Research on Coronavirus' Proteins

Why in news?

Research shows that the spike protein of SARS-CoV-2 changes its form after it attaches itself to a human cell.

What is the spike protein?

- A spike protein protrudes from the surface of a coronavirus, like the spikes of a crown or corona.
- In the SARS-CoV-2 coronavirus, the spike protein **initiates the process of infection** in a human cell.
- It attaches itself to a human enzyme (ACE2 receptor) before entering into the cell and makes multiple copies of itself.

What has the new research found?

- Researchers have freeze-framed the spike protein of SARS-CoV-2 in both its shapes - before and after fusion with the cell.
- For doing this, they have used the technique of cryogenic electron microscopy (cryo-EM).
- The images show a dramatic change to the hairpin shape after the spike protein binds with the ACE2 receptor.
- The "after" shape can show itself before fusion without the virus binding to a cell at all.
- The spike can go into its alternative form prematurely.

What does that signify?

- The alternative shape may help keep SARS-CoV-2 from breaking down.
- The rigid shape may explain why the virus remains viable on various surfaces for various periods.
- It is speculated that the post fusion form may protect the SARS-CoV-2 from our immune system.

In what way can it protect the virus from the immune system?

- Post fusion shape can induce antibodies that do not neutralise the virus.
- In effect, the spikes in this form may **act as decoys** that distract the immune system.
- Antibodies specifically targeting the post fusion state would not be able to block viral entry since it would be too late in the process.

Do the two forms share any similarities?

- Both the “before” and “after” forms have sugar molecules, called glycans, at evenly spaced locations on their surface.
- Glycans are another feature that helps the virus avoid immune detection.

How is the knowledge about the alternative shape useful?

- These findings may have implications for **vaccine development**.
- Many vaccines that are currently in development use the spike protein to stimulate the immune system.
- But these may have varying mixes of the prefusion and postfusion forms.
- This may limit their protective efficacy.
- There is a need for stabilising the spike protein in its prefusion structure to block the conformational changes that lead to the postfusion state.
- If the protein is not stable, antibodies may be induced but they will be less effective in terms of blocking the virus.
- Using this research’s prefusion structure as a guide should help us in introducing stabilizing mutations to mimic the prefusion state.
- This could be more effective in eliciting neutralizing antibody responses.
- This would be done by the researchers in case the first round of vaccines are not as effective as we all hope.

Source: The Indian Express