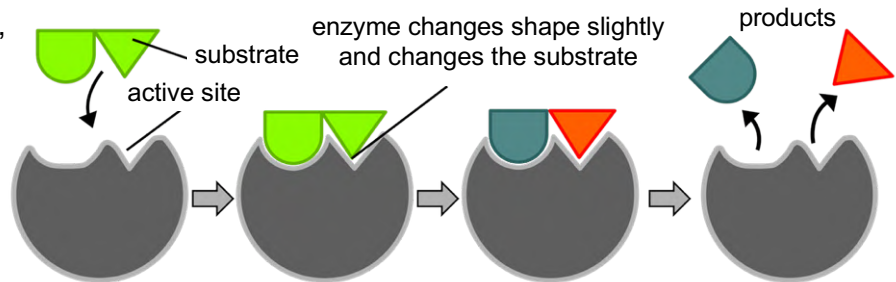


Catalysts

A substance that speeds up a chemical reaction is a **catalyst**. **Enzymes** are biological catalysts - they speed up reactions in organisms. For example, amylase is an enzyme in the digestive system. It breaks big starch molecules into smaller sugar molecules. A very simple model is to imagine it acting like scissors. The starch is the **substrate** for the enzyme. The sugars are the **products**.

Some enzymes build bigger molecules from smaller substrates. Other enzymes change their substrates in some way, without making them bigger or smaller.

An enzyme has a specific shape, the most important part of which is its **active site**. A substrate of the wrong shape will not fit the active site. Like keys fitting into locks, enzymes are very specific for their substrates. So, amylase cannot break down proteins because only starch fits its active site.



So, amylase cannot break down proteins because only starch fits its active site.

Temperature and pH both change the shape of an enzyme and its active site. If this happens the enzyme may not bind to its substrate properly and a reaction will not happen so quickly. Sometimes, an enzyme's shape is changed so much that it stops working. We say that it has been **denatured**.

SARS-CoV-2 enzymes

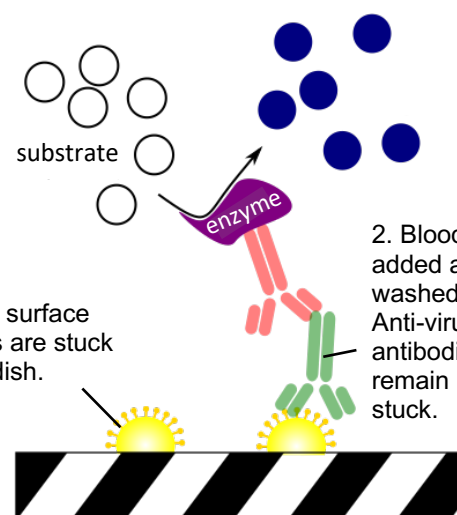
When SARS-CoV-2 enters a cell, it instructs the cell to make proteins. Some of these proteins are enzymes, which make molecules for new virus particles. Scientists are testing substances that stick to and block the active sites of virus enzymes to stop them working. These are enzyme inhibitors.

ELISA tests

After a person has had COVID-19, antibodies are left in the blood. The body has made these anti-virus antibodies with a specific shape that only matches and sticks to proteins from the virus. Enzymes are used in an ELISA test to detect these antibodies in a person's blood. The diagram shows how this works.

3. An artificial antibody (pink) with an enzyme attached is added and washed off. If there are anti-virus antibodies, the artificial antibodies remain stuck to them.

4. A substrate is added, which the enzyme turns a different colour.



Find out

- I. 1. What does ELISA stand for? _____
2. a. Name an inhibitor of the 3CL^{pro} enzyme from SARS-CoV-2. _____
- b. What type of enzyme is 3CL^{pro}? (tick one).
- amylase polymerase lipase protease
- c. What do enzymes of this type do? _____

Test yourself

3. Explain why enzymes are described as biological catalysts. _____
- _____
4. a. Name the process in humans for which amylase is important. _____
- b. Explain why other enzymes are also needed to complete this process. _____
- _____
5. Name a substance that enzymes are made of. _____
6. a. Explain why scientists think that some inhibitors could treat COVID-19 patients.
- _____
- b. Explain why it is important that these substances do not inhibit human enzymes.
- _____
7. a. Give the reason why an ELISA test does not detect all the types of antibody in blood.
- _____
- b. In the diagram on page 1, state the colour that shows a positive test result. _____
- c. Explain why there is no colour change in a negative result. _____
- _____
- d. Explain why doing an ELISA test at too high a temperature may give a 'false negative'.
- _____
- e. Name one other variable that needs to be controlled in an ELISA test. _____

Check-up

- I. Check your answers.
- II. Build a model to show the importance of the shape of an enzyme's active site. You might use plastic modelling bricks (e.g. LEGO®).

