The science behind a successful virus

The B1617 variant of the Sars-CoV-2 virus spreads more easily and has now reached over 50 countries worldwide. **Dr Sebastian Maurer-Stroh**, virus expert and executive director of the Bioinformatics Institute at the Agency for Science, Technology and Research, tells **Clara Chong** about the science behind coronavirus mutations.

Dictionary of terms

Infectivity

- Refers to the virus' ability to infect a host cell. If infectivity increases, the virus is able to infect the host cells faster.
- Only cells with the ACE2 receptor can be infected by Sars-CoV-2.

Transmissibility

- Refers to how quickly the virus spreads from one person to another.

Severity

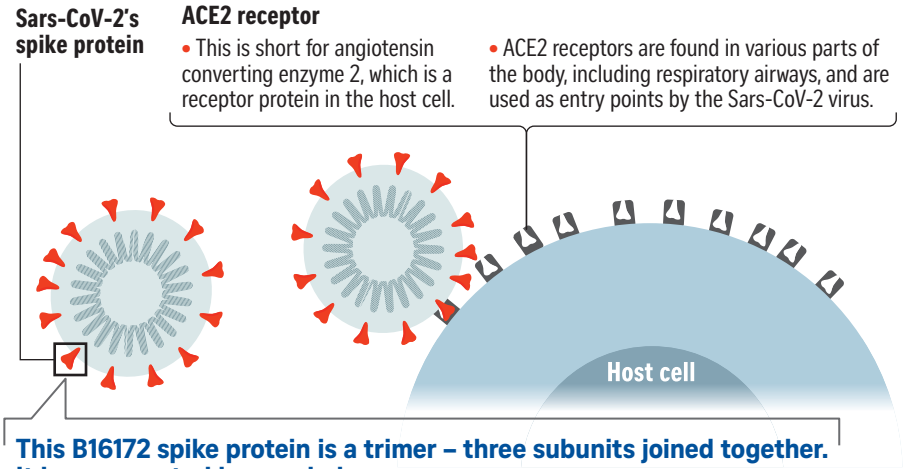
- Refers to how seriously ill the person is.
- A person with severe Covid-19 disease might need hospitalisation and intensive care.

FOUR CHARACTERISTICS OF SUCCESSFUL VIRAL STRAINS

Dr Maurer-Stroh outlines four features that show up repeatedly in the more successful viral strains*.

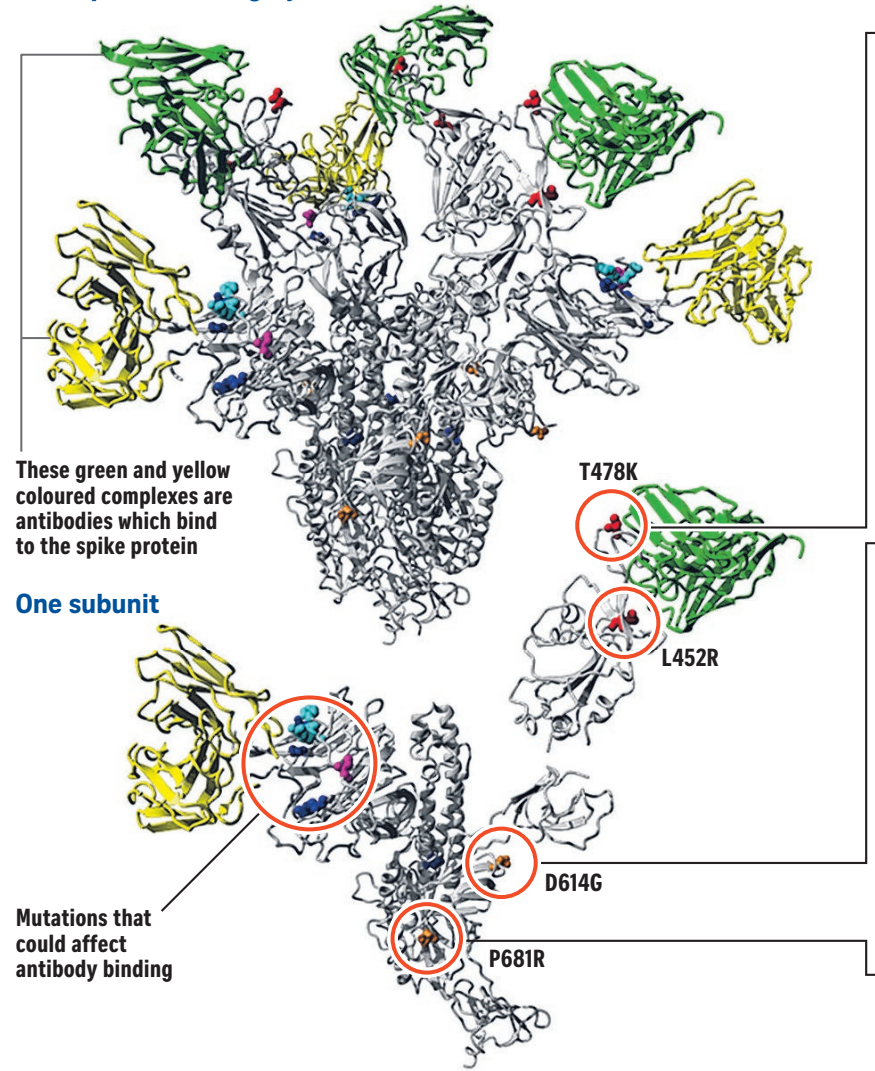
NOTE: *There are three versions of the B1617 strain, with the second version – B16172 – being the most relevant here.

1 The virus' mutations help it to bind more easily to the ACE2 receptor



- The Sars-CoV-2 virus gets inside a host cell using its surface spike protein.
- The spike protein attaches to an ACE2 receptor in the host cell before being activated by another enzyme.
- Scientists think the L452R mutation – and to a lesser extent the T478K mutation – makes it easier for the virus to attach itself to the receptor and thus get inside the cell.
- If binding to the receptor is easier, the virus can get inside the host cell more easily and infect more cells.
- But being more infectious does not mean it can make people more ill.
- A more transmissible strain most often **does not have more symptoms or lead to a more severe form of the disease.**

This B16172 spike protein is a trimer – three subunits joined together. It is represented in grey below.



2 Antibodies

T478K and certain other mutations probably make the virus less likely to stick to antibodies.

- In a full immune response, many types of antibodies work together.
- Though a decrease in antibody binding has yet to be proven for T478K, correlation was drawn based on existing data. The E484K mutation found in the B1351 and P1 variants is located in the same region as T478K – hence it is likely that there will be a similar effect.
- Even though **one mutation could slightly reduce the protection derived from vaccines and prior infections,** it is insufficient to remove their utility.
- **Vaccination and natural immunity from prior infections are still very effective** in reducing the chance of getting infected and spreading the disease, as well as providing protection against a severe form of the disease – even in the case of variants.

3 A more stable spike protein

The D614G mutation has been very successful in improving spike protein stability and is found in practically all strains of the virus.

- D614G results in the spike protein adopting a more open conformation, which gives it more surface area to interact with the ACE2 receptor, hence **increasing its infectivity.**
- A more stable spike protein can also mean more spike protein expressed on the virus surface, increasing its chances of infecting host cells.
- D614G has been linked to **increased transmissibility and a higher viral load** but not increased severity.

4 Improving cleavage rates

The spike protein needs to be cleaved into two units to allow structural changes needed to enter cells.

- Mutations like P681R could **potentially improve cleavage rates and hence increase infectivity.** This has yet to be confirmed experimentally.

SOURCES AND PHOTO: GISAID, ASTAR STRAITS TIMES GRAPHICS