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**Albert-László Barabási/Network Science Institute Case Statement**

**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

**Pivoting to Fight COVID-19: Using Network Science to Understand its Spread**

As the COVID-19 pandemic intensifies, researchers are rapidly working to develop pharmaceutical drugs that not only slow the virus’s reach, but also heal infected patients. But what if promising therapies already exist? Scientists are racing to identify approved and experimental drugs that may be beneficial to patients, and network medicine is our most powerful platform to identify candidate therapies.

In this moment of exceptional global need, Northeastern University’s Albert-László Barabási has assembled a multidisciplinary team to focus his lab’s network medicine approach to accelerate the hunt for a COVID-19 treatment. And critically, with traditional lengthy drug development pipelines now impracticable, Barabási is exploring repurposing clinically approved drugs, with known toxicity and side effects, that may have a therapeutic effect on COVID-19 patients. To do so, he requires funding to further scrutinize how the virus invades healthy cells, to apply this data to pinpoint drugs to treat the virus, and to validate drugs using artificial intelligence/machine learning bioinformatics and trials.

**Taking a Closer Look: Repurposing Drugs to Attack COVID-19**

In March, the Barabási Lab began re-curating its past work on the human interactome, a complex intracellular and intercellular network of protein interaction. COVID-19 latches on to a healthy cell’s proteins, then disrupts functions within that cell and generates millions more versions of the virus. So, Barabási’s 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. For example, using this model to examine how COVID-19 binds with host proteins, the Barabási Lab predicted that the virus could attack healthy cells in the brain—which may explain why early symptoms in people with the disease include loss of the senses of smell and taste.

After forecasting the cellular progression of COVID-19, the Barabási Lab began looking for drugs and experimental compounds that could fight the virus by targeting proteins in the network vicinity of the viral proteins. Less than 10 days after starting, the lab identified 40 medications that target the same cellular areas where the virus works, and one or more of them may be an effective combatant against COVID-19. The new list of drugs adds to other potential treatments already uncovered by other researchers.

**Uncovering Potential Treatments: Opportunities for Support**

Barabási is working closely with Harvard Medical School researchers to refine their models using advanced AI/ML tools, comb through data on approved and experimental drugs that could be repurposed to treat COVID-19, and proceed to validate their findings in clinical trials. To continue this work, Barabási needs funding to perform computation, network modeling, and experimental validation. Opportunities for support include:

**Computation**—The Barabási Lab requires funds to continue developing and running computational models with the potential to better grasp how COVID-19 hijacks healthy cells. This will enable the team to have data processed and analyzed by powerful cloud services, and to utilize powerful supercomputers at Lawrence Livermore National Laboratory that apply advanced AI/ML bioinformatics tools to locate candidate therapies.

**Network modeling**—Virtually every human disease spreads through a cellular network, and COVID-19 has a particularly fast way of doing so as it invades a healthy cell with viral proteins. With additional support, Barabási will be able to add post-doctoral researchers who will help his team use 3D modeling to more fully understand the virus’s spread.

**Experimental validation**—As candidate drugs that could be repurposed to test against COVID-19 are identified, Barabási and his collaborators will test these drugs in human cells. Biologists will observe how the drugs target areas within cells where the virus works, and ideally, find effective treatments against COVID-19.

By investing in the work of Albert-László Barabási, members of the Northeastern community will help empower his team to rapidly solve the mysteries of COVID-19: how it imperils healthy cells and how it spreads. And in doing so, the Barabási Lab will accelerate research around the world with much-needed information about how we can fight the pandemic.