

**AQA, OCR, Edexcel**

**A Level**

# **A Level Biology**

**Control of Gene Expression  
Questions**

Name:

**M M E**

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**Total Marks: /34**

## Control of Gene Expression

The DNA code is a specific sequence of A, T, C and G bases that base pair. For this code to be useful it must be read by cells in a specific way which divides up the code into genes. All cells in an organism have the same genes however the structure and function of cells differs because not all of these genes are expressed.

1. Some of the control of gene expression occurs during transcription.

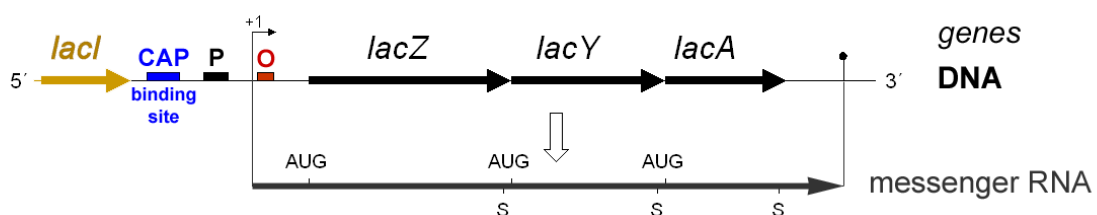
a) i) In the passage above, explain what is meant when it says that ‘not all the genes in a cell are expressed’ and how does this cause cells to be different? (2 marks)

ii) How is this process of differential gene expression controlled in transcription? (3 marks)

iii) What affect can the hormone oestrogen have on transcription? (1 mark)

b) Regulation of transcription is controlled by factors that determine how likely it is that transcription will occur. Activators enhance this process. One example of an activator is CAP (catabolite activator protein) which activates transcription at the lac operon, shown below.

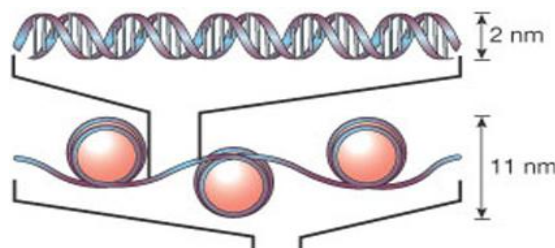
### The *lac* Operon and its Control Elements



- i) What is an operon? (1 mark)
  - ii) The lac operon is found in some bacteria and is activated in the presence of lactose. What is the function of the lac operon? (1 mark)
  - iii) Using the diagram above explain how CAP activates transcription. (4 marks)
  - iv) Suggest the role of cAMP, a second messenger, in this process? (1 mark)
- c) Transcription creates a strand of pre-mRNA which is then transported from the nucleus to the ribosome so that translation can occur. Before this the pre-mRNA must undergo further modifications.
- i) Explain why pre-mRNA must be modified before translation and how the process occurs. (3 marks)

### **AQA & EDEXCEL ONLY: 9 MARKS**

2. Epigenetics is the study of heritable changes in gene expression without a change in the DNA sequence.
- a)
    - i) Identify two examples of factors that cause epigenetic changes to our genes. (2 marks)



ii) In the diagram above, explain the structure of the DNA strand. (2 marks)

b) There are two types of epigenetic modifications that occur to the DNA; DNA methylation and histone modification.

i) Explain how these two types of epigenetic modification affect genes expression. (4 marks)

ii) How does knowledge of epigenetic interactions alter the basic model of disease causation? (1 mark)

### **OCR ONLY: 9 MARKS**

3. Cell differentiation is involved in the growth and development of organisms; these processes are controlled by gene expression.

a) The body pattern of every organism is unique because of the influence of Homeobox genes.

i) What are homeobox genes and how do they alter gene expression? (3 marks)

ii) Other than altering gene expression, identify two other ways in which homeotic genes interact with cells. (2 marks)

iii) What evidence is there to suggest that Homeobox genes are vital for evolution and speciation of all organisms with different body patterns? (2 marks)

- iv) Using the diagram below, explain the genetic differences in the two *Drosophila* labelled A and B. (2 marks)

