World view

By Stephen K. Burley

How to help the free market fight coronavirus

Share data, boost incentives and reduce red tape to identify drugs for use in emerging coronavirus epidemics.

About five weeks after cases of COVID-19 began to appear, scientists based in Shanghai, China, deposited the first 3D structure of a crucial protein from the virus causing the disease into the Protein Data Bank (PDB), an open-access repository for data on biological structures. As happened with severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) — both also caused by coronaviruses — scientists are sharing information in ways not typical for a competitive, commercial field. Knowing the shapes of proteins from the virus that causes COVID-19 could accelerate the discovery of drugs and vaccines. But that will not happen if other barriers — financial, regulatory or legal — get in the way. Lowering them is essential to defending against COVID-19 and preparing for the inevitable future outbreaks.

Had drug hunters been offered appropriate incentives in the mid-2000s, there would probably be a drug available for COVID-19 today. In 2003, SGX Pharmaceuticals — a company where I ran research at the time — deposited into the PDB the first structure of a SARS virus protein (its main protease, a key drug target). Our decision surprised competitors, because the data were made available without restriction or royalty obligations. Since then, hundreds of additional protein structures from this and other coronaviruses have been shared in this way. Many reveal how viral proteins can be disabled by small molecules.

During the SARS outbreak, I was confident that drug companies would build on open-access data and produce anti-SARS drugs. None was forthcoming. I was similarly optimistic in the wake of the MERS epidemic a decade later. Again, I was disappointed. Economists call this a failure of the free market. With no clear prospect of income from investment in drugs for future epidemics, most companies choose to focus on potential blockbusters.

That is why the public and private sectors need to work together. Collaborative projects are under way on malaria, antibiotic resistance and neglected diseases, but a more focused effort on coronavirus could make us better prepared for a future outbreak and suggest routes to address unmet medical needs. Such a focused effort overcame another free-market failure in the case of cystic fibrosis, which affects only about 70,000 individuals worldwide. An innovative partnership between the non-profit Cystic Fibrosis Foundation in Bethesda, Maryland, and biotech company Vertex Pharmaceuticals in Boston, Massachusetts, led to safe and effective new drugs.

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It might seem reckless to invest public or private money in combating a pathogen that is yet to be identified, but there is a logical way to proceed. Like coronaviruses, many viruses initially produce their half-dozen or so essential proteins as long strings of amino acids, which won't work until they have been snipped apart by 'cutting machines' — viral proteases. Without its main protease, a coronavirus infection cannot spread. The main proteases of the viruses that cause SARS and COVID-19 are 95% identical in their amino-acid sequence. More importantly, their active sites (molecular 'scissors') are identical at the amino-acid level and differ only minutely in 3D structure.

A drug that blocks the main protease of one coronavirus is likely to work for another. As a veteran of small and large drug companies and current director of the US data centre for the PDB, I know how good industry is at targeting proteases. Tens of millions benefit daily from protease-inhibitor drugs treating high blood pressure or heart failure.

I call on world leaders to commit to introducing a new regulatory category of broad-spectrum drugs that can be held in reserve against future disease outbreaks, with appropriate criteria for demonstrating safety and efficacy. Companies would license these drugs to governments or a non-governmental organization (NGO) in exchange for financial rewards and liability protection, necessary incentives that would be independent of drug sales. When the next epidemic hits, viral-genome sequencing would help to establish which drugs represent the best treatment options. Public funds would be used to pay for manufacture and distribution. Clinical trials of approved or safety-tested drugs that could be repurposed for new illnesses should also be accelerated under such a framework.

There are many details to be worked out, but the stakes are so high that we need to make it happen. Government policymakers, industry leaders and NGO representatives have important parts to play in building consensus and developing the framework. I am reminded of the ozone crisis of the 1980s. Universal recognition of an imminent threat to life on the planet and the consistency of the science linking chlorofluorocarbons to ozone depletion inspired the 1987 Montreal Protocol banning their production. In 2019, NASA reported that the seasonal 'ozone hole' had shrunk to its smallest size since 1982.

Rising numbers of COVID-19 infections and deaths show that must we prepare for the next coronavirus outbreak. And the science is as clear as it was with ozone. With the benefit of hindsight, we can see that investment of a few hundred million dollars after the SARS epidemic might have averted thousands of COVID-19 deaths, and financial losses predicted to exceed more than US$1 trillion worldwide. It is time for governments, industry and NGOs to confront the failure of the free market in emergency medicines head-on.

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