

Northeastern COVID-19 Faculty Research

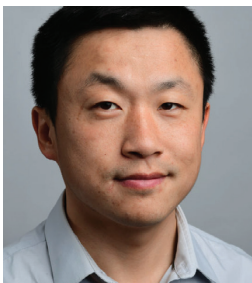
DEVELOPING NEW, EFFECTIVE TREATMENTS TO COMBAT COVID-19

Our faculty have significantly increased their efforts to provide wide-scale solutions to fight the global COVID-19 pandemic. Their research covers a range of topics. We are actively raising funds to support their research at this time. A few highlights of our therapeutics research are below.



Albert-László Barabási is focusing on a network medicine approach to dramatically accelerate the search for a COVID-19 treatment. Network medicine offers computational tools to rapidly identify disease mechanisms, potential drug targets, biomarkers, and, notably, drug repurposing

opportunities. Less than ten days after Barabási and his team began working on the COVID-19 problem, they identified 40 medications that target the same cellular areas where the virus works. These preliminary findings require further validation, but may ultimately offer a shorter path to clinical approval than drug compounds in the earlier stages of development. Barabási is working closely with Harvard Medical School researchers to refine their models using advanced artificial intelligence/machine learning tools; comb through data on approved and experimental drugs that could be repurposed to treat COVID-19; and validate findings in clinical trials. To continue this work, Barabási needs funding to perform computation, network modeling, and experimental validation.



Ke Zhang, an expert in polymer chemistry, is proposing a strategy to inhibit the SARS-CoV-2 virus by directly targeting the viral genome. Using a proprietary oligonucleotide technology developed by the Zhang group, known as pacDNA, a protective and/or therapeutic effect is expected. While this

general approach has been demonstrated in cells for many types of coronaviruses, getting the materials into the lung in high quantities, reducing side effects, and realizing high efficacy in a safe manner remain major roadblocks for developing an effective treatment. The pacDNA technology enables safe and efficient delivery of oligonucleotides to the lung via short infusion. Based on materials proven safe, pacDNA allows the DNA drug to persist in the lung for weeks. Originally developed for lung cancer treatment, this technology has been validated in efficacy and safety in the lung using several mouse models. Transforming the agents to target COVID-19 would only require a change in the DNA sequence, allowing for rapid next steps in drug development.



The Bencherif Laboratory

has recently developed a therapeutic vaccine platform comprised of a biodegradable and injectable cryogel, an advanced type of hydrogel, made from FDA-approved polysaccharides. The cryogel technology shows high potential to function prophylactically and

therapeutically through an optimized formulation; sustained delivery of immunomodulatory factors; and the control of immune signaling (i.e. recruitment, activation/training, and release of immune cells). Building on ongoing efforts, the vaccine can be leveraged to treat COVID-19 patients—both prophylactically and therapeutically. Bencherif's strategy for vaccine development is based on an injectable biomaterial that is able to slowly release immunomodulatory factors (e.g. adjuvants) and SARS-CoV-2 subunits (e.g. S-protein, N-protein). The coronavirus spike (S) protein, a characteristic structural component of the viral envelope, is a key target for vaccines, while the N-protein, the most abundant protein in coronavirus, is highly immunogenic. The Bencherif Laboratory has the expertise to engineer this technology quickly and test it in mice to assess the humoral immune response (i.e. the type and amounts of activated immune cells and the titration of anti-antibodies specific to SARS-CoV-2 in the serum of vaccinated mice at quantities to be sufficient for neutralizing the virus).