

Revealed: Protein 'spike' lets the 2019-nCoV coronavirus pierce, invade human cells

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Researchers Jason McLellan (left) and Daniel Wrapp study the structure of the 2019-nCoV coronavirus. Credit: Vivian Abagiu/Univ. of Texas at Austin

Researchers in the United States have unveiled the [structure](#) of the "spike protein" of 2019-nCoV—the virus behind the current coronavirus disease outbreak.

Despite the fact that researchers have already pieced together the virus's [genetic sequence](#), the World Health Organisation has warned that a

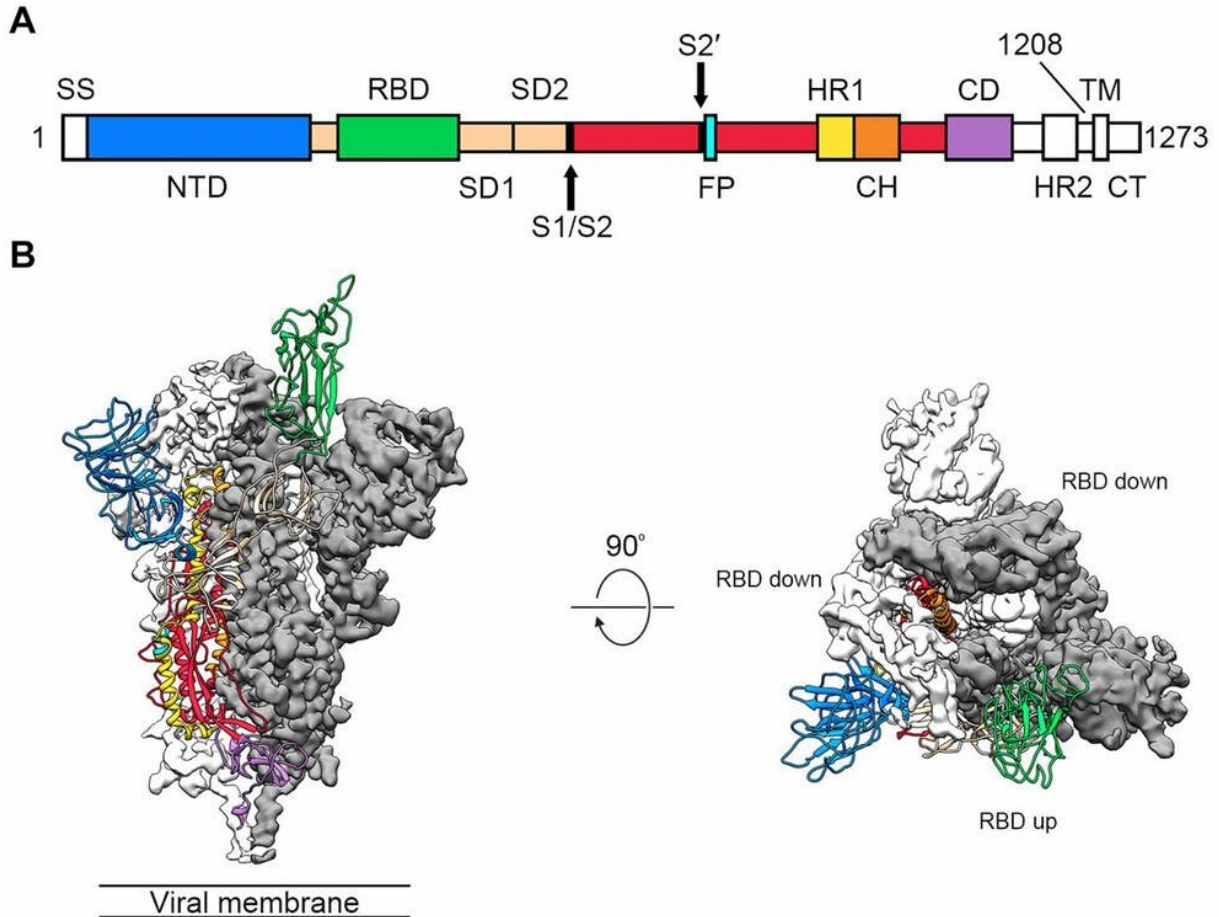
vaccine is still 18 months away.

But knowing the structure of the virus's spike protein gives us crucial information about exactly how the virus infects host cells. This could be a vital piece of the puzzle in making the hoped-for vaccine a reality.

What is a spike protein?

A viral spike protein is like a key that "unlocks the door" to gain access to the cells of a specific host—humans, in this case. To understand how to deal with 2019-nCoV, we first need to understand what this key looks like, and what "keyhole" it targets on human cells. This is exactly what the new paper, [published overnight in Science](#), is all about.

The researchers, led by Jason McLellan of the University of Texas at Austin, defined the structure of 2019-nCoV's spike protein using a technique called cryogenic electron microscopy, or "Cryo-EM". This involves cooling the protein to below -150°C , so that it crystallises and then its structure can be determined with near-atomic resolution.



The newly discovered molecular structure of the 2019-nCoV spike protein, which the virus uses as a 'key' to gain access to human cells. Credit: Wrapp et al. 2019/Science

They also identified the "keyhole", the [host cell](#) receptor: it is a human protein called angiotensin converting enzyme 2 (ACE2). This is the same human receptor protein targeted by the earlier SARS coronavirus.

But, disturbingly, the researchers found that 2019-nCoV binds to ACE2 with much higher affinity (10-20 times higher!) than SARS. In other words, 2019-nCoV's "key" is a lot "stickier" than the SARS one. It's like

a SARS "key" covered in superglue. This means that once it's in the lock, it's far less likely to be shaken loose and is therefore presumably more effective at invading our [cells](#).

So what about a vaccine?

The researchers reasoned that, given that both viruses attack the same protein on [human cells](#), it would be worth seeing whether the already available antibodies against SARS-CoV would work against 2019-nCoV. Unfortunately, they didn't work.

This means we still have to wait for a stronger solution to this problem. Perhaps this is a reflection of the ongoing "arms race" between humans and viruses. We have stronger weapons now, thanks to [scientific advances](#), but our enemies are gaining strength too—now they are using superglue against us!

Globally, the competition is heating up to hunt for the best anti-2019-nCoV vaccine. But as the old [Chinese proverb](#) says, "distant water can't put out a nearby fire". The earliest clinical trials to test a suitable vaccine will not be available until several months or even a year after a candidate [vaccine](#) is identified, and the global coronavirus outbreak may well be controlled by then.

The discovery of the 2019-nCoV spike [protein structure](#) therefore represents both good news and bad. The good news is now we know what it looks like, it will be easier to find the most suitable weapon against the [virus](#). The bad news is the enemy is much stronger than we thought, and our current ammunition depot doesn't have anything efficient against it.

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