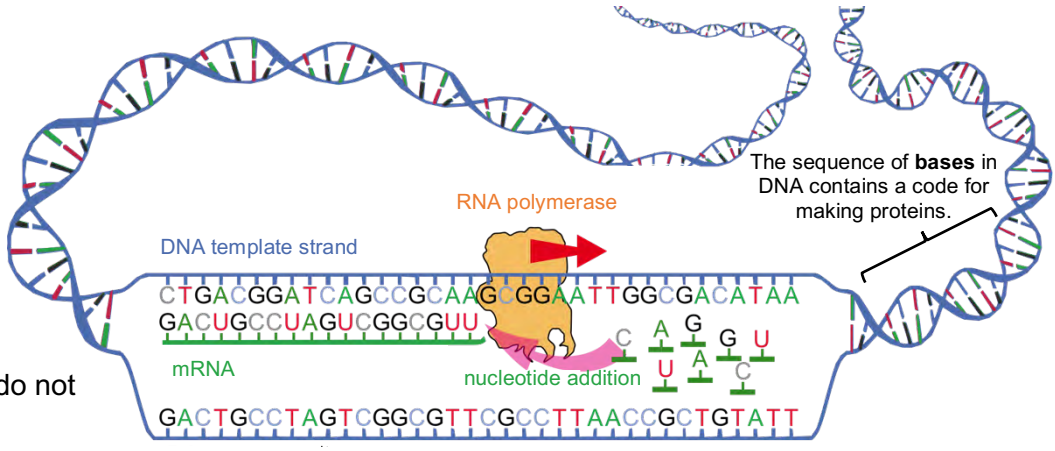
12 Proteins & COVID-19

Links:
• *Edexcel 9-1* SB3d/e

Transcription

Some sections of a DNA molecule contain the code needed to a make a protien. These are **genes**. Other sections are non-coding because they do not contain these instructions.

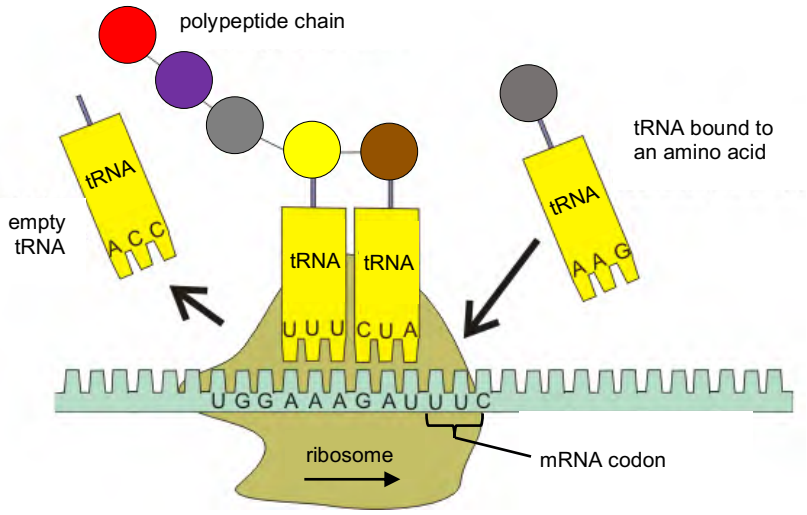


To make a protein, the code on a gene is transferred to a molecule called **messenger RNA** (**or mRNA**).This can leave the nucleus, taking the code to the cytoplasm where proteins are made.

To make mRNA, an enzyme called RNA polymerase attaches to a non-coding region next to a gene. It moves along the DNA, separating its strands and using one (the **template strand**) to match up complementary RNA nucleotides. It adds these together to form a single mRNA strand. This is similar to DNA but has ribose sugar and the base uracil instead of thymine. This process is **transcription**.

Translation

The mRNA leaves the nucleus through a **nuclear pore** (a tiny hole in the nucleus membrane). In the cytoplasm it attaches to a **ribosome**. This pairs up the bases on the mRNA with bases on molecules of **transfer RNA** (**tRNA**), in groups of three (called **codons**).



The mRNA codons match different tRNA molecules carrying different **amino acids**. As the ribosome moves, it links the amino acids into a **polypeptide chain**. This is **translation**. Polypeptide chains are cut, joined and folded into proteins.

When SARS-CoV-2 enters a cell, it releases its single strand of RNA. Human ribosomes translate this to make proteins, including the virus' RNA polymerase (which makes copies of the viral RNA). Favipiravir is a drug that blocks this enzyme and is being tested to see if helps COVID-19 patients.

Scientists have also made human mRNA with the same sequence of bases found on the virus' spike protein gene. By injecting this mRNA, they hope that some of the body's cells will produce the spike protein, which will cause **lymphocytes** to make **antibodies** against it. This is an RNA vaccine.

Find out

I. 1. 20 amino acids are found in human proteins. Their corresponding mRNA codons are shown in an RNA codon table. Find an example on Wikipedia (wikipedia.org).

a. How many codons are shown on the mRNA in the diagram on page 1? _____

b. Use the RNA codon table to give the name of the amino acid that each one adds.

_____

2. There are different ways in which the spike protein gene from SARS-CoV-2 used to make a vaccine. One is described on page 1. Find out what these other types consist of.

a. viral vector _____

b. DNA plasmid _____

Test yourself

3. Some *template strand* codons are shown. Write in the corresponding mRNA codons.

A A T	T G G	G C G	T A G	C G T

4. State the name of the process in which mRNA is produced. _____

5. Deoxyribose is the sugar in DNA strands. Which sugar is in RNA? _____

6. Explain why the code from DNA needs to be copied onto mRNA. _____

_____

7. Give the number of mRNA *bases* in the code for a polypeptide with 8 amino acids. _____

8. What does RNA polymerase break when separating DNA strands? _____

9. Haemoglobin is a protein that contains four polypeptides. Describe what is means.

_____

Check-up

I. Check your answers.

II. Go to https://bit.ly/3dmVXrL which shows an animation. Gly, Pro and Met are shorthand names for the amino acids glycine, proline and methioine. You are going to write a voice-over to explain what happens in five scenes. Scene 1 is what you see when you open the page. Scenes 2 – 5 are what happens when you click on 'Translate step by step' a total of four times. Try recording your voice-over with the scenes.