Coronavirus: How we're creating a rapid test that could help halt the pandemic

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Credit: Enric Cruz López from Pexels

Testing has become central to the discussion about how to best tackle the current coronavirus pandemic. The World Health Organization is recommending frequent and broad testing in order to identify exactly who has and hasn't caught the virus and stop its spread by isolating the infected.

But the currently available tests don't provide the kind of rapid result that is needed to isolate people before they can pass on the virus. This is especially true for healthcare staff and other people who need to keep working outside their homes but could be unwittingly transmitting the disease because they don't realize they have it.

My colleagues and I are one of several groups of researchers around the world working to develop a rapid test for the virus that could solve this problem. Our goal is to produce a cheap, near-instant test kit that anyone can use, and we hope to have one ready later this year.

The current test method relies on looking for genetic evidence of the virus using the so-called polymerase chain reaction (PCR) method. This method is very sensitive and can diagnose infected patients even in the early phase of the disease.

But it typically takes at least three hours, including handling at the hospital, to produce a result. If a nurse or doctor is waiting three hours to find out if they are infected, that's valuable time they could be using to treat patients—or time they may be infecting others. The workload and cost involved also mean the test can't easily be used to carry out mass screening of the rest of the population.

Another option is to test patients' blood for antibodies that the body creates to fight the virus. This is cheaper and easier than the PCR method but the antibodies may not be detectable for up to a week after contracting the virus. That makes it good for estimating what percentage of people have had the disease but means it can miss newly infected patients.

All this means there is a clear need for a sensitive, rapid test that can identify the virus in a person within minutes, and that people can ideally use on themselves at home without a medical professional. The way my

colleagues and I are working to produce such a test is to create our own antibodies that can catch the virus so we can directly identify its presence in a sample.

Diagnostic antibodies

Antibodies are proteins that bind in a highly targeted way with very specific structures on the surface of harmful microbes such as viruses. The antibodies can be attached to a particle that acts as a label and becomes easily detectable in the presence of the microbe.

These kind of diagnostic antibodies are typically generated by injecting part of a virus into a mouse. This essentially vaccinates it so that its immune system starts to produce antibodies against the virus. We can then isolate and cultivate the cells that produce these specific antibodies to create our own unlimited supply.

My university department has been developing a range of diagnostic antibodies for several years. A single mouse can produce millions of different antibodies and we specialize in developing very selective ways to screen a selection of antibody candidates. Our aim is to rapidly narrow them down to the few that are best at binding to the virus and not to other molecules.

In the case of the current coronavirus pandemic, we were initially contacted by a the clinical microbiology department of Odense University Hospital to see if we could help grow the virus for study. Given our expertise, it was natural for us to also start producing antibodies as a research tool. We are currently working hard at making and selecting antibodies, with the aim of producing a test for a second wave of the disease, which could well occur later this year.

For the test to function, we also need a way to deliver a patient's sample

to the antibodies and quickly reveal if the virus is present. One solution is to use the so-called lateral flow technique commonly used in over-the-counter pregnancy stick tests but other tests for viruses such as HIV and influenza. The patient's sample flows down the test stick and is captured by a line of antibodies, which then become visible thanks to the colored label particles.

In the past, these kinds of test haven't been as accurate as the PCR method as they can produce more false positive results (indicating someone has the virus when, in fact, they don't). We can minimize this problem by finding the most specific antibodies using the screening process mentioned above. Our aim is create a test with similar levels of sensitivity and accuracy to the current PCR based methods. But people who test positive for the virus could also follow up with a PCR test to be sure.

Working with company BioPorto Diagnostics, we hope to have an approved version of the test kit is available within the second half of 2020. Our initial goal is to help hospital staff continue working while minimizing the risk they are passing on the virus. In the longer term, we can even envision screening air passengers or people going to work or social events. This could mean the current lockdown measures could be lifted for some aspects of life because we would be able to quickly determine who was infected and who wasn't.

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