Northeastern University

COVID-19: Fighting Outbreaks, Configuring Preventions, and Flattening the Curve

Opportunities and Solutions within Northeastern's Robust Research Enterprise

The COVID-19 pandemic is bringing unprecedented changes and challenges worldwide. But the research powerhouse at Northeastern University comprises some of the most sought-after scientists, analysts, and clinicians who are armed to attack the outbreak from all angles.

Funding for the following innovative research projects is critical during this time. Foresighted philanthropists who understand the urgency of this moment are our best hope of flattening the curve of the outbreak, developing efficacious prevention and treatment strategies, and ultimately saving lives.

Pharmaceutical Development: Fighting COVID-19 on the Frontlines
Faculty Experts:
Tali Konry, Assistant Professor, Department of Pharmaceutical Sciences, Faculty, School of Pharmacy
Seth Cooper, Assistant Professor, Playable Innovative Technologies Lab
Sidi Bencherif, Assistant Professor, Chemical Engineering Department, Laboratory for Advanced and Multifunctional Polymeric Biomaterials
Fundraising Contact: Rob Silk, Associate Vice President, Corporate and Foundation Relations

The COVID-19 pandemic is overwhelming healthcare systems around the world. The pharmaceutical sciences play a critical, frontline role in stopping the spread of the virus by improving testing and developing treatments. Gifts to support scientific research at Northeastern University during this unprecedented crisis will enable faculty members to continue their research and development efforts. Funding opportunities vary widely across the university.

Professor Tali Konry and her colleagues are working to adapt ScanDrop, a microchip-based technology developed at Northeastern, to detect the novel coronavirus in a manner that will be cheaper, faster, and easier to use than anything currently available. Professor Seth Cooper has created Foldit, an online puzzle game that is helping him to crowdsource ideas for the folding of proteins. This virtual research on proteins can be used in COVID-related work to identify the right structure combination of ingredients for a vaccine. And Professor Sidi Bencherif has developed a biomaterial-based platform that could be

leveraged for COVID-19 vaccine development. Bencherif's strategy is based on an injectable biomaterial that has potential both to prevent and treat infections.

Forecasting the Spread of Disease: World-Renowned Expertise in Network Modeling
Faculty Expert: Alessandro Vespignani, Sternberg Family Distinguished University Professor, Director of the Network Science Institute and Director of the Laboratory for the Modeling of Biological and Sociotechnical Systems (MOBS Lab)
Fundraising Contact: James Poulos, Associate Dean of Development, College of Science

One of the world's most renowned experts in infectious disease modeling, Professor Alessandro Vespignani has rapidly mobilized an interdisciplinary team to combat COVID-19 and is leading the response across a consortium of 60 academic centers. He is forecasting the virus's reach in real time, harnessing enormous computing power to analyze how patterns of human behavior like air travel fuel or suppress the virus. Professor Vespignani is also developing hundreds of COVID-19 models that inform intervention strategies—such as school closures and social distance policies—and his recommendations are sought by global health agencies, government officials, and senior leaders.

The demand on the MOBS Lab intensifies as each new case of COVID-19 is diagnosed. The lab is one of four teams advising the White House on the COVID-19 outbreak, and Professor Vespignani also reports daily to the World Health Organization and Centers for Disease Control and Prevention, and government leaders use his models to inform decisions that impact communities.

As the research effort intensifies, Professor Vespignani seeks to grow his staff by adding contract researchers, software developers, PhD students, and technical writers who will amplify his lab's ability to model and forecast the pandemic and inform key decision makers.

The MOBS Lab also requires resources for computation, where additional financial support will boost processing more computational packets—collections of data that are used by computers—through powerful cloud systems run by Google and IBM. And with funds to purchase even more datasets, Professor Vespignani will be able to add data to his network model, which will result in increasingly accurate predictions of the evolution of COVID-19.

Uncovering Potential Treatments: Repurposing Drugs to Attack COVID-19
Faculty Expert: Albert-László Barabási, Robert Gray Dodge Professor of Network Science and Distinguished Professor of Physics; Director of the Center for Complex Network Research
Fundraising Contact: James Poulos, Associate Dean for Development, College of Science

Researchers are working to develop pharmaceutical drugs that slow COVID-19's reach, heal the ill, and ultimately, might offer a vaccine. But what if promising therapies already exist? Network science pioneer Professor Albert-László Barabási is working to identify approved and experimental drugs that may pinpoint disease mechanisms, drug targets, and biomarkers, and drug repurposing opportunities. Given the urgency of this moment, traditional drug development pipelines are not feasible. By investigating

drug repurposing options, Barabási is exploring clinically approved drugs, with known toxicity and side effects, that may have a therapeutic effect on the virus's patients—potentially saving time and lives.

In March, the Barabási Lab began re-curating its past work on the human interactome, a intracellular and intercellular network of protein interaction. Less than 10 days after starting, the team identified 40 medications that target the same cellular areas as COVID-19. The virus latches on to a healthy cell's proteins, then disrupts functions within that cell and generates millions more copies of the virus. The lab developed a model of the 332 proteins targeted by COVID-19 and the subcellular neighborhoods it attacks, then examined how the virus's perturbing activity may affect tissues and organs.

Professor Barabási is working with Harvard Medical School researchers to comb through data on drugs that could be repurposed to treat COVID-19. To further the team's efforts, he requires funding to have information processed and analyzed by cloud services, and to utilize supercomputers that apply advanced artificial intelligence/machine learning bioinformatics tools to locate candidate therapies.

The Barabási Lab also seeks resources to hire post-doctoral researchers, who will use 3D modeling to better understand the virus's spread. Further, as drugs that may be repurposed to test against COVID-19 are identified, Barabási and his collaborators need funding to test these drugs in human cells, observe how they target areas within cells where the virus works, and ideally, find effective treatments.

Teaching the Teacher: Training to Conduct COVID-19 Testing
<u>Faculty Expert</u>: Jared Auclair, Director of Biotechnology and Bioinformatics, Associate Teaching Professor, Director, Biopharmaceutical Analysis Training Laboratory Executive Director
<u>Fundraising Contact</u>: Patty Flint, Assistant Vice President for Interdisciplinary Initiatives

A critical mission in the U.S. and around the world is ramping up the number of tests for COVID-19 that can be processed quickly and accurately. The Biopharmaceutical Analysis Training Laboratory (BATL) stands ready to train employees at these sites virtually and respond to other needs of the healthcare and biopharmaceutical industries. BATL can facilitate instruction on how to properly conduct RNA/DNA based testing and train personnel on GxP (Good Lab Practices, Good Clinical Practices, and Good Manufacturing Practices) that ensure sterility and compliance with clean room standards. The lab employs a Microsoft HoloLens to provide enhanced virtual training that allows us to teach up to 100 students in their home or at a training site

For nearly a decade, the Biopharmaceutical Analysis Training Laboratory has served as a vital source for training in compliance with regulations of pharmaceutical, biopharmaceutical, and other related health products. BATL was created to improve patient access to safe healthcare products and health security and is an internationally recognized training partner for APEC and ICH in biologics, cell/gene therapies, and developing quality medications.

Endorsed and supported by the Massachusetts Life Sciences Collaborative, BATL is specifically designed to help increase skilled workforce development in the life sciences. The lab works closely with

instrumentation companies, including Thermo, Agilent, and Waters; and biopharma, including Biogen, Roche-Genentech, Pfizer, and Amgen. Its faculty can provide training on proper administering of RNA/DNA-based or protein-based testing. BATL is also active in application-based research such as analytical, process, operational, and standards development, as well as diagnostic and therapeutic development.

With the call for testing becoming more urgent each day, there will be an influx of new employees who will need to learn to run these COVID-19 tests properly, and BATL is poised to work with other industry partners to meet their training and research needs. The lab also urgently requires philanthropic funding to increase its reach. Finally, BATL is also available to share data with researchers to enhance efforts to track and trace outbreaks.

Preserving and Analyzing History: Digital Public Scholarship of COVID-19
Faculty Experts:
Victoria Cain, Associate Professor of History
Dan Cohen, Vice Provost for Information, Dean of the Northeastern University Library, and Professor of History
Fundraising Contact: Bethany Basile, Officer of Corporation and Foundation Advancement

With the COVID-19 global health crisis spreading rapidly, the need for proper documentation of this challenging moment in history is greater than ever. Northeastern's College of Social Sciences and Humanities and the University Library have joined forces with a vast network of historians, curators, and students in a nationwide effort to develop, analyze, and expand a #Covid19Archive digital repository. This new repository aims to crowdsource images, oral histories, and stories about the global experience of COVID-19 to create a lasting historical record of this unprecedented moment.

The #Covid19Archive project is directed by Victoria Cain, Associate Professor of History, and guided by Dan Cohen, Dean of the Northeastern Library, both of whom are distinguished leaders with extensive experience in curating digital historical collections. Professor Cain has previously led and contributed to a wide variety of public history projects, including the Encyclopedia of Boston, a digital encyclopedia of Boston linked to the Boston Research Center, while Dean Cohen helped establish and co-directed the September 11 Digital Archive, the nation's first major digital archive of a historical event, now stored in the Library of Congress. The COVID-19 student-initiated, faculty-led effort embodies the experiential liberal arts by combining teaching and research. Historians and students will work closely together to build the #Covid19Archive in real time by gathering items to add to the repository, creating exhibits, and analyzing the archive as it unfolds. Northeastern students are poised to play a key role in the curation and development of the content in the archive itself, building an important historical resource while benefiting from a novel research opportunity to hone valuable digital skills in the process.

With so much new information and content emerging every day, there is a great need for additional staff in the Digital Scholarship Group, which will support projects and learning initiatives across the university, in addition to potential future co-op positions and next-generation research opportunities.

Northeastern also welcomes submissions to the archive from the global public. The archive represents diverse experiences not limited to particular generations, socioeconomic statuses, or ethnic groups. And to ensure Northeastern stays on the cutting edge of this important moment in history, we require financial support to strengthen and expand our personnel. With generous philanthropic backing, our students and faculty can continue to create a lasting historical record of this extraordinary moment.

Bolstering the Supply Chain: Keeping Supplies Robust During Complex Global Events

<u>Faculty Experts</u>:

Kwong Chan, Associate Academic Specialist, Marketing; Executive Director, DATA Initiative

Ozlem Ergun, Professor, Mechanical and Industrial Engineering; Affiliated Faculty, Electrical and Computer Engineering; Affiliated Faculty, Global Resilience Institute

Lee Makowski, Professor and Chair, Bioengineering; Professor, Chemistry and Chemical Biology; Affiliated Faculty, Electrical and Computer Engineering

Alicia Sasser Modestino, Associate Professor of Public Policy and Urban Affairs and Economics; Associate Director, Dukakis Center

Janet Rico, Assistant Dean, Nursing Graduate Programs, Faculty, School of Nursing

Nada Sanders, Distinguished Professor, Supply Chain Management

Maria van Pelt, Dean and Associate Clinical Professor, School of Nursing and Associate Dean, Bouvé College of Health Sciences; Faculty, School of Nursing

<u>Fundraising Contact</u>: Paul Zernicke, Associate Vice President of Individual Giving

As global supply chains bow under the weight of COVID-19 because of factory closures in major manufacturing countries like China, the effects of supply chain disruptions may spread as quickly as the disease itself. However, Northeastern is home to recognized experts in resilient supply chain structures who can help advise best practices for keeping chains robust even during times of economic and workforce-related upheaval.

Our faculty have expertise in forecasting, predictive analytics, risk management, and supply chain management. They can advise on reconfiguration of supplies to meet evolving needs and how to manage seamless transitions between the natural and virtual worlds. And they can work with medical facilities in developing nations, helping them to treat patients in respiratory distress with inexpensive tools and lightly trained staff.

Further, supply chain issues go beyond products to encompass labor force implications for workers, such as the people that will buoy the healthcare system and treat patients during the pandemic. To boost the supply chain of healthcare providers, Northeastern experts can conceive strategies such as bringing back retired professionals to assist with management of situations and lead younger providers.

The current pandemic is, and will be, long-lasting, and the supply chain post-crisis will look quite different from the previously adopted lean, just-in-time manufacturing models. But with philanthropic funding, faculty researchers at Northeastern are studying and disseminating in real time what makes supply chains agile and what makes them fragile. Additional resources to spur their discovery can

uncover the precise features of resilient supply chain structures that can be used as lessons for rebuilding the future.

Focus on Public Health: Prevention and Access to Care

Stephen Flynn, Founding Director of the Global Resilience Institute, Professor of Political Science, College of Social Sciences and Humanities

Dan Jackson, Executive Director, NuLawLab, School of Law

Neil Maniar, Professor of the Practice and Director, Master of Public Health in Urban Health Program, Department of Health Sciences, Faculty, Institute on Urban Health Research, Bouvé College of Health Sciences

Maria Van Pelt, Dean and Associate Clinical Professor, School of Nursing and Associate Dean, Bouvé College of Health Sciences

Miso Kim, Assistant Professor of Experience Design, Department of Art and Design, College of Arts, Media and Design

<u>Fundraising Contact</u>: Jennifer Trapp, Director of Development, Bouvé College of Health Sciences

Public health is essential to protecting and improving the health of people and their communities—starting with prevention. As the world encounters the many challenges that have resulted from the COVID-19 pandemic, ambitious, driven, and knowledgeable public health professionals in Northeastern University's network are spearheading efforts to safeguard humankind.

As Founding Director of the Global Resilience Institute at Northeastern, Dr. Stephen Flynn is leading a major university-wide research initiative to inform and advance societal resilience in the face of growing human-made and naturally occurring turbulence, such as the novel coronavirus. NuLawLab Executive Director Dan Jackson seeks to solidify a collaboration between the lab, the School of Law's Domestic Violence Institute, and a hotel that has the capacity to provide shelter for current victims of intimate partner abuse amid the COVID-19 crisis. Further, Professor Neil Maniar is co-leading an innovative and cutting-edge effort to engage students, alumni, and faculty in virtual volunteer efforts to assist local health departments; Dean and Professor Maria Van Pelt is disseminating webinars that provide frontline workers with support to overcome anxiety, fear, and negative emotions; and Professor Miso Kim is developing Social Window, a tool that creates a sense of telepresence and human connection for isolated populations.

To take on this rapidly spreading virus and make a profound impact on health equity, health policy, health disparities, and social justice during this time, additional support is required. Donors to the university can help faculty researchers develop, uncover, and share transformative ideas, lessons, and programs that are crucial to facing COVID-19.

About Northeastern

Northeastern University is a place of learning with a global reach, making a difference in the world while providing transformational experiences to students. Founded in 1898, today's Northeastern is a global,

experiential, research university offering undergraduate and graduate programs leading to degrees through the doctorate in nine colleges.

More than 1,150 full-time faculty members teach over 18,000 undergraduate and 10,000 graduate students, who come from all 50 states and more than 125 countries. Northeastern is distinguished for its superb cooperative education program and the entrepreneurial focus of the young people who study here. Students graduate fully prepared to contribute to the workforce as innovative problem-solvers and to the world as leaders.