McCANN HEALTH

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Published 3 June, 2020

THE WHO, WHAT, HOW AND WHY OF VIRUS DETECTION

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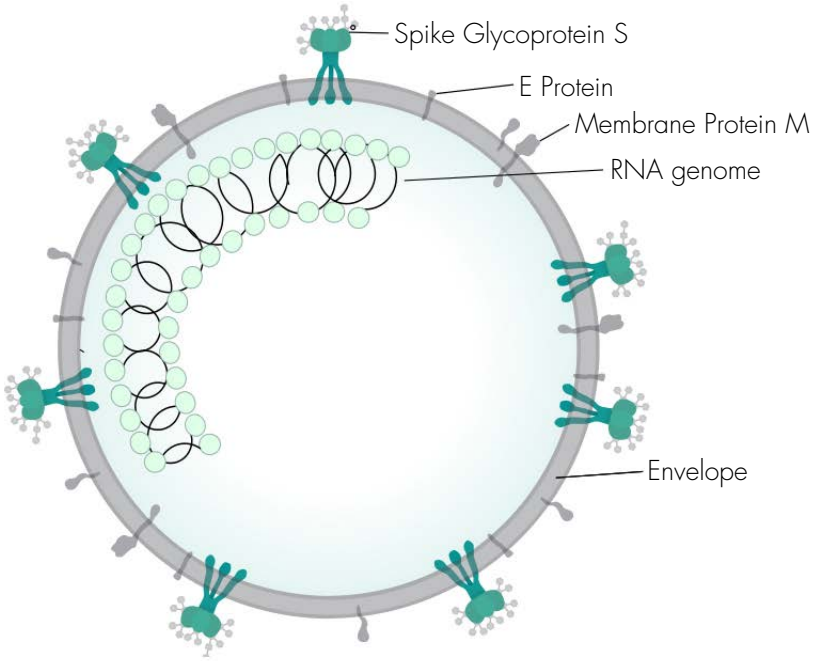
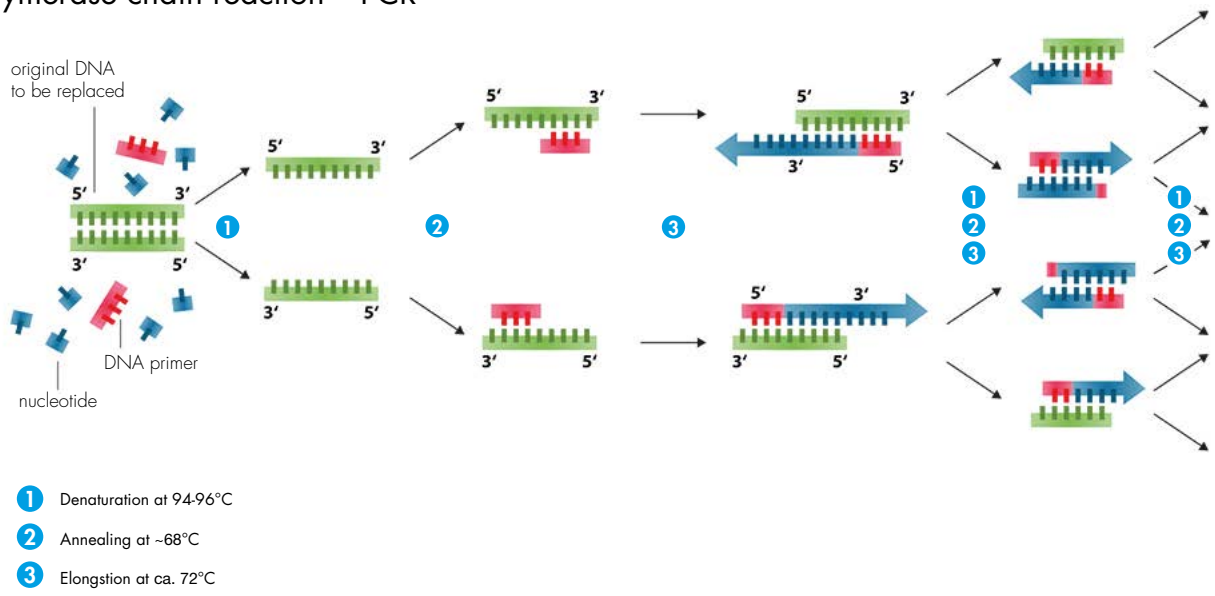


The SARS-CoV-2 virus that causes COVID-19 (*By SPQR10Binte altaf – Own work, CC BY-SA 4.0*)

WHAT CAN WE DO TO DETECT A VIRUS THAT WE CAN'T SEE?

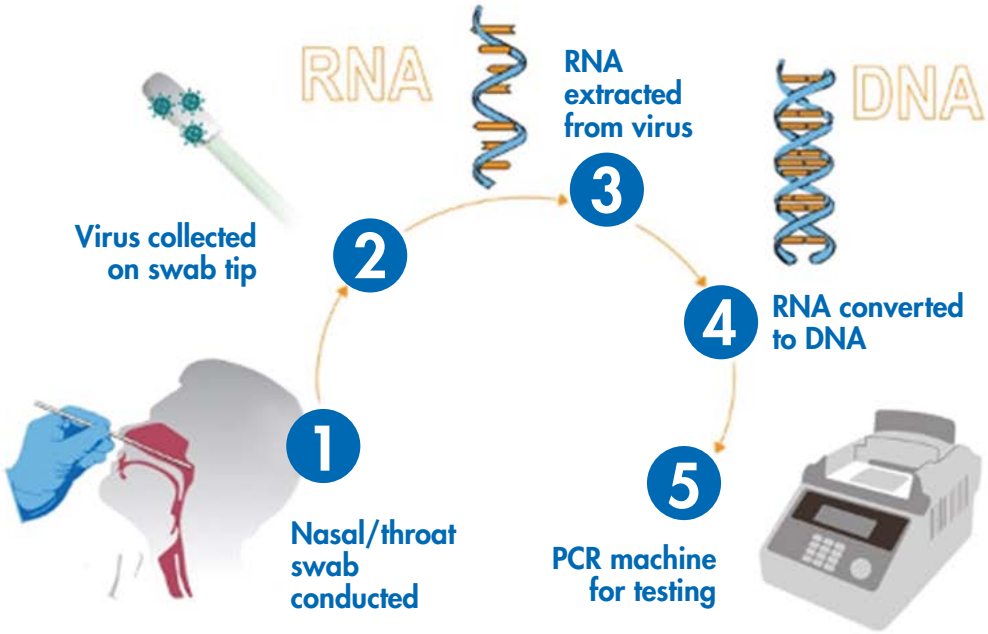
Each virus particle is 50–200 nanometers in diameter (or about 50–200 billionths of a meter). Because of this small size, one of the most accurate methods that can be used to detect the COVID-19 virus is a technique known as PCR (polymerase chain reaction). This method works by using short strands of DNA, called primers, to specifically detect genetic material from the virus and make copies of it. A single molecule of genetic material can result in billions of copies. It's a little like a molecular photocopier/Xerox, except this copier will only work if your document fits into very, very precise margins.

Polymerase chain reaction – PCR



How PCR works – a molecular photocopier/xerox for DNA (*By Enzoklop – Own work, CC BY-SA 3.0*)

SO HOW DOES THIS WORK WHEN MY NOSE/THROAT GETS SWABBED?



As the virus is known to target the lining of the nasal passages, testing involves taking a swab from the very back of your nose/throat. It's a little uncomfortable, but it's the only way at the moment to be sure that a good sample can be collected; new sample collection methods that use saliva are being developed. The swab is then stored in a sterile container with a small amount of liquid to prevent contamination from the environment and is transported to a testing facility. At the facility, the genetic material on the swab (i.e. RNA) is isolated, converted to DNA and fed into the PCR machine (i.e. the molecular photocopier/Xerox). If there is any genetic material from the virus, it will get copied million/billions of times, so even tiny amounts can be detected. We all know how hard it is to find that single post-it note that gets lost amongst the clutter on our desks, so imagine how easy it'd be to find it after it got copied almost 70 million times!

THAT SOUNDS REALLY SIMPLE. SO WHY IS IT SO HARD TO GET MORE TESTS DONE?

While this sounds simple, the actual isolation of genetic material and operation of the PCR test requires very specialised equipment and highly trained people. Because the PCR method is so sensitive, even a tiny amount of contamination can alter the results. Imagine if you got an extra scrap of paper caught in the copier while it was making 70 million copies of that post-it!

Also, depending on the method used for the PCR, the time needed to go from sample collection to testing and result interpretation can range from several hours (best case scenario when there are only a few dozen samples to process) to a day or more.

Importantly, the virus's genetic material (RNA) is very delicate. So if the greatest of care is not taken when sample collection and testing are done, the virus material can get destroyed and a false negative result may happen (i.e. the test says you don't have the virus when you actually do). The flip side of this is that a positive test means that virus genetic material was detected, but it may not mean that you have whole and infectious virus particles in you. Which just goes to show why it's so important to have specially trained people to conduct the testing and interpret the results.

WHY CAN'T WE JUST USE THOSE NEW RAPID TESTS INSTEAD?

The new rapid tests that have been developed work by detecting antibodies against the virus. Antibodies against the virus are only formed weeks **after** you've recovered from COVID-19, so the presence of antibodies does not mean that you still have the virus. You may have recovered long ago.

Antibody testing can't tell us if you still have the virus, but PCR can because it only works if you have viral genetic material on you (or rather in your nasal passages).

New rapid tests are being developed that can detect the viral protein, antigens, as opposed to the genetic material. These tests are much easier to administer, are less expensive, and can provide results in minutes. Although antigen detection tests are less sensitive than PCR they are highly specific, meaning that if the test is positive it is very likely that the antigen is present. However, they are less sensitive than PCR, which means that a negative test does not necessarily rule out infection and which may require confirmation by PCR. The first antigen detection test has been given Emergency Use Authorization by the U.S. FDA.