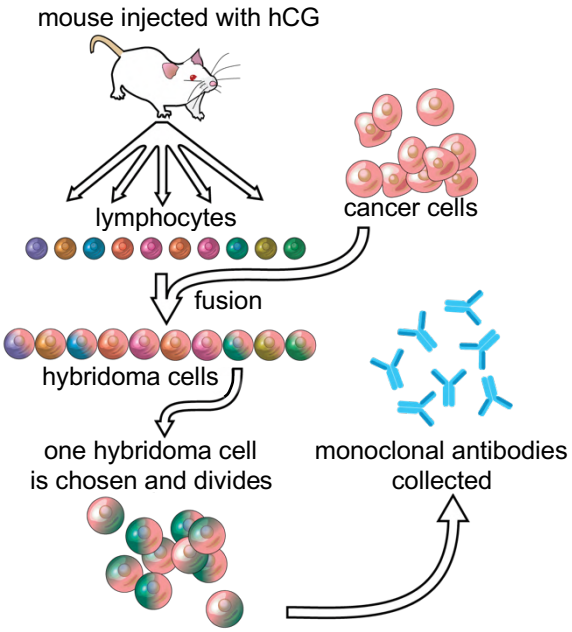
17 Antibodies & COVID-19

Links:
• *Edexcel 9-1* SB5l

Monoclonal antibodies

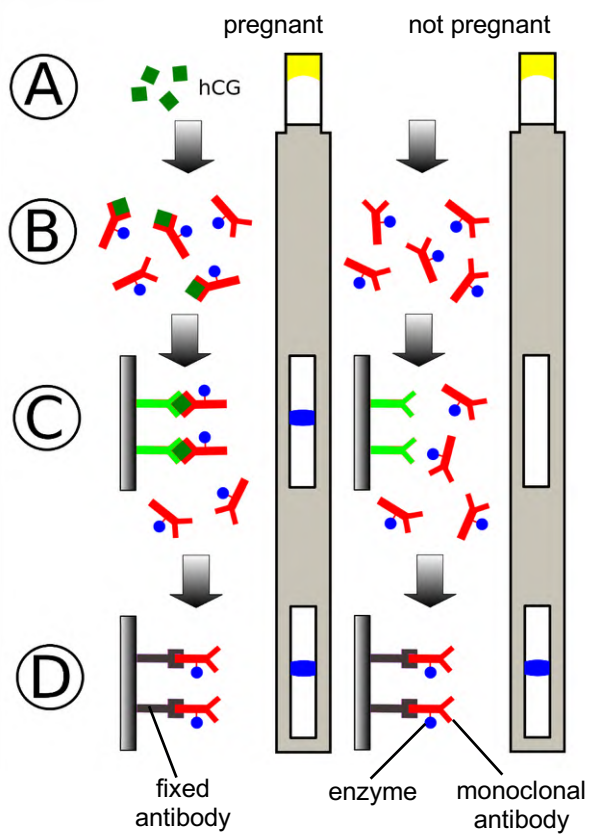


During pregnancy, a substance called hCG appears in the urine. Pregnancy test strips detect hCG using **antibodies** that only stick to hCG. To make test strips, vast numbers of the antibodies are needed.

To make the antibodies, hCG is injected into a mouse. Some of its lymphocytes then produce antibodies that stick only to hCG. The mouse lymphocytes are collected.

However, these lymphocytes do not undergo **cell division** and so obtaining enough of them would take a very long time. To overcome this, the lymphocytes are fused with cancer cells to form **hybridoma cells**. These make antibodies *and* divide to make copies (**clones**) of themselves, which gives us a limitless supply. The antibodies are **monoclonal** because they come from clones of one hybridoma cell.

Test strips



Enzymes are attached to monoclonal antibodies for use in test strips. In a pregnancy test strip, urine is added to zone A (in the diagram) and soaks along the strip. In zone B, any hCG molecules stick to the monoclonal antibodies (but there are more antibodies than hCG molecules).

The urine carries the monoclonal antibodies into zone C. Here, there are antibodies (in green) that also stick to hCG. But these are fixed in place and cannot move. They trap the monoclonal antibodies that are attached to hCG. The monoclonal antibodies without hCG carry on moving.

Zone D is to show that the test strip is working. It contains fixed antibodies that capture the monoclonal antibodies.

Zones C and D contain a colourless substrate for the enzyme. The enzymes on the monoclonal antibodies that are stuck in either of these zones, slowly change the substrate into a coloured substance.

Similar test strips are being developed to find out if someone has antibodies against SARS-CoV-2. If a person has antibodies against the virus it means that they have had COVID-19.

Find out

I. 1. Apart from test kits, describe two further uses of monoclonal antibodies.

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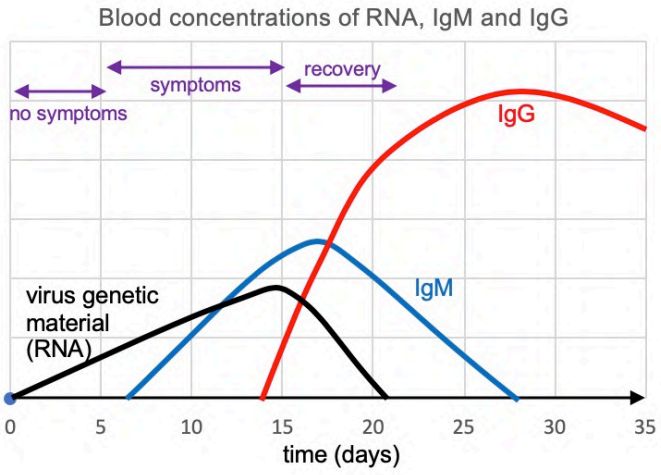
_____

2. From what mouse organ are the lymphocytes collected. _____
3. Who won a Nobel Prize for their work on monoclonal antibodies?

_____

Test yourself

4. The graph shows changes in the concentrations of three substances in blood during COVID-19 infection. IgG and IgM are two different types of antibody, which are different shapes and sizes.



   a. Name the molecule used as the virus' genetic material. _____

   b. Explain the shape of the graph for this material. _____

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_____

   c. The virus genetic material is detected in a PCR test. IgG and IgM could be detected in a test strip. Complete the table to show the results of these tests at different stages of infection. Use + for positive and – for negative.

Test results (+ / -)			Stage of infection
PCR	IgM	IgG	
			No symptoms and no sign of previous infection.
			No symptoms but is infected.
			No symptoms but has previously been infected.
			Symptoms present for less than a week.
			Symptoms present for a week or more.

   d. Describe how to get lymphocytes to make anti-IgG and anti-IgM antibodies for the test.

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Check-up

I. Check your answers.

II. Design an antibody test strip for COVID-19. Present your idea in a similar way to the diagram on page 1, showing what type of antibodies will be present in each zone.