

A Level Biology B

H422/02 Scientific literacy in biology

Question Set 16

- 1 (a) The extracellular matrix (ECM) can be thought of as the 'glue' that holds together the cells in a tissue. The ECM consists of water, proteins and polysaccharides.

Matrix metalloproteinases (MMPs) are a group of proteases that hydrolyse proteins in the ECM. Each MMP consists of a single polypeptide chain.

For each of the following features of MMP structure, draw a line connecting the feature to the correct description.

Feature	Description
The active site of MMP contains a Zn^{2+} ion that is required for substrate binding.	Primary structure
The enzyme contains a β -pleated sheet and three α -helices.	Secondary structure
The amino acid histidine occurs in three places in the sequence making up the active site of all MMPs.	Tertiary structure
	Competitive inhibition
	Cofactor

[3]

- (b) (i)** Matrix metalloproteinase (MMP) activity has been linked to the development of cancer.

Women with tumours in their breasts will often have biopsies (tissue samples) taken and tested to see if the tumours are malignant (cancerous) or benign (non-cancerous).

In one study, the total MMP activity was measured in breast biopsies that were classed as either:

- benign
- malignant grade I (the least malignant)
- malignant grade II
- malignant grade III (the most malignant).

Table 3 shows the results of this study.

Tumour classification	MMP activity (units per μg protein)
Benign	6.58
Malignant grade I	1.34
Malignant grade II	6.80
Malignant grade III	32.29

Table 3

The researchers carried out a statistical test to compare the MMP activity in grade III tumours with the mean activity in all other tumours (benign, grade I and grade II).

Suggest a null hypothesis that the researchers would have used.

[1]

- (ii)** The result of this test gave $p < 0.0001$.

Use the words 'probability' and 'chance' to describe the conclusion the researchers would make.

[1]

- (iii)** Use the data in Table 3 to evaluate the hypothesis that MMP activity increases the severity of breast cancer.

[3]

- (c)** Marimastat is an MMP inhibitor that was used in clinical trials as a potential treatment for cancer.

Suggest how marimastat could inhibit MMPs to reduce the hydrolysis of proteins in the ECM.

[2]

Total Marks for Question Set 16: 10

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