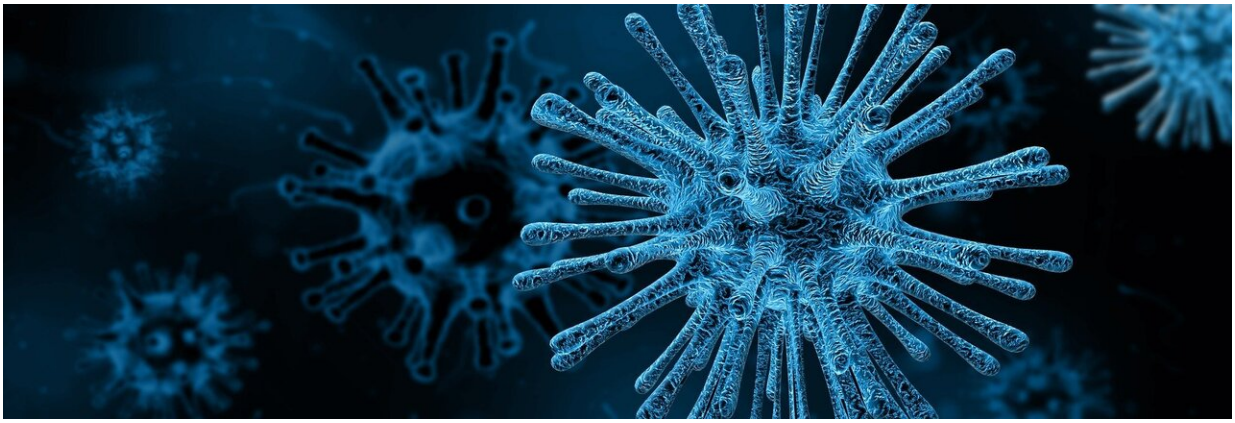
Taming COVID-19 requires urgent search for both vaccine and treatment

May 29 2020, by Patrick Ercolano



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Bonnie Robeson, a senior lecturer at the Johns Hopkins Carey Business School, knows what it's like to take part in an urgent race to find a vaccine or treatment for a lethal malady, such as the current effort to contain the spread of COVID-19. During the 1980s and '90s, Robeson served as principal investigator for a drug discovery and development contract with the National Cancer Institute. Robeson and her colleagues worked on identifying chemical compounds that could kill or slow the growth of cancer cells. As the AIDS epidemic spread, the team shifted its focus to developing a therapy for HIV, the virus that causes AIDS.

While involved in these projects, Robeson took an interest in the

business aspects of science and entered the Johns Hopkins Master of Administrative Science program, the precursor to the current MBA program of the Carey Business School. She earned her MAS in 1988 and a year later joined the adjunct faculty of what was then JHU's School of Continuing Studies in Business and Education. She also holds an MS and a Ph.D. in biochemistry from West Virginia University. As a Carey faculty member, she provides expertise in operations management and the business side of the life sciences.

The Carey School reached out to Robeson for more insights into lessons learned from a career of developing treatments and therapies. Robeson discusses the best approach to combating COVID-19 and considers whether it's better to create a vaccine that can prevent the virus or a therapy that can treat it—or a combination of the two. She also takes the costs into account, in terms of both time and money.

What are the differences between a vaccine and a therapeutic drug?

A vaccine protects a person who is inoculated early from acquiring the disease. All vaccines stimulate the immune system to develop antibodies against the disease. This is a biologic approach. Another is using antibodies processed from the serum of recovered patients. These are then injected into patients who have the disease to stimulate their production of antibodies against the virus.

A therapeutic is a drug administered after the patient has developed a condition—such as drugs that people take to control high blood pressure, diabetes, heart disease, etc. Therapeutics for COVID-19 that are being investigated include hydroxychloroquine and remdesivir. Most often, such drugs are small molecule chemicals, primarily synthesized in a lab or extracted from natural products. Now with the rise of biotechnology

and biopharma, drugs classified as biologics can be manufactured from biological sources.

Should there be more of a focus on finding a therapeutic treatment for COVID-19 or a vaccine?

Both approaches for COVID-19 need to be pursued. It's significant to acknowledge that HIV is a virus, and after 20 years of research, there is still no vaccine for HIV. One challenge with vaccines is that for them to be effective in stimulating the immune response, the world population has to have access to inoculation. Therefore, billions of doses have to be manufactured and distributed. This process takes years to complete. Another challenge is that vaccines often require a cold supply chain. For the vaccine to maintain its potency, the product has to be stored, transported, and delivered within a refrigerated temperature range. Delivering vaccines to developing countries' rural areas where electricity is a luxury is difficult if not impossible. In the meantime, virus mutations may be making the vaccine ineffective.

Therapeutic drugs are often easier to manufacture and distribute. Once the virus's chemistry is understood, then methods to attack the virus replication can be identified and drugs developed to attack the virus using different mechanisms. An ideal therapeutic is one administered orally and stored and transported at ambient temperatures. Presently, remdesivir is administered only by IV drip in hospitals.

Hydroxychloroquine, an antimalarial drug, is in pill form and easy to distribute and take. However, most recent clinical trials do not show efficiency for COVID-19, and the drug can have serious side effects for patients with heart problems.

What are some similarities and differences between

the discovery of AIDS therapies years ago and the work today on possible COVID-19 therapies?

The first approach then and now is the same. The first step is to screen compounds that have been or are in development for other viruses (i.e., antivirals). Thousands of compounds with characteristics of having biological activity against viruses were tested in the 1980s. AZT, which failed as an antiviral therapy for other viruses, was the first compound identified to show activity against HIV. Eventually the compound was approved for use in the general population. Continuing to understand and identify ways to attack the virus led to development of many other therapeutics to include protease inhibitors, integrase inhibitors, etc. Now a multidrug regimen often referred to as a drug cocktail is prescribed for HIV-positive patients.

Remdesivir as a therapy for COVID-19 is following a similar path. It was already in development as an antiviral therapeutic for Ebola.

How long might the process last to develop an effective therapeutic treatment for COVID-19?

In general, it takes 10 years and over $1 billion to develop a therapeutic. However, when you can narrow down the candidates in the beginning, the timeline can be reduced, thanks to advanced scientific tools not available in the past. These include, among others, polymerase chain reaction, or PCR, and X-ray crystallography. PCR takes a small sample of DNA or RNA and amplifies it millions or billions of times. Being able to understand more details about the virus will enable the development of a number of points of attack. X-ray crystallography provides details about the physical structure proteins and a binding site.

The bottom line is today there are sophisticated scientific tools to

understand the virus and identify compounds in a faster timeframe. But the process is very costly. The instrumentation discussed is expensive, the consumables used in the assaying process are costly, and then there are the salaries of the scientists, to name just a few costs in the discovery phase. This is not even considering scale-up, clinical trials, manufacturing, and distribution to patient.

As a rule, pharmaceutical companies do not make much of a profit from vaccines. Instead, they prefer to target diseases for which the high cost of development can be recovered with a sizable profit. Therefore, the companies have been targeting neurological conditions such as Parkinson's disease and Alzheimer's, due to the increased population of aging patients. Also, developing drugs taken orally on a daily basis provides profits for shareholders.

Provided by Johns Hopkins University

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