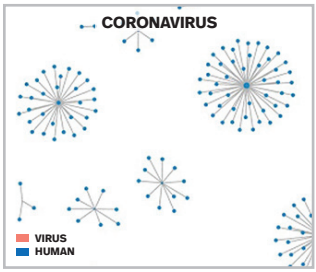
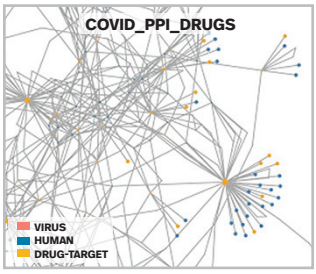
Northeastern University

Repurposing Drugs to Attack COVID-19

The Network Science Institute

Northeastern's **Albert-László Barabási,** Robert Gray Dodge Professor of Network Science, Distinguished Professor of Physics, and Director of the Center for Complex Network Research, is working to answer the question: What if promising therapies for COVID-19 already exist? With traditional lengthy drug development pipelines impracticable during the growing pandemic, Barabási is exploring repurposing existing drugs with known toxicity and side effects that may have a therapeutic effect on the virus's patients. He requires philanthropic funding that will enable him to scrutinize how COVID-19 invades healthy cells, to find drugs that treat the virus, and to validate those drugs using AI/ML bioinformatics and trials.





Uncovering Potential Treatments

In March, the **Barabási Lab** began re-curating its past work on the human interactome, a complex intracellular and intercellular network of protein interaction. Less than 10 days after starting, the team identified 40 medications that target the same cellular areas where COVID-19 works.

COVID-19 latches on to a healthy cell's proteins, then disrupts that cell's functions and generates millions more copies of the virus. The Barabási Lab developed a network model of the 332 proteins targeted by COVID-19 and the subcellular neighborhoods it attacks–and examined how the virus's perturbing activity might affect tissues and organs.

- Since forecasting the cellular progression of COVID-19, Barabási is looking for drugs and experimental compounds that could fight the virus by targeting proteins in its network vicinity.
- The Barabási Lab is working with Harvard Medical School researchers to comb through data on approved and experimental drugs that could be repurposed to treat COVID-19, and to validate the team's findings in clinical trials.
- Barabási needs funding to perform computation to better grasp how COVID-19 hijacks healthy cells; to use 3D modeling to more fully understand the virus's spread; and to conduct experimental validation to identify and test drugs that could be repurposed against COVID-19.

Northeastern University

Forecasting the Reach of COVID-19

The Network Science Institute

One of the world's most renowned experts on the spread of infectious disease, Northeastern's **Alessandro Vespignani** has mobilized an interdisciplinary team to combat COVID-19, working tirelessly to forecast the virus's spread in real time. Vespignani, the Sternberg Family Distinguished University Professor, and director of both the **Network Science Institute** and the **Laboratory for the Modeling of Biological and Sociotechnical Systems (MOBS Lab),** is harnessing computing power to analyze how human behavior patterns fuel or suppress the virus. He is also developing COVID-19 models that are informing intervention strategies–such as travel bans, school closures, and social distance policies.

Predictive Modeling, Shaping Policy

Vespignani and his MOBS Lab are one of four teams advising the White House on the COVID-19 outbreak in the United States. Along with groups from Harvard, Columbia, and Imperial College London, they showed that, with appropriate measures, the U.S. could drastically reduce the virus's human toll.

- The demand on the MOBS Lab is acute and grows as each new case of COVID-19 is diagnosed.
- Vespignani is also communicating with the World Health Organization, Centers for Disease Control and Prevention, international task forces, and others to inform decisions that impact communities.
- Vespignani seeks to expand his team by adding researchers, software developers, PhD students, and technical writers who will amplify his lab's ability to model and forecast the pandemic.
- The MOBS Lab requires resources to boost the processing of more computational packets–collections of data used by computers–through powerful cloud systems run by Google and IBM.
- With funds to acquire datasets on population mobility, COVID-19 cases, and hospital capacity and referral patterns, Vespignani will be better able to model the pandemic in real time and design effective interventions.

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Robust Supply Chains During Complex Global Events

Solutions from Northeastern University Experts

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 such as the COVID-19 pandemic. We seek philanthropic partners who understand the urgency of the moment and want to bolster any of the following projects:

- Managing all aspects of the supply chain, including forecasting, predictive analytics, risk management, and post-crisis recovery of networked systems.
- Helping companies and agencies turn their factories into COVID-19 equipment producers and spaces into makeshift medical facilities.
- Envisioning how to reconfigure supplies to meet evolving needs and manage seamless transitions between the natural and virtual worlds.
- Working with medical facilities in developing nations, helping them to treat patients in respiratory distress with inexpensive tools and lightly trained staff.

The current pandemic is, and will be, long-lasting. But with philanthropic funding, faculty researchers at Northeastern are disseminating in real time what makes supply chains agile and what makes them fragile. Additional resources to spur the projects above can save lives and be used as lessons for rebuilding the future.

Professor Auroop Ganguly

Professor Nada Sanders

Professor Ozlem Ergun

Northeastern University

Training the Trainer for COVID-19

The Biopharmaceutical Analysis Training Laboratory

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)** at Northeastern University stands ready to train employees to process COVID-19 tests and respond to other needs of the healthcare and biopharmaceutical industries. At this moment, we seek philanthropic funders who understand the urgency of the moment, as well as partners in the instrumentation and biopharmaceutical spaces whose training needs we can meet, either virtually or otherwise.

Learning Any Time, Anywhere

The Biopharmaceutical Analysis Training Laboratory is a training facility, endorsed and supported by the Massachusetts Life Sciences Center, specifically designed to help increase skilled workforce development in the life sciences. It is an internationally recognized training partner for APEC and ICH in biologics, cell/gene therapies, and developing quality medicines.

- BATL works closely with instrumentation companies, including Thermo, Agilent, and Waters.
- BATL works with biopharmaceutical companies, including Biogen, Roche-Genentech, Pfizer, and Amgen.
- Our faculty can provide training on proper administering of RNA/DNA-based or protein-based testing.
- BATL has facilities to train personnel on GxP (good manufacturing, clinical, and lab practices), including clean room procedures.
- Northeastern's Burlington, Massachusetts, campus has 20,000+ sq. ft. of space available immediately–contiguous with BATL's space–as a potential additional test processing location, if needed.
- The lab employs a Microsoft HoloLens to provide enhanced virtual training that allows us to teach up to 100 students at a time at a training site or in their own homes.
- BATL is active in application-based research such as analytical, process, operational, and standards development, as well as diagnostic and therapeutic development.

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Preserving and Analyzing History

Digital Public Scholarship of COVID-19

With the COVID-19 global health crisis spreading rapidly on an enormous scale, 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 digital repository aims to create a lasting historical record of the unprecedented global experiences of COVID-19.

A Student-Initiated, Faculty-Led Project

The **#Covid19Archive digital repository** embodies the experiential liberal arts by combining teaching and research.

- This project is under the leadership of Victoria Cain, Associate Professor of History, and guided by Dan Cohen, Dean of the Northeastern Library, two distinguished leaders with extensive experience in curating historical collections.

- Students will 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 develop valuable digital skills in the process.

- Historians and students will work closely together in a unique instructional and learning environment by gathering items to add to the repository, curating exhibits, and analyzing data in the archive as the pandemic unfolds.

- The addition of more staff will provide increased support of projects and learning initiatives across the university, in addition to opportunities for future co-ops and next-generation research.

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Communicating and Designing for Public Health Emergencies

Faculty at the College of Arts, Media and Design are leaders in the fields of communication and design - developing innovative solutions to global, complex problems in a world of burgeoning information and data. Their work harnesses cutting edge knowledge and new media technologies, effectively and accurately communicating, engaging and designing solutions around preparedness, resilience and emergencies.

The Center for Design launched Design for Emergency, an open platform for mobilizing design competencies to address the needs and conditions of people forced into isolation. Led by Professor Paolo Ciuccarelli and Sara Comlombo, this rapidly developed, research-driven design initiative helps analyze needs and envision responsive solutions. Design for Emergency launched in Italy with over 1800+ survey responses on people's problems, desires and emotions to the COVID-19 emergency. They are now planning a series of open design challenges to collaboratively ideate and implement digital and physical solutions to address challenges identified by the survey platform.

Professor Casper Harteveld's lab at Northeastern is investigating how game design can be leveraged to disseminate and collect information from the public in times of crisis. Additionally, they are researching how can game design increases access to public health information for vulnerable populations.

Professor Matt Nisbet is studying and sharing effective communication by spotlighting, evaluating, and experimenting with data-driven storytelling and expert commentary about the scientific, communication, and societal dimensions of the pandemic. His team is exploring how to optimally communicate systemic issues around public health and other global crises that intersect such as climate, energy, and food systems. Professor Meg Heckman is leveraging area-outlets to serve local public information needs; she is working with Northeastern's students fill gaps in COVID-19 coverage for local publications.

Professor Sara Jensen Carr examines the connections between landscape, human health, urban ecology and design. Her current work is focused on how humans have responded to infectious disease by redesigning our physical spaces. Her forthcoming book, *The Topography of Wellness: Health and the American Urban Landscape*, is due out this Fall.

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Increasing Prevention Efforts

Public health initiatives at Northeastern

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.

Taking initiative: 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.

Providing shelter: NuLawLab Executive Director **Dan Jackson** seeks to solidify a collaboration between the lab, Northeastern University 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.

Expanding virtual and digital efforts: 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.