

APOLLO

# Mutation and gene editing

## HL

Biology

First assessment 2025

9 questions | questions

11. A DNA sequence before and after a mutation is shown.

**Before mutation**      3' TAC TCC TGC TTC 5'

**After mutation**      3' TAC TGC TGC TTC 5'

The table contains mRNA codons and their associated amino acids.

| mRNA codon | Amino acid |
|------------|------------|
| AUG        | Met        |
| AGG        | Arg        |
| ACG        | Thr        |
| AAG        | Lys        |
| UAC        | Tyr        |
| UCC        | Ser        |
| UGC        | Cys        |
| UUC        | Phe        |

What would be the effect of this mutation on the translated polypeptide?

- A. Thr would replace Arg.
- B. Cys would replace Ser.
- C. There would be an extra Arg.
- D. There would be no change in the amino acid sequence.

**11.** What is gene knockout used for?

- A. Increasing protein production by editing a gene
- B. Investigating the function of a gene by replacing it to make it inoperative
- C. Identifying the presence of a gene by editing it to produce a different protein
- D. Editing a gene to initiate cell death

**Turn over**

- 27.** Azithromycin is an antibiotic commonly used to treat pneumonia, an infection of the lungs caused by *Streptococcus pneumoniae*. A patient was diagnosed for the second time with pneumonia, but the same antibiotic was ineffective this time. What biological explanation might there be for this?
- A. *S. pneumoniae* had mutated.
  - B. *S. pneumoniae* had developed antibodies for the antibiotic.
  - C. The patient was immune to the antibiotic.
  - D. The patient had antibiotic remaining from the first treatment.

**Turn over**

10. The sequence of DNA bases coding for part of a polypeptide is shown.

AAG TTA CCC GAG TTT AGT



What is the fourth mRNA codon transcribed from the DNA if the base indicated by the arrow is deleted?

- A. UCA
- B. CUC
- C. TCA
- D. AGT

- 19.** Which characteristic is shared by all tumours?
- A. Cells metastasize from the primary tumour
  - B. They result from mutations
  - C. Spherical in shape
  - D. Malignancy

11. Two DNA sequences are shown.

**Sequence 1**      CACGTGGACTGAGGACTCCTC

**Sequence 2**      CACGTGGACTGAGGACACCTC

What type of mutation is occurring between sequence 1 and sequence 2?

- A. Substitution
- B. Polyploidy
- C. Insertion
- D. Deletion

- 11.** Knockout organisms are used as models in research. The p53 knockout mouse is named after p53, a gene which codes for a protein that normally suppresses the growth of cancerous tumours.

How could scientists use p53 knockout mice in cancer research?

- A. To extract tumour suppressor protein from p53 knockout mice for cancer treatments
- B. To obtain functional copies of the p53 gene to use in gene replacement therapy
- C. To investigate the effect of new anti-cancer drugs on mouse tumours
- D. To study the effect of mutations on the expression of the p53 gene

- 22.** What is **always** a consequence of single-nucleotide polymorphisms (SNPs) within a species?
- A. Different proteomes
  - B. Different genomes
  - C. Deletion mutations
  - D. Insertion mutations

## Section B

Answer **two** questions. One additional mark is available for the construction of your answers for each question. Answers must be written within the answer boxes provided.

**10.** Changes in the form of biological molecules lead to changes in their function.

- (a) Outline the role of UV radiation as a mutagen. [4]
- (b) Explain how the function of DNA is linked to its molecular structure. [7]
- (c) Describe the use of gene knockout technology in research. [4]



**References:**

2. *Electron micrograph of cells from the leaf of a corn plant*, n.d. [image online] Available at: <<http://innolearn.weebly.com/bio-cell.html>> [Accessed 9 December 2020].
- 3a. Smith, R.S., 2008. The Role of Auxin Transport in Plant Patterning Mechanisms. *PLoS Biol*, 6(12): e323. <https://doi.org/10.1371/journal.pbio.0060323>.
- 4b. Left image:  
[*Alveoli in the lungs of a human*], n.d. [image online] Available at: <[http://medcell.med.yale.edu/histology/respiratory\\_system\\_lab.php#slides](http://medcell.med.yale.edu/histology/respiratory_system_lab.php#slides)> [Accessed 9 December 2020].
- Right image:  
[*salt water fish gills histology*], n.d. [image online] Available at: <<https://br.pinterest.com/pin/255297872605284426/>> [Accessed 9 December 2020].
- 4c. *Transmission electron micrograph of the S1 segment of a rat proximal tubule*, n.d. [image online] Available at: <<https://abdominalkey.com/anatomy-of-the-kidney/>> [Accessed 9 December 2020].
5. Wani, n.d. [*Hare and lynx populations*]. [image online] Available at: <<https://www.cleanpng.com/png-cat-snowshoe-hare-eurasian-lynx-lotkavolterra-e-3913514/>> [Accessed 29 July 2020].

