shared instrumentation repair and upgrades. It is worth noting that much of the equipment in the NEIDL is already 8 – 10 years old. Collectively, the expectation is that seed funding from the Director's Fund will be leveraged to improve the research enterprise, promote multidisciplinary studies between NEIDL investigators and investigators across the institution, and/or to develop new programs within the NEIDL, as well as to sustain existing programs where other sources of funding are essential. The following programs received seed funding during this fiscal year.

1. Arbovirus study and establishment of the NEIDL insectary

This year, funds were used to help expand our research into arboviruses (viruses spread by arthropod vectors, such as mosquitoes and ticks). In the prior two years, funding had been used to initiate a Zika virus program, which represented our first arbovirus studies. This year, with the recruitment of a new

faculty member, Tonya Colpitts, who studies viral pathogenesis at the interface between the virus, the vector (mosquito) and the host, the NEIDL used funds to outfit and establish a functional insectary which is capable of allowing investigators to safely undertake work on mosquitoes and the arboviruses they transmit. This insectary can be used to study viruses at both Arthropod Containment Laboratory Biosafety level 2 (ACL-2) and ACL-3, enabling the expansion of studies into BSL-3 viruses.

There are four rooms in the insectary, arranged for optimum safety and the flow of experiments. The first room is for PPE and preparation. The second room is for growing mosquitoes, sorting larvae and pupae and performing other maintenance duties. The third room is the experimental procedure room and is the only room where mosquito manipulations and virus infections are performed. The final room is for storage and trash removal. The fourth room also connects to the ABSL-3 (Animal Biosafety Level 3) so that experimental animals can be brought into the insectary for transmission studies when necessary. Currently, Dr. Colpitts laboratory is actively using the space, with the expectation that other laboratories can take advantage of the facility over time.

Funding was also provided to support new studies on host cytokine – vector crosstalk, to determine the impact of host immune status on transmission of pathogens (Colpitts, Bhadelia).

2. Support of a BSL-2 microbial repository

During this past year, we continued to invest in the personnel, resources, and tools needed to develop a secured freezer repository within the NEIDL to store viruses that could be of future interest to NEIDL investigators and their collaborators. The agents, when needed in research, will be distributed to investigators with appropriate IBC protocols and training for their research. The rationale for developing this repository was to accelerate our ability to do research on emerging pathogens, since it often takes considerable time to obtain pathogens of interest. We learned our lesson from the recent Zika virus outbreak: when our investigators tried to obtain samples of Zika virus, it took 4 months in order to get samples. The agents we are importing are those that are generally present in the western hemisphere and are known or predicted to be concerns, and/or are related to pathogens in the western hemisphere or are of more immediate interest to our faculty. During the next year, we plan to expand the repository into BSL-3 viral pathogens.

3. Other areas of Support

The NEIDL Director's Funds were also used to support NanoString studies of the Connor laboratory for biomarker discovery, as well as for innovative studies on the nature of a novel potential filovirus, the Lloviu virus, which was discovered as a viral sequence in European bats from Spain in 2002 (Mühlberger). New instrumentation includes a new liquid nitrogen storage system, as well as significant repair and upkeep of equipment in BSL-2 and BSL-3.

Funding was also used to support travel of various staff to scientific meetings to support their career development.

Finally, funding to support scholarships to students enrolled in Boston University's Careers in Medicine Program were granted, representing another way we can give to the community to enhance the diversity of students in STEM careers.

Introducing New Faculty

Tonya Colpitts, PhD

ASSISTANT PROFESSOR, MICROBIOLOGY

Dr. Colpitts' research focuses on arbovirus pathogenesis and cellular interactions during infection in the mosquito and the mammal, examining the host-virus-vector interface. Arboviral diseases are one of the leading causes of morbidity and disability in the developing world. The majority of these diseases lack an effective vaccine or specific treatment to prevent infection and control transmission. We aim to uncover mechanisms at play during the entire arboviral transmission cycle, from infection in the mammal to acquisition in the mosquito vector, and transmission from the mosquito back to the mammal.

Currently her laboratory is focused on Dengue and Zika viruses, both flaviviruses transmitted by Aedes mosquitoes. Dengue virus causes serious human disease and mortality worldwide. Infection results in a severe febrile illness, occasionally leading to lethal hemorrhagic fever, especially in children. In recent years, there has been increased epidemic activity and geographic expansion of dengue infection along with its mosquito vector, and it is considered a serious emerging global health problem. The disease has an enormous impact on the health and economies of tropical and subtropical regions, with dengue infections occurring in Asia, the Americas, Africa, Pacific and Mediterranean regions. While most cases in the United States occur in travelers returning from endemic areas, there have been recent outbreaks in Texas, Florida and Hawaii, where transmission occurred on American soil. Zika virus is a rapidly emerging flavivirus that has recently been responsible for severe disease outbreaks in the Western hemisphere. Zika fever is characterized by mild headache, rash, fever, malaise, conjunctivitis, and joint pain. There are no targeted therapeutics or prophylactic drugs, and treatment is generally palliative. Recently described neurological complications of Zika virus infection include babies born with microcephaly and the development of Guillain-Barre syndrome in adults. As climate change continues, the range of Aedes, the mosquito vectors of dengue and Zika viruses, is expected to expand northwards, placing an increased proportion of the US public at risk for disease.

Nicholas Crossland, DVM, DACVP

ASSISTANT PROFESSOR, PATHOLOGY AND LABORATORY MEDICINE

Dr. Crossland is a board certified Veterinary Anatomic Pathologist. He shares a dual appointment as an Assistant Professor in the Department of Pathology and Laboratory Medicine at Boston University School of Medicine and an Investigator at the NEIDL. His primary responsibility is the development and optimization of an experimental pathology service that will operate safely and efficiently in in the highest biosafety level (BSL4). His specialization is in comparative pathology and the use of animal models to best mimic human diseases. Dr. Crossland takes pride in closely working with all of the NEIDL investigators and helps address investigators research goals by making the most out of their animal studies. Future teaching goals include the development of a comparative pathology slide seminar for MD pathology residents using veterinary cases to communicate correlates of human and animal diseases. His lab space is also open to graduate students from the Pathology and Laboratory Medicine Department where he provides mentorship in the development and optimization of immunohistochemistry and RNA in situ hybridization techniques to answer complex biological questions asked by NEIDL investigators.

Bang-Bon Koo, PhD

ASSISTANT PROFESSOR, ANATOMY AND NEUROBIOLOGY

Dr.Koo's research interests span the areas of neuroimaging, particularly the development of multi-modal magnetic resonance imaging (MRI) and analysis methods. Neuroimaging commonly aims to identify difference between healthy and unhealthy brains in a quantitative way. However, due to the complexity of the human brain, it is extremely difficult to analyze early stage or slow disease progressions from visually inspecting the image. Dr.Koo's work focuses on developing novel imaging protocols and mapping methods with better sensitivities on monitoring neurological and functional changes in the brain. The goal is to develop multimodal imaging protocol that allows in-vivo monitoring on different stages of tissue inflammatory/immune responses.

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.

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Invited Speakers - National and International Forums

Nahid Bhadelia

- A World Without Malaria? Martina Brandegee Lawrence Forum, Invited Panelist. The Windsor School, Boston, MA May 3, 2018

Tonya Colpitts

- *Garlic reduces inflammation and oxidative stress during dengue virus infection*. Londono-Renteria B, Troupin A, Hall A, Colpitts TM. American Society of Tropical Medicine and Hygiene Annual Meeting, Baltimore, MD. November 5-9, 2017.
- *Development of transmission-blocking vaccines for flaviviruses*, University of Florida Emerging Pathogens Institute, Gainesville, FL. March 2018.

John Connor

- Ragon Institute (MIT Synthetic Biology Center). October 2017
- Boston University, Department of Medicine, ID Section. October 2017
- Harvard Immunology (TH Chan school of public health) December 2017
- Invited Speaker. National University Singapore (Duke-NUS). January 2018
- Invited speaker, session chair. EMBO Conference on Mathematical Modeling and Infectious Disease. January 2018
- *"Viruses No Longer Welcome: Using bacteria to fight the spread of viruses in mosquitos"* Bryn Mawr University, Bryn Mawr PA. April 2018
- Swarthmore College, Swarthmore PA. April 2018

Ronald Corley

- *New laboratories and public opinion: earning support and trust of the public.* WHO International Meeting on BSL-4 Containment Facilities, 13-15 December, Lyon, France
- *Expert panelist at: Emerging diseases : Pasteur's legacy under the spotlight of Climate Change*. 2018 BIO International Convention, June 4-7, 2018 Boston, MA

Paul Duprex

- Modeling the evolutionary trajectories of an ever expanding morbillivirus genus: getting in, getting about and Measles and me: 40,000 foot view before the 10 foot dive! New Horizons for measles-based vaccines and therapeutics: Making and Regulating (Speaker and Symposium Scientific Chair). Vienna, Austria. 2017
- A and B permits us to C H, RSV: right virus, right cells and reasonable animal model. Medimmune LLC, Gaithersburg, MD, USA. 2017

- The contracting and expanding Morbillivirus genus: from eradication to discovery … from acute to chronic. Emerging Viruses of Zoonotic and Veterinary Importance. Cambridge, England, UK. 2017
- Morbilliviruses are much more than measles: why it's critical to keep a close eye on our animal cousins … Institute of Virology and Immunology (IVI), University of Bern, Switzerland. 2017
- The multitropic meanderings of measles: air-borne, immune-spread and brain-doomed! University of San Francisco California, San Francisco, CA, USA. 2017
- From bat … to bedsides. AAAS Annual Meeting: Advancing Science: Discovery to Application Austin, Texas, USA. February 2018
- Multiroute morbillivirus entry. Negative Strand Virology Meeting, Verona, Italy. June 2018

Rachel Fearns

- Mechanism of action of small molecule inhibitors of the RSV polymerase. Invited speaker, GTCBio Antiviral Drugs Research & Development 2017, Baltimore, USA (July 2017)
- Exploration of RSV polymerase activities using small molecule inhibitors and mutagenesis. TWINCORE – Centre for Experimental and Clinical Infection Research, Hannover, Germany (October 2017)
- Initiation of RSV transcription and genome replication. Mayo Clinic, Department of Molecular Medicine, Rochester MN, USA (November 2017).

Horacio Frydman

- Flies and Wolbachia talk using Wnt sign(aling) language. Speaker and Session Chair at Wolbachia 2018, Salem, MA. June 2018.

Tarik Haydar

- "Distinct Progenitor Lineages Fine-Tune Neuronal Diversity in a Layer-Specific Manner." Department of Physiology and Neurobiology, UConn Storrs, CT. October 25, 2017

Kath Hardcastle

- Murine Models of Infectious Disease; Laboratory Animal Veterinary Post-Docs; Massachusetts Institute of Technology, Cambridge, MA. March 2018
- Biosafety practices working with animals in maximum biocontainment; American Biological Safety Association (ABSA) Annual Conference, Cambridge, MA. November 2017
- Infectious Disease Research Models. Boston Laboratory Animal Veterinary Group, Boston, MA. Nov 2017
- Novel ferret cages specifically designed for use in high and maximum biocontainment. AALAS National Meeting, Austin, TX. October 2017

Gerald Keusch

- Implementing Clinical Trials during Epidemics: The Ebola Experience. Center for Global Development, Washington DC. August 10, 2017
- A Wake-Up Call For R&D: Developing Vaccines And Therapeutics In The Midst Of An Epidemic. World Bank Health, Nutrition, Population Group, Washington DC. September 7, 2017.
- Research governance during epidemics. Center for Strategic and International Studies, Washington DC. September 8, 2017.
- Therapeutics and Vaccines for Ebola. Boston Medical Center Infectious Diseases Grand Rounds. January 11, 2018
- Improving Clinical Research And Trials During Epidemics: When Will We Ever Learn? University of North Carolina Infectious Diseases Grand Rounds. April 20, 2018.

Igor Kramnik

- *TB co-morbidities: roles in host susceptibility, M.tuberculosis transmission and evolution.* The Many Hosts of Mycobacteria MHM-7 meeting. Fort Collins, Colorado. August 10 – 12, 2017.

Elke Mühlberger

- *Filovirus pathogenesis - lessons learned from Ebola's neglected cousins.* Harvard T. H. Chan School of Public Health, Boston, MA, November 29, 2017.
- *E. Minigenomes and why I love them.* 9th International Symposium on Filoviruses, Marburg, Germany, September 13-16, 2017.
- *Filovirus pathogenesis - lessons learned from Ebola's neglected cousins*. Friedrich-Loeffler-Institut, Federal Research Institute for Animal Health, Greifswald, Germany, September 5, 2017.

Scott Rusk

- Second Next Generation Research Labs Conference, Cleveland OH, August 2017.

International Meeting Organizers/Chairs

Paul Duprex

- New Horizons for Measles-based Vaccines and Therapies: Making and Regulating, Themis LLC, Vienna, Austria 2017

Rachel Fearns

- Expressing and Multiplying Session Chairperson; Negative Strand Viruses Conference, Verona, Italy. 2018
- American Society of Virology Plenary Session. Convenor, June 2017

Gerald Keusch.

- Clinical research during epidemics. Convener, Wellcome Trust, London UK. October 10, 2017
- Emerging Epidemic Pathogens: Basic, Translational, and Social Science. Convener, American Association for the Advancement of Science, Austin TX. February 16, 2018

Elke Mühlberger

- 9th International Symposium on Filoviruses, Convener September, 2017

Honors

Tonya Colpitts

- Appointed Director of the Arthropod Containment Lab ACL3, Boston University National Emerging Infectious Diseases Laboratories (NEIDL), Boston, MA. August 2017

Tarik Haydar

- Educator of the Year Award, Boston University School of Medicine
- Jack Spivack Excellence in Neurosciences Award

Editorial Boards

Tonya Colpitts

- Editor for Frontiers Virology, Microbiology (2017-present)

John Connor

- Journal of Virology (2011-2020)

Paul Duprex

- Senior Editor: mSphere, American Society for Microbiology.
- 2017-present: Deputy Editor-in-Chief: Journal of General Virology, Society for General Microbiology

Study Sections and Grant Review Panels

Tonya Colpitts

- 2018 Reviewer for NIH, NIAID R13 panel
- 2017 Reviewer for NIH; Infectious Diseases & Microbiology (IDM) R15 AREA panel
- 2017 Reviewer for National Institutes of Health: Zika virus FOA panel
- 2018 Scientist Reviewer for US DOD PRMRP Vaccine Development Discovery panel
- 2018 Scientist Reviewer for US DOD PRMRP Infectious Disease panel
- 2018 Scientist Reviewer for US DOD MIDRP Flavivirus: Dengue Vaccine panel
- 2017 Scientist Reviewer for US DOD PRMRP Infectious Disease Vaccine panel
- 2017 Scientist Reviewer for US DOD MIDRP Focused Program panel
- 2017 Scientist Reviewer for US DOD MIDRP Flavivirus Vaccine Research panel

John Connor

- 2017 Reviewer Zika R21 study section
- 2017 Reviewer NIAID review panel Virology A
- 2018 Reviewer Zika R21 study section
- 2018 Reviewer F31/32/30 fellowship study section
- 2018 Reviewer NIAID review panel Virology A

Ronald Corley

- National Research Foundation Singapore, Competitive Research Program, September 2017

Rachel Fearns

- 2018 *Ad Hoc* grant reviewer for the French National Research Agency
  2018 CSR reviewer for study titled “Program Evaluation of NIH Peer Review Processes: The Role of Anonymization

James Galagan

- 2017 Appointed reviewer, NIH, Prokaryotic Cell and Molecular Biology Study Section [PCMB]

Elke Mühlberger

- 2018 ***NIH*** Special Emphasis Panel (ZRG1-IDM-W-02), Topics in Virology, April 4, 2018

Advisory Council and Program Memberships

Nahid Bhadelia

- May 2018 - Consultant, Global Health Surveillance and Diagnostics, MRI Global, Palm Bay, Florida

Paul Duprex

- 2015- 2018 American Society of Virology (Scientific Programs Committee Member)
- 2016-2020 American Society for Virology Communications Committee (Chair)
- 2017-2020 ZikaVAX consortium (a public private partnership of European Vaccine Initiative, Institut Pasteur, Themis Bioscience and Commissariat à l'Energie Atomique et aux énergies alternatives). Supported by a 10 million Euro grant from Horizon 2020 Research and Innovation Programme of the Europeans Commission.
- Fellow of the American Society of Microbiology

Rachel Fearns

- 2016-2019 Member ASV Education and Career Development Committee
  2017 Consultant for First Manhattan Co.

Tarik Haydar

- Member, Key Opinion Leader Meeting, Silencing a chromosome in Down syndrome, LuMind Foundation

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International Vaccine Task Force

In November 2017, Gerald T. Keusch, MD, Director of the NEIDL Collaborative Research Core, was appointed by the World Bank and the Coalition on Epidemic Preparedness Innovations (CEPI) to the International Vaccine Task Force (IVTF). The Task Force included 16 international experts convened to advise the Bank and CEPI on strategic investments to strengthen clinical research and clinical trial capacity in low- and middle-income countries with the goal of promoting vaccine development against potentially epidemic infectious diseases. The rationale for this effort was the recommendations in the 2017 report from the U.S. National Academies of Science, Engineering and Medicine on clinical research and trials during the 2014-2015 Ebola outbreak in West Africa, which was Co-Chaired by Dr. Keusch. The Task Force report, *Money and Microbes: Strengthening Clinical Research Capacity to Prevent Epidemics*, issued in May 2018, proposes ways in which national governments and development partners can finance investments in clinical research capacity and strengthen low- and middle-income countries capacity to conduct and participate in a late-stage vaccine trial during an outbreak. The report recommends that concessional funding from the Bank's International Development Association loan program and targeted program support from CEPI, supplemented by contributions from other partners to buy down the loans when countries demonstrate progress, by private sector investments, and domestic resource mobilization in developing countries, be used to invest in clinical research capacity. Current efforts are focused on identifying potential co-funders and implementation partners, and how to operationalize the program and employ the resources most effectively.

Committee on Enhancing Global Health Security through International Biosecurity and Health Engagement Programs

In January 2018, Gerald T. Keusch, MD, Director of the NEIDL Collaborative Research Core, was appointed to the Committee On Enhancing Global Health Security Through International Biosecurity And Health Engagement by the National Academies of Sciences, Engineering, and Medicine. This committee has been charged with examining international health security missions and programs of the Cooperative Biological Engagement Program (CBEP) of the Department of Defense (DoD)'s Cooperative Threat Reduction (CTR) program, and other domestic and international agencies and organizations engaged in similar efforts. The committee will produce a peer-reviewed report with a five-year strategic vision for health security, and consensus findings and recommendations to facilitate the promotion of

biosafety, biosecurity, disease surveillance, health security, and biorisk management with foreign partner countries.

The Cooperative Biological Engagement Program at the Defense Threat Reduction Agency has existed for over 20 years worked to reduce the threat posed by especially dangerous pathogens and related materials and expertise, as well as other emerging infectious disease risks. CBEP, in collaboration with other U.S. government agencies and international partners, builds long-term capabilities that create human capital, infrastructure, and culture to support partner countries' achievement of the International Health Regulations (IHR) and relevant goals of the Global Health Security Agenda (GHSA). These collaborations also support international nonproliferation agreements, such as the Biological and Toxin Weapons Convention and United Nations Security Council Resolution 1540.

The objective of the review is to help CBEP and its sister programs to be as effective as possible and ensure that important opportunities are not missed. To accomplish this the study committee will examine multiple U.S. government missions and programs to identify coordination gaps and challenges. Based on identified gaps and challenges, the study will make recommendations to optimize coordination and resources in U.S. government agencies with the ultimate objective to promote biosafety, biosecurity, disease surveillance, health security, and biorisk management in foreign countries. The report is due in early 2019. The NEIDL will host one of the committee meetings in the fall of 2018.

Professional Certifications

Our NEIDL ABSL4 Animal Core Operations Manager, Corey Nunes and Technician, Yulianela Diaz Perez passed the American Association of Laboratory Animal Science's (AALAS) highest certification exam for Laboratory Animal Technologist (LATG). The AALAS Technician Certification Program sets professional standards for the advancement of laboratory animal science. This program was developed to recognize professional achievement and provide an authoritative endorsement of a technician's level of knowledge in laboratory animal technology. The technician certification designations of ALAT (Assistant Laboratory Animal Technician), LAT (Laboratory Animal Technician), and LATG (Laboratory Animal Technologist) are well known and widely used throughout the varied fields of laboratory animal care. In fact, these certifications have come to be a common requirement for a lab animal care position.

NEIDL Public Safety Officer Adil Salhi is a state-certified medical instructor who provides mandatory medical training for the Public Safety Department at BUMC. This year Officer Sahli has completed two in-house CPR-Medical Training sessions for NEIDL associated personnel and will continue doing so going forward.

NEIDL Public Safety Officer Ann Justen, who has joined the NEIDL this year, has completed the 16-week Special State Police Officers Academy in New Braintree, Massachusetts. This very challenging training program is a combination of academics, law, physical fitness, and law enforcement tactics administered by the Massachusetts State Police.

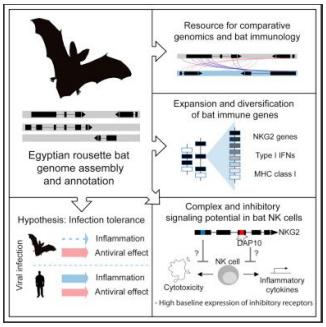
NEIDL Researchers in the News

Can the Egyptian Fruit Bat's Unusual Genome show us How to Fight Deadly Marburg Virus?

Original article from **Genetic Literacy Project** by Ricki Lewis. June 5, 2018

The Egyptian fruit bat's immune system enables it to peacefully co-exist with Marburg virus, which can cause a swiftly deadly infection in humans. Although Marburg virus disease affects only a few dozen or hundred people a year, the case: fatality ratio in the scattered outbreaks ranges from 50% to 100%. A recent paper in **Cell** , co-authored by NEIDL scientists Thomas Kepler, Elke Mühlberger and Adam Hume, that explores the bat's genome reveals how its immune system may prevent the virus from harming the flying mammals, which may hold clues for preventing or treating the infection in humans.

The Egyptian fruit bat Rousettus aegyptiacus lives in groups of 1,000 to more than 100,000 in caves and mines in many places in Africa. The bat weighs less than half a pound and is only half a foot long, but the wings stretch to two feet. Males are distinguishable by their large scrotums, and the bats are highly vocal. Marburg virus, and the related Ebola virus, are filoviruses. They have a single strand of RNA as their genetic material.



People are infected with Marburg virus when they touch bat excrement, body fluids, or tissue, and can transmit the infection to other people through direct contact. After an incubation period of 2 to 21 days, the illness starts suddenly with high fever, excruciating headache, and aches and pains. Day three brings severe watery diarrhea, abdominal cramps, and nausea and vomiting.

Click to read more in Genetic Literacy Project

BU Experts on New Ebola Outbreak in Democratic Republic of the Congo

Original article from **BU Today** by Barbara Moran**.** May 31, 2018

On May 8, 2018, the Democratic Republic of the Congo (DRC) declared a new outbreak of Ebola virus disease centered on the market town of Bikoro, near the DRC's border with the Republic of Congo. This is DRC's ninth Ebola outbreak since 1976; the most recent outbreak occurred in 2017.

The Ebola virus, which spreads through contact with bodily fluids, causes severe illness that is often fatal if untreated. The 2014–2016 West Africa outbreak, the largest in history, killed more than 11,000 people. As of May 28, the DRC outbreak included 51 cases and 25 deaths.

BU Today spoke with two Boston University Ebola experts about the unfolding situation in the DRC. John Connor, a School of Medicine associate professor of microbiology and an investigator at BU's National Emerging Infectious Diseases Laboratories, studies better ways to diagnose Ebola virus disease. Nahid Bhadelia, a MED assistant professor in the section of infectious diseases, is the medical director of the Boston Medical Center Special Pathogens Unit, which is designed to care for patients with highly

communicable diseases. During the West African outbreak, Bhadelia made four trips to Sierra Leone to care for patients, work with survivors, and collect public health data.

Click to read more in BU Today

Vaccines Alone Won't Beat Ebola

Original article from **The Atlantic** by Ed Yong**.** May 24, 2018
Updated on May 25 at 3:12 p.m. ET

Three people who had been infected with Ebola recently left an isolation ward at Wangata Hospital against medical advice, according to the Democratic Republic of the Congo's Ministry of Health. The hospital lies in Mbandaka, a city of 1.2 million, where health workers are trying to contain the Congo's ninth Ebola outbreak. One patient was on the mend, but decided to leave on Sunday and didn't come back. Two more left with their families on Monday and went to church. One died at home, before his body was returned to the hospital for safe burial. The other returned voluntarily, before passing away at the hospital.

"Of course you want vaccines, but yellow fever and cholera are perfect examples of disease where we have vaccines and still get raging outbreaks," says Nahid Bhadelia, a physician at Boston University who helped to tackle Ebola in Sierra Leone. "We still need the public-health pillars."

Click to read more in The Atlantic

An Ebola Vaccine Gets Its First Real-World Test

Original article from **WIRED** by Adam Rogers**.** May 21, 2018

The Ebola virus kills half the people who get it, and it's a tragically familiar disease in the Democratic Republic of Congo. Since scientists first characterized the disease in 1976, Congo has had nine outbreaks. Now it's happening again: To date the country has seen 46 possible or confirmed cases, and 26 people are dead.

But this time is different. Four cases are in a city—Mbandaka, with more than a million people and easy transport to the megacity of Kinshasa. That has chilling implications for the potential spread of the infection. "In a rural area you might have had 10 contacts, but in an urban area after two days of fever you might have been in contact with 50, 60," says Micaela Serafini, medical director of MSF Switzerland. "It magnifies the response."

But this outbreak is different for another reason, too: This time there is a vaccine.

Beginning Monday, health care workers and other people on the front lines of the outbreak will receive a recombinant Ebola vaccine called rVSV-ZEBOV. After that, people who've been in contact with those infected with Ebola, and the contacts of those contacts, will get shots, too. It's a strategy called ring vaccination, tailored to put the brakes on in-progress outbreaks.

Click to read more in WIRED

Bats Carry Deadly Viruses But Don't Get Sick. How?

Original article from **Futurity** by Barbara Moran**.** April 26, 2018

The newly-sequenced genome of an Egyptian fruit bat from a cave in Uganda offers clues as to how bats harbor and transmit deadly viruses—but don't get sick themselves.

Researchers were investigating a 2008 case of a 44-year-old woman from Colorado who returned home from a 2-week safari in Uganda and developed a severe headache, chills, nausea, vomiting, and diarrhea. Then came a rash, abdominal pain, fatigue, and confusion.

Doctors eventually diagnosed her illness as Marburg disease, a virus from the same family as Ebola virus, and one of the most deadly pathogens to infect humans. The tourist had likely caught it during a visit to Python Cave, by touching rocks covered with bat guano. She survived, but a Dutch tourist who had visited the same cave and contracted the virus did not.

The genome of *Rousettus aegyptiacus*, the Egyptian fruit bat, includes larger-than-expected families of genes related to the mammalian immune system. Specifically, researchers found large families of interferon and natural killer genes that differed dramatically from their counterparts in other mammals.

As reported in ***Cell***, co-authored by NEIDL scientists Elke Mühlberger, Thomas Kepler, and Adam Hume, the findings may eventually lead to a deeper understanding of virus transmission, and better treatments for humans who become infected.

What we learn from bats may help us in the development of pharmacological agents," says Thomas Kepler, professor of microbiology at Boston University, and co-senior author of the study with Gustavo Palacios of the US Army Medical Research Institute of Infectious Diseases (USAMRIID).

"And more importantly, it may help us understand zoonotic transmission—how animals host a virus without being symptomatic, and pass it to humans. Exactly what is going on in that transmission? What does an animal gain by hosting a virus for a very long time, for co-evolving with the virus, so that when it's transferred, it's highly virulent in the spillover host?"

Click to read more in Futurity

Diagnosing Ebola before Symptoms Arrive

Original article from **BU Today** by Barbara Moran. March 29, 2018

In 2014, an Ebola epidemic began to ravage West Africa. It became the largest Ebola outbreak in history, lasting two years and infecting an estimated 28,000 people—most in Liberia, Guinea, and Sierra Leone. Ultimately, it took more than 11,000 lives.

Many of those lives might have been saved if health-care workers could have treated and quarantined infected people during the early stages of the disease. Currently, however, there is no way to diagnose Ebola until symptoms arrive—and the fever, severe headache, and muscle pain that mark Ebola can strike victims anytime between 2 and 21 days after exposure. "Right now, we wait for diagnosis until the virus spills out of primary infection sites into the blood," says Emily Speranza (GRS'18). "At that point, it's already tremendously far along."

Speranza may have found a better way. Working with colleagues at BU's National Emerging Infectious Diseases Laboratories (NEIDL), as well as the US Army Medical Research Institute of Infectious Diseases (USAMRIID), Speranza, who recently earned a PhD in the interdisciplinary bioinformatics program, studied data from 12 monkeys exposed to Ebola virus and discovered a common pattern of immune response among the ones that got sick. This response occurred four days before the onset of fever—the first observable symptom of infection. The work, funded by the National Institutes of Health, the National Science Foundation, and others and published on March 28, 2018, in the journal *Science Translational Medicine*, suggests a possible biomarker for early diagnosis of the disease.

"Four days! Think about it," says paper senior author John Connor, a School of Medicine associate professor of microbiology and a NEIDL researcher. "If I could tell you four days before you were going to be sick, that would be fantastic."

Click to read more in BU Today

BU Study Raises Prospect of Earlier Diagnosis of Deadly Ebola Virus

March 28th, 2018
Original article from Boston Globe by Martin Finucane. March 28, 2018

Researchers at Boston University say they have detected signs that the deadly Ebola virus causes an immune response in monkeys four days before they begin exhibiting symptoms.

More research is needed, but the discovery raises the prospect of diagnosing the disease earlier in humans, allowing earlier treatment to help patients and earlier quarantine to control breakouts, the university said in a statement Wednesday.

"Right now, we wait for diagnosis until the virus spills out of primary infection sites into the blood," says Emily Speranza, who recently received her doctorate from Boston University's bioinformatics program and is one of the first authors on the paper. "At that point, it's already tremendously far along."

"If you can start treating someone very, very early on after exposure, they're less likely to develop really severe disease," Speranza said in the statement. "And if you can identify people who are sick before they even show symptoms, you can better quarantine and actually control outbreaks."

The research was led by John Connor, a professor at Boston University School of Medicine and a researcher at the university's National Emerging Infectious Diseases Laboratories, a biolab built on the BU medical campus in the South End.

Click to read more in Boston Globe

Themis Establishes Scientific Advisory Board of Experts in Virology and Vaccine Development

BusinessWire February 26, 2018 05:00 AM EST

VIENNA--(BUSINESS WIRE)--Themis has established a Scientific Advisory Board (SAB) with the appointment of Christian W. Mandl, Ph.D., M.D., **W. Paul Duprex, Ph.D**., Stephen J. Thomas, M.D. and Nadia G. Tornieporth, M.D., the company announced today. The newly formed SAB brings a wealth of experience in molecular virology, viral pathogenesis and vaccine development. The purpose of the SAB will be to advise Themis as it continues to develop its pipeline of urgently needed vaccines and immune system activation approaches.

"It is a testament to our achievements as a company and the potential of our technology to have attracted this roster of world-renowned leaders in vaccine development to join our SAB," said Erich Tauber, CEO of Themis. "I would like to welcome Christian, Paul, Stephen and Nadia and look forward to their invaluable scientific insights as we advance our clinical programs and expand our vaccine pipeline beyond infectious diseases."

"Themis' mission is to expand the potential of vectored-vaccine technology and prevent a broad spectrum of infectious diseases," said Dr. Christian Mandl, Chair of the Themis Scientific Advisory Board. "We are eager to contribute to a company which has a focus so closely aligned with our scientific interests and goals. Our commitment is to provide ongoing development and regulatory counsel for Themis' clinical programs and define optimal strategies for advancing their preclinical programs."

Click to read the Themis press release

BU Biolab Prepares To Study Deadly Viruses After Decade Of Controversy

January 10th, 2018
Original article from **CBS Boston** by Lisa Hughes**.** January 9, 2018

BOSTON (CBS) – They will study some of the most deadly viruses in the world and the lab is in a densely populated Boston neighborhood.

After more than a decade of controversy, Boston University's National Emerging Infectious Diseases Laboratory (NEIDL) has received its final approval, and could begin studying Ebola and other viruses in a few months. WBZ-TV got an inside look at what they hope to accomplish, and how they plan to keep themselves, and the community safe.

The Bio Safety Level 4 lab is located in the South End, on Albany Street. It's here that Boston University scientists hope to break the code of some of the world's deadliest pathogens, like Ebola, the virus that killed thousands of people in Africa just a few years ago. In fact, Ebola is the first target of the NEIDL, one of only 10 of these labs in the United States.

"Trying to understand where these pathogens are, and being able to detect them early on would actually go a long way in stopping these types of terrible outbreaks, says Ron Corley, Ph.D. the director of the lab.

Click to read more and view the news clip at CBS Boston

Boston University Gears Up To Research Ebola (Video)

January 5th, 2018

Original article from: ***WGBH News*** posted on January 4, 2018. by Cristina Quinn

After years of neighborhood battles, Boston University has won approval to conduct biosafety level 4 research. In layman's terms, that means they can now study the world's deadliest pathogens at the university's National Emerging Infectious Disease Lab on the medical school's South End campus.

Rows of blue and white protective lab suits hang in the changing room of a simulation of Boston University's biosafety level 4 lab, also known as BSL-4. The real lab is in an inner sanctum of the building with 12-inch thick walls and 14-inch heavily fortified concrete flooring designed to withstand an earthquake.

Coiled air hoses hang from the ceiling. Microbiologist Elke Muhlberger grabs one to demonstrate how it works. Pointing to a socket on the waist of the suit, she takes the end of the hose and snaps it in. Air immediately starts hissing into the suit.

Read Article and Watch Video on WGBH News

Feds lift gain-of-function research pause, offer guidance

Lisa Schnirring | News Editor | **CIDRAP News** | Dec 19, 2017

The National Institutes of Health (NIH) today lifted a 3-year moratorium on funding gain-of-function (GOF) research on potential pandemic viruses such as avian flu, SARS, and MERS, opening the door for certain types of research to resume.

The action coincides with today's release of a US Department of Health and Human Services (HHS) framework for guiding funding decisions about proposed research involving pathogens that have enhanced potential for creating pandemics. […]

Paul Duprex, PhD, professor of microbiology at Boston University School of Medicine and its National Emerging Infectious Diseases Laboratories, is among the lab scientists who have watched the discussions play out against the backdrop of unknowns about whether stalled experiments might have moved the field forward, colleagues' lab work being in limbo, and much time spent justifying the work.

"So on a personal level I'm really pleased these NIH funded scientists get some clarity," he said, noting that today's framework release and lifting of the research funding pause are signs of progress.

Regarding how the framework will play out for reviewers and researchers, the proof will be in the Christmas pudding, Duprex said, adding that he hopes the new framework produces a lean, functional, and responsive process rather than one that is heavily bureaucratic. Read CIDRAP Article

BU Lab will Begin Studying Deadly Viruses

December 12th, 2017

Original article from **The Boston Globe** by Sophia Eppolito**.** December 12th, 2017

Boston University's high-security laboratory can begin studying Ebola, Zika, and other deadly pathogens, after the city's public health commission gave final approval last week for the work to proceed. The move ended a decade and a half of controversy during which South End and Roxbury residents and others raised concerns about an accident or a terrorist attack.

For years, the 192,000-square-foot high-security biolab near Boston Medical Center was tied up by legal challenges and regulatory reviews. Built with $200 million in federal money, the building has been mostly empty since its completion in 2008.

Here is a look back at some key events during the lab's history:

Click to read more in The Boston Globe

NEIDL BSL-4 Lab Gets Green Light

December 7th, 2017

Original article from **BU Today** by Sara Rimer. December 6th, 2017

After years of scrutiny by regulatory agencies and city, state, and federal officials, Boston University's National Emerging Infectious Diseases Laboratories (NEIDL) has received final approval from the Boston Public Health Commission (BPHC) to conduct research at Biosafety Level 4 (BSL-4).

"We're extraordinarily pleased," says NEIDL Director Ronald B. Corley, a School of Medicine professor of microbiology. The BSL-4 lab, on BU's Medical Campus in the South End, was built according to the most stringent safety specifications set by the US government for infectious disease research. Corley says the BPHC permission is "the last hurdle for our scientists being able to work with approved BSL-4 pathogens—specifically, Ebola and Marburg." Ebola and Marburg are both rare but life-threatening viruses that have become global public health threats. There is no available FDA-approved vaccine or therapy for Ebola, which killed and sickened tens of thousands of people in West Africa in a 2014–2016 outbreak, or for Marburg. Ebola cases traveled to the United States and Europe during the 2014 outbreak.

Click to read more in BU Today

BU Infectious Disease Lab gets Clearance to Work with Ebola, Marburg Viruses

December 7th, 2017

Original article from **Boston Business Journal** by Jessica Bartlett**.** December 7th, 2017

Boston University researchers will now be allowed to work with pathogens as viral as Ebola, following the upgrade of one of its labs being upgraded to a Biosafety Level 4 facility by the Boston Public Health Commission.

The upgrade to Level 4 for Boston University's National Emerging Infectious Disease Laboratories is years in the making, the university said, and comes after scrutiny by state, city and federal officials, including approval in December from the Centers for Disease Control and Prevention.

The approval makes the lab the 10th Biosafety Level 4 lab in the country, and only one of two sited on a university campus. The lab, located on BU's Medical Campus on Albany Street in the South End, will now be able to work with pathogens such as Ebola and Marburg viruses.

"As we have seen over the past several years, we are all vulnerable to potentially devastating infectious diseases that may have originated halfway across the globe," said Gloria Waters, BU vice president and associate provost for research, according to a report on BU Today. "With the opening of the NEIDL's BSL-4 lab, BU is poised to establish itself as a national leader in fighting microbial systems and infectious diseases. The work that will be carried out here will bring benefit and relief in the form of vaccines, treatments, and cures to people in Boston, the United States, and around the world.

Click to read more in Boston Business Journal

Boston University To Begin Researching World's Deadliest Infectious Diseases At 'Biolab' (Audio)

December 7th, 2017
Original article from **WBUR** by Lisa Mullins and Lynn Jolicoeur. December 6th, 2017

Boston University has received final approval to begin researching the world's deadliest infectious diseases at its so-called "Biolab" in Boston's South End.

The Boston Public Health Commission gave that approval Wednesday. The Centers for Disease Control had given approval late last year.

The lab has been open but awaiting the final go-ahead for the highest-tier infectious disease research.

Ronald Corley, director of BU's National Emerging Infectious Diseases Laboratory, joined WBUR's *All Things Considered* to discuss.

Click to listen on WBUR

Research On the World's Deadliest Microbes will soon begin at a Boston Lab

December 7th, 2017
Original article from **The Boston Globe** by **Felice J. Freyer** and **Danny McDonald.** December 6th, 2017

The Boston Public Health Commission on Wednesday gave the final approval for Boston University's high-security laboratory to start research on the world's deadliest microbes, ending a decade and a half of controversy.

The commission's OK was the final step allowing the study of Biosafety Level 4 pathogens — those that have no treatment or vaccine, such as Ebola. Level 4 research could begin in a month or two at the facility, called the National Emerging Infectious Disease Laboratories.

Facing fierce opposition from neighbors and others concerned that dangerous germs would escape, the biolab underwent more than a dozen years of risk assessments, public hearings, and failed lawsuits. It received more than 50 permits and approvals from federal, state, and city agencies, most recently passing muster a year ago with the US Centers for Disease Control and Prevention.

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Built with $200 million in federal money, the building has been looming, mostly empty, over the South End near Boston Medical Center since its completion in 2008.

Opponents, including people who live nearby, have said it poses unnecessary risks to the neighborhood and belongs in a more remote area. But a risk assessment by an environmental consulting firm concluded that the likelihood of members of the public becoming infected was "extremely low or beyond reasonably foreseeable."

For five years, teams of microbiologists, virologists, engineers, and other scientists have been doing research on less-dangerous germs in the building. Now, they will be able to move into a separate earthquake-proof structure within the building, encased in 12-inch-thick walls.

Click to read more in Boston Globe

Fogarty funds additional grants to support research training in Ebola-affected countries

NIH Announcement, September, 2017

Ebola struck hardest in three West African countries that had little scientific capacity to monitor or respond to the 2014-2016 outbreak. To better prepare health officials in Guinea, Liberia and Sierra Leone to deal with future infectious disease epidemics, Fogarty has issued a second round of four grants to help the countries develop research training plans through its Emerging Epidemic Virus Research Training for West African Countries with Widespread Transmission of Ebola program.

In Guinea, an award will strengthen an ongoing south-south collaboration between Mali's University of Science, Technique and Technologies of Bamako and the University of Conakry to develop advanced degree and non-degree programs. The effort, which stresses clinical and health services research, brings together two French-speaking countries and principal investigators who were on the frontlines of the

Ebola epidemic. It also draws on the expertise of researchers from NIH's National Institute of Allergy and Infectious Diseases (NIAID), Johns Hopkins University and Northwestern University.

Boston University, through The BU-UL Partnership to Enhance Emerging Epidemic Virus Research in Liberia (BULEEVR) will use its award to assist the University of Liberia's (UL) medical school and health ministry to strategize how to deploy training to address both a shortage of scientific faculty and lack of opportunity for mentored research. In addition, the University of California, San Francisco will collaborate with UL and UCLA to devise a master's-level training program for clinical and epidemiologic research in collaboration with PREVAIL, the Partnership for Research on Ebola Virus in Liberia, a clinical research initiative supported by NIAID. Finally, the University of Hawaii will team up with the University of Yaoundé in Cameroon to improve biomedical sciences at UL where only about one-third of the biology department faculty have degrees above the bachelor's level. Initial goals include devising a career development plan, determining how to strengthen the curriculum and assessing the feasibility of distance learning.

The Fogarty program is intended to help institutions prepare to compete for larger, longer-term grants to implement their research training plans. In 2016, the first year of the program, Fogarty made four awards to fund projects in Sierra Leone and Liberia.

Raising Ebola with Elke Muhlberger (360 Video)

October 24th, 2017

Original article from: ***STAT*** posted on October 20, 2017. by Hyacinth Empinado

Research on dangerous pathogens like Ebola takes place inside highly secure biosafety level-4 (BSL-4) labs. Elke Mühlberger, a researcher at the National Emerging Diseases Laboratory at Boston University, takes you as close to Ebola as you'll ever get and talks about why she thinks of the deadly virus as her pet.
Click here to view video

BU Annual Giving Society Webinar: A Conversation with Dr. Ronald Corley

June 9th, 2017

The BU Annual Fund Leadership Giving Society presents a conversation with Dr. Ronald Corley, professor and chair of the microbiology at the BU School of Medicine and director of the National Emerging Infectious Diseases Laboratories (NEIDL).

Click here to view video

Education

The NEIDL participates in a number of educational opportunities for the broader community. It sponsors a seminar series for the scientific community and continues to sponsor its Biosafety & Biosecurity Grand Rounds, to promote the culture of safety, and sponsors symposia.

Emerging Infectious Diseases Seminars

Sep 29	Mark Harris, Ph.D. University of Leeds	The Hepatitis C Virus Protein: Function and Regulation
Oct 4	Jason Rock, Ph.D. Boston University	Stem Cells and Lung Repair/ Regeneration
Oct 18	Scott Weaver, Ph.D. Univ of Texas Medical Branch	Vaccines for Emerging Urban Arboviruses: Chikungunya and Zika
Nov 1	James Whitney, Ph.D. Ragon Institute	Therapeutic Development for Zika Virus Infection
Dec 6	Mohsan Saeed, Ph.D. The Rockefeller University	Creating a Suitable Host Environment for Virus Replication
Dec 13	Jason Botten, Ph.D. University of Vermont	Virus Particles: Host Machinery Critical for their Formation and Infectivity
Feb 14	Alan Rothman, Ph.D. University of Rhode Island	Protective and Pathological Immune Mechanisms in Dengue
Mar 7	Roberto Cattaneo, Ph.D. Mayo Clinic	The secret life of measles virus in lymphocytes and epithelia
Apr 25	Daniel Cifuentes, Ph.D. BU School of Medicine	miR-144/451 Cluster: The Trojan Horse of Hematopoietic microRNAs
May 2	Catharine Bosio, Ph.D. NIAID, NIH	Manipulation of Host Cell Metabolism as a Mechanism of Virulence for *Francisella tularensis*
May 9	Balaji Manicassamy, Ph.D. University of Chicago	Viral and Host Determinants of Avian H5N1 Influenza Virus Pathogenesis
May 16	Robert Stahelin, Ph.D. Purdue University	Lipid-Dependent Assembly and Budding of Filoviruses
May 30	Florian Douam, Ph.D. Princeton University	Elucidating Immunological Mechanisms Regulating Flavivirus Infection *in vivo*
June 13	Hector Aguilar-Carreno, Ph.D. Cornell University	Glycoprotein Team Burglary: Entry and Egress of the Deadly Zoonotic Henipaviruses

Biosafety and Biosecurity Grand Rounds

Oct 18	Sony Heir EHS Prog Mgr for Tech Info	Integration of BioRAFT: a system used for management of enterprise safety, regulatory compliance, and training.
Nov 29	John McCall Director, NEIDL IT	Implementing the NEIDL firewall
Jun20	Ron Corley, NEIDL Director and ROHP staff	Introduction to new virus work at the NEIDL

Other Educational Opportunities

Visitor from Nagasaki University returns

In early 2017, the NEIDL had hosted a group of scientists and engineers from Nagasaki University. The purpose of their visit was to learn about the construction and safe operation of a BSL-4 laboratory. The government of Japan had recently approved a budget for the construction a new state of the art BSL-4 laboratory with the aim of conducting basic research to develop new treatments and vaccines for containing outbreaks of highly contagious and deadly diseases. With the cooperation of the local authorities of Nagasaki, this new facility will be built on the university's School of Medicine campus.

This year Dr. Junko Okamura, Associate Professor in the Department of International Health, Institute of Tropical Medicine and Global Center of Excellence Program, Nagasaki University, and lead scientist in this project, returned to the NEIDL to continue learning about biosafety and biosecurity best practices at the NEIDL.

Partnership with BU EPIC Program

Since 2017, members of the BU College of Mechanical Engineering's EPIC program, along with NEIDL researcher, Dr. Bang-Bon Koo and NEIDL Director of IS&T, John McCall, have been engaged in a project with the goal of developing a means to adjust the position of a sedated animal within an MRI. The critical requirements for this project are to develop two degrees of freedom (lateral and rotational) with the provided range and accuracy, operation of the device within the imaging field of an MRI machine, compatibility with the existing animal test chamber, and remote operation.

The existing process requires a technician to manually reposition the animal chamber according to instructions from a scientist outside of the room of containment. The automated system should permit the scientist to directly adjust the animal chamber without assistance from the technician. Elements from the existing system that will be crucial for the redesign are: the animal test chamber, the Bruker MRI machine, and the existing table in the room which utilizes a track and slider to move the position of the animal chamber.

During research, the group discovered commercial competitors, and investigated several MRI-compatible actuation methods. After determining engineering specifications, a functional decomposition is proposed after several brainstorming sessions. The group then evaluated various methods used to achieve linear motion and rotational motion. Ultimately, pneumatics was chosen as the method of actuation for both types of motion. The axial position problem has been solved, and the group can now easily achieve ½ mm positioning with a pneumatic stepper made (mostly) from plastic, and from all-plastic if needed for MRI. See video of the CAD animation: *https://youtu.be/2mfPxtxdgck*

Training

Australian Animal Health Laboratory (AAHL)

Geelong, Victoria, April/May 2018.

After an initial visit to complete access requirements last year and assist with staff competency preparations, Dr. Kath Hardcastle returned to help conduct a vaccine experiment using the ferret model of Ebola Virus to the Australian Animal Health Laboratory. The staff have worked extensively with ferrets over the last 2 years at the NEIDL on paramyxovirus pathogenesis with the Duprex lab, using many of the experiments to develop our ABSL4 SOPs and specifically designed biocontainment caging.

The AAHL is a huge facility with a historical emphasis on large animal (livestock) disease investigation and treatments. The biocontainment rooms are all designed with specific emphasis on cattle, horses, sheep and pigs. Using smaller animal models requires some adaptation of the facility work flow and staff skills. Kath has been collaborating with both the large and small animal facility teams at AAHL to help them develop these capabilities.

Much of the ABSL4 work the AAHL are undertaking is carried out to GLP-like standards under US contract. This provides a valuable learning experience on the factors for consideration in developing the NEIDL GLP program.

Transboundary Animal Diseases (TAD) Fellowship

Kansas State University, June/July 2018.

For the second year in a row, NEIDL hosted a select group of veterinary students from the Transboundary Animal Disease Fellowship Program at Kansas State University, as trainees in the Baseline Biosafety Level (BSL) 4 Simulator Laboratory. The TAD special research fellowship program is supported by the U.S. Department of Homeland Security, and administered through the Biosecurity Research Institute, or BRI, and the College of Veterinary Medicine at Kansas University. It was designed to train a future generation of research leaders specialized in the field of transboundary animal diseases (TAD). TAD are highly contagious epidemic diseases that can spread extremely rapidly, irrespective of national borders. They cause high rates of death and disease in animals, thereby having serious socio-economic and sometimes public health consequences while constituting a constant threat to the livelihoods of livestock farmers.

Dr. Gene Olinger and Dr. Kath Hardcastle first visited the students at their ABSL3Ag home facility the Biosecurity Research Institute (BRI) in Manhattan, Kansas to carry out a week of didactic training in preparation for the simulator phase of training at the NEIDL. It is worth noting that the BRI will be the future home of the National Bio and Agro Defense Facility (NBAF).

For training at the NEIDL, the students travelled to Boston for a week to complete multiple suited entries into the simulator and practice technical skills. Drs. Olinger and Hardcastle worked together to conduct a full 2 weeks of training each year tailored to these students and work with individuals in their career pathways.

Community Engagement

Engaging and sharing information with the community remains an important component of the NEIDL's mission. To succeed in this endeavor, the Community Relations Core ensures that the local community is informed in a timely, transparent and ongoing basis about the operations, safety, research and expertise of NEIDL personnel. We must continue and improve our efforts to inform and educate the community about what we do and why, while at the same time building and sustaining community trust about the NEIDL and its mission. Below are the highlights from this past year's activities.

Community Liaison Committee (CLC)

The CLC continues to be an important group for promoting public participation and transparency at the NEIDL. Meetings are open to the public and provide an opportunity for key NEIDL personnel and researchers to provide regular updates on operational, regulatory, and scientific matters affecting the NEIDL. By taking advantage of the CLC's input, talents and expertise, we hope to ensure more effective communication and collaboration on engagement activities and programs involving the NEIDL and the community.

To ensure that community representatives continue to be involved in vetting research protocols before research is permitted; two members of the CLC sit on Boston University's Institutional Biosafety Committee. Three members of the CLC have volunteered their time and expertise to the Boston Biosafety Committee, the advisory group to the Boston Public Health Commission with respect to the BSL-4 permit and have agreed to continue to be resources as the need arises. As the CLC expands, other oversight groups will be interested in their knowledge and experience as additions to these committees.

Further, it should be noted that CLC members are invited, attend and participate in both tabletop and active simulated emergency response planning drills and exercises for the NEIDL with first responders (emergency, medical and other public safety personnel) to enable them to understand how emergency response procedures for incidents affecting the NEIDL are designed, implemented, evaluated, and improved.

Community Meetings

Representatives from the Community Relations Core are active in the community and serve as the face of Boston University in neighborhood and local business meetings as well as community events on a regular basis. We serve as members of various neighborhood business, safety and development committees. We sponsor and fund community activities either by the contribution of cash or through provision of University resources. This community presence allows us to identify and understand issues of neighboring residents, and answer questions in a timely manner.

Three of the events the NEIDL Community Relations Core sponsored this year are worth highlighting: **Family Wellness Night** at the Blackstone Innovation School, **South End Soccer** and **Orchard Gardens Back to School Jamboree.**

Tours

The Community Relations team continues to plan, provide, and coordinate NEIDL tours. Tours regularly introduce community and other stakeholders to the NEIDL and reinforce the relevance of the facility, as well as the appropriateness of its location. The addition of post docs as tour guides has proven informative and beneficial for both the guides and the attendees. During the summer months, requests to visit the NEIDL increase, providing greater opportunities to talk with high school and undergraduate students about career choices in a variety of different areas highlighting our NEIDL personnel. For example, as part of a summer tour with a group of teenage girls interested in STEM participating in GROW – Greater Boston Research Opportunities for Young Women, we arranged for an all-female group of NEIDL researchers and staff to lead a panel discussion. This led to a very lively and frank exchange. A special thank you to our volunteers this year: Judith Olejnik, Kath Hardcastle, Sarah Gross, Tessa Cressy and Michelle Toomey Olsen.

We also regularly provide tours to first responders to familiarize them with the NEIDL and its safety protocols. In addition, we develop refresher-training sessions for first responders in the NEIDL. Since 2012, approximately 3200 people have toured the NEIDL. From September 2017 to August 2018, we conducted 54 tours with 947 attendees. From youth to retirees, all have been impressed with the facility and our willingness to answer questions and share information.

NBL-RBL Network Coordination

The NBL (National Biocontainment Laboratories) - RBL (Regional Biocontainment Laboratories) network is an organization of the NIAID funded centers from 13 academic research institutions, which promotes sharing of practices for improving the operations and safety of these biocontainment facilities. The NEIDL Community Relations staff collaborates regularly with other members of the NBL/RBL network via meetings, conferences and teleconferencing for sharing information on community activities of each member and adopting best practices learned during these interactions.

The annual meeting of the NIAID network of National and Regional Biocontainment Laboratories held their meeting this year in Boston on the Charles River Campus.

Each year, the National and Regional Biocontainment Laboratories Network gathers either in Boston or Galveston to exchange relevant information, share experiences, and maintain peer interactions in a supportive, informal setting.

The forum for the networking meeting includes general sessions, breakout sessions into subgroups of Directors, Operations/Maintenance, Biosafety, and Lab Animal Care. Our dinner speaker was Kevin M. Esvelt, PhD. His dinner presentation was entitled “When The Risk Isn’t To Humans: Gene Drive Escape and Available Safeguards”. While in Boston, attendees also took a tour of the NEIDL.

This year’s speakers included subject matter experts from NIAID, USDA, APHIS, AgSAS (Agriculture Select Agent Services) and CDC, DSAT (Division of Select Agents and Toxins DSAT), WHO, CDC, MIT, Georgetown University School of Medicine, the National Microbiology Laboratory in Winnipeg, Tulane University and UTMB.

These meetings are always informative and a great way to meet and connect with colleagues from the regional and national laboratories. For Valeda Britton, Director of the Community Relations Core, and her Galveston counterpart, Connie Holubar, it was a good opportunity to sit with presenter, Dr. Hank Parker, PhD from Georgetown University and share communication strategies to better inform the public about containment and bio-risk at the BSL-3 and BSL-4 levels.

Educational Programs: Career Development

In connection with the NEIDL's mission to educate and train the next generation of scientists and in collaboration with BU's Medical Campus STEM efforts, the NEIDL provided scholarships for two females from a local high school to attend an eight -week BU sponsored program that met on Sundays called Introduction to Careers in Medicine. Students had presentations and hands on activities in the fields of Anatomy, Physiology, Microbiology, Surgery, Emergency Medicine and Infectious Diseases. As part of the hands on/field training, they took a tour of the NEIDL. This is the second year that the NEIDL has participated in this program.

During the past year, the Community Relations Core invited students from Cumberland High School to tour the NEIDL as part of their introduction to the Medical Campus and its many educational/career opportunities. They spent time talking with Public Safety, visiting the Dental School and the Blood Bank. We hope to see them again next year for their third trip to the campus. In addition, we granted scholarships to five high students from public schools "in our backyard" to participate in a BU program called SummerLab. SummerLab allowed these students to have a hands-on experience participating in a "mock" clinical trial of a new sickle cell drug.

Last, but not least, we collaborated with the School of Medicine, Boston Public Health Commission (BPHC) and the Boston Area Health Education Center (BAHEC) in planning efforts for the BAHEC six-week summer program which is aimed at increasing diversity among Boston's healthcare workers. The BAHEC students spent their mornings delving into science and math. Afternoons were devoted to electives and other field trips. This is the second year that we have had BAHEC visit the NEIDL. After the tour, the students tried on demo NEIDL BSL-4 upper body PPE, including thigh high boots. Students took part in dexterity exercises led by two of our NEIDL lab technicians – Judy Yen and Aditi Broos-Caldwell. The students enjoyed putting on multiple gloves and pipetting. When they tried to pick up small objects with their gloves, they realized it was not as easy as it looked. This activity became not only challenging, but also competitive. When asked what they had enjoyed most about the NEIDL, it was the dexterity exercises (or course!). On a side note, the experience with pipetting was a useful exercise. When they visited another Med Campus lab later in the summer and participated in a mock lab simulation, we heard that they were very confident in their ability to pipette thanks to their patient NEIDL instructors. Thank you Judy and Aditi!

BOSTON UNIVERSITY

/NEIDL National Emerging Infectious Diseases Laboratories

620 Albany Street, Boston, MA 02118

bu.edu/neidl