

5 The endocrine system and the nervous system both coordinate responses in mammals.

(a) Complete Table 5.1 to show the features of three cell-signalling molecules of the endocrine system: antidiuretic hormone (ADH), glucagon and insulin.

Use a tick (✓) if the molecule has the feature and a cross (✗) if the molecule does **not** have the feature.

Put a tick (✓) or a cross (✗) in every box.

Table 5.1

feature	ADH	glucagon	insulin
binds to receptors on cell surface membranes			
results in molecules moving from cells into the blood			
is secreted as a result of detection by osmoreceptors			

[3]

(b) The endocrine system has a slower transmission speed than the nervous system.

Describe **other** ways in which the endocrine system and the nervous system differ.

[4]

(c) The endocrine system and the nervous system can affect muscle function.

Fig. 5.1 shows a transmission electron micrograph of a longitudinal section of striated muscle tissue that is in a relaxed state.

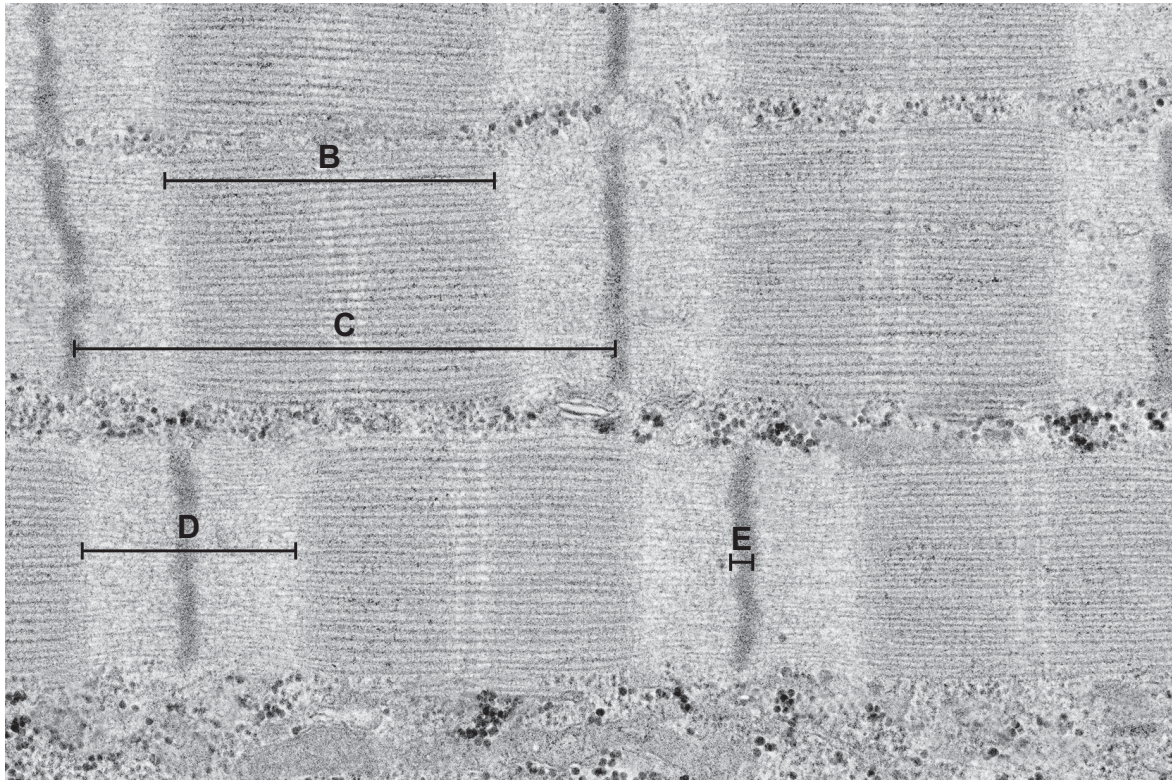


Fig. 5.1

(i) State the letter on Fig. 5.1 that indicates the length of a sarcomere.

..... [1]

(ii) State the letter on Fig. 5.1 that indicates a region where actin and myosin overlap.

..... [1]

(iii) Describe **and** explain how the region labelled **D** on Fig. 5.1 changes during muscle contraction.

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9 (a) Fig. 9.1 shows a longitudinal section of a human kidney.

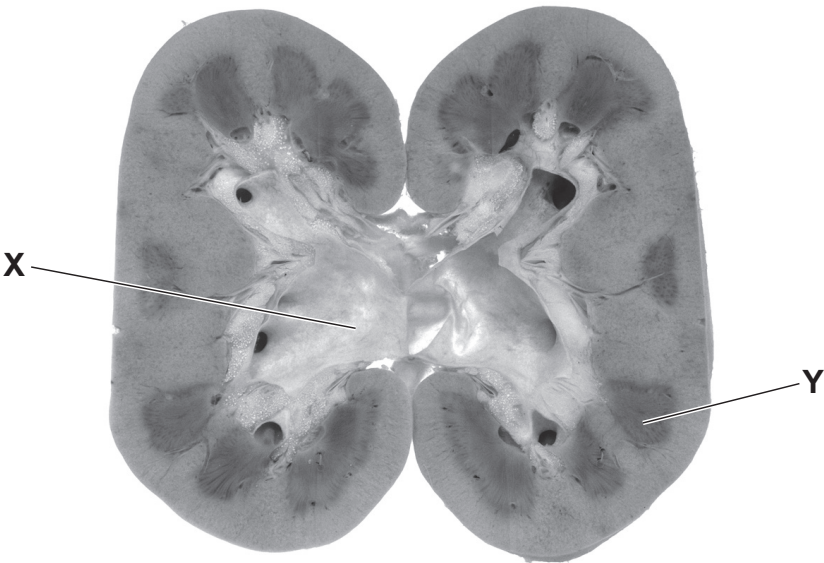


Fig. 9.1

Name the regions of the kidney labelled **X** and **Y** in Fig. 9.1.

X

Y [2]

(b) A biosensor can be used to measure the concentration of glucose in urine.

Outline how a biosensor measures the concentration of glucose in urine.

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..... [4]

[Total: 6]

- Fig. 6.1 shows a cell-signalling pathway involving insulin, PI3K and PKB in a muscle cell.

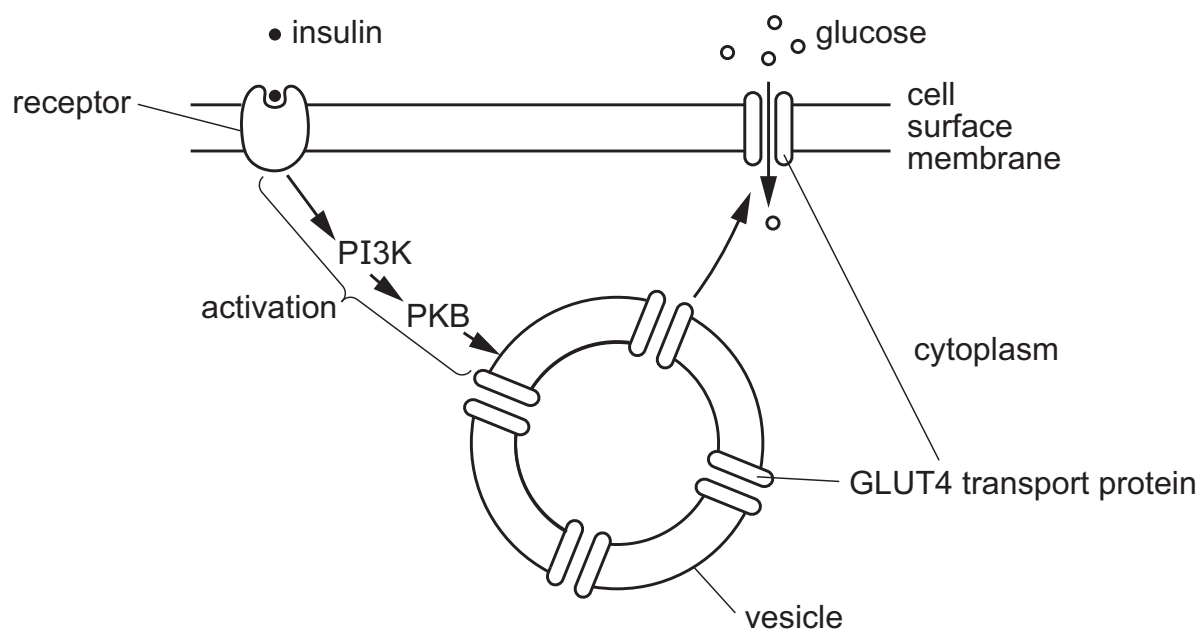


Fig. 6.1

Type 2 diabetes mellitus is a common disease. Some people with type 2 diabetes have a low concentration of PI3K in their muscle cells and cannot maintain their blood glucose concentration within normal limits.

With reference to Fig. 6.1, suggest why a low concentration of PI3K can lead to type 2 diabetes.

[4]

(b) Describe how a biosensor can be used to measure blood glucose concentration.

[7]

[Total: 11]

- 6 Some people can develop a condition called type 2 diabetes. In people with type 2 diabetes, glucose uptake from the blood is decreased. In some cases, the pancreas cannot make enough insulin to keep blood glucose concentration within a healthy range.

- (a) A person with type 2 diabetes and a person without type 2 diabetes were given a glucose drink. The blood glucose concentration of each person was measured at regular intervals for 120 minutes.

The results are shown in Fig. 6.1.

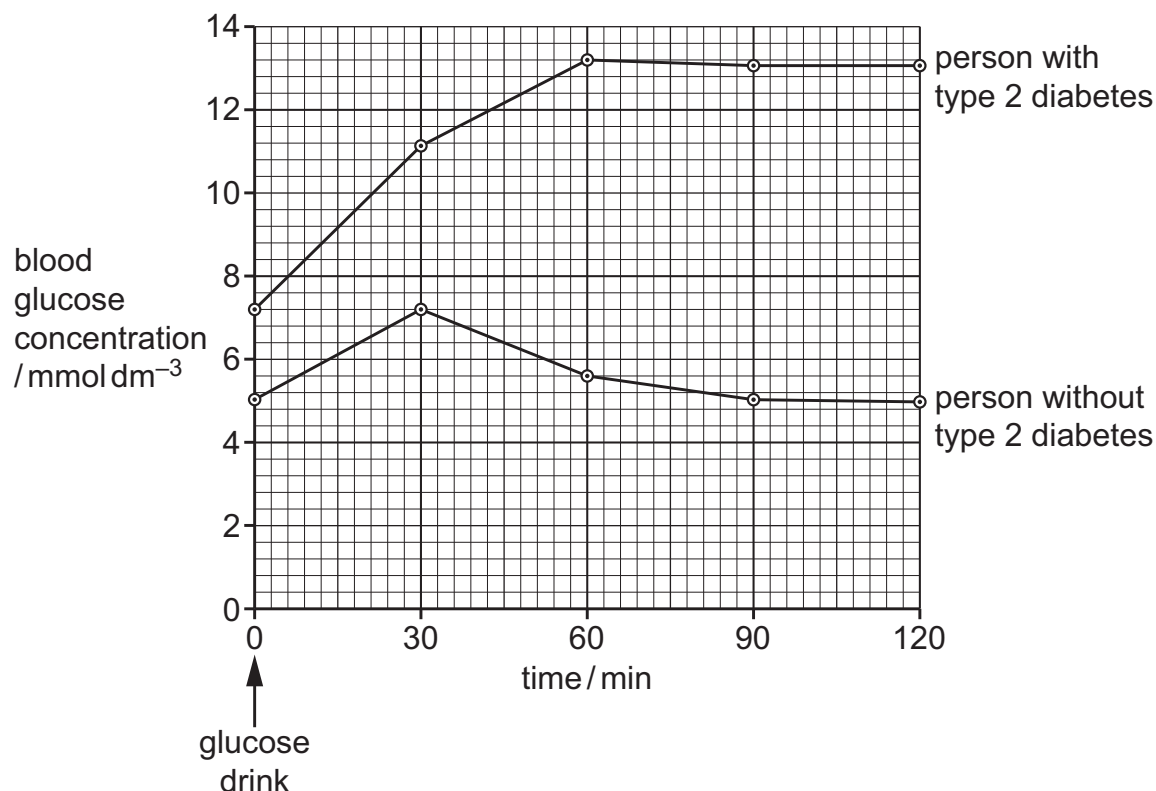


Fig. 6.1

- (i) Describe the curve for the person **without** type 2 diabetes.

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..... [2]

- (ii) Calculate the percentage increase in blood glucose concentration, between 0 and 60 minutes, for the person **with** type 2 diabetes.

answer [2]

..... [2]

..... [7]

7

6 (a) In the kidney, various molecules move between the blood and the kidney nephron.

Table 6.1 describes the movements of molecules at three regions of the nephron, **P**, **Q** and **R**.

Table 6.1

region of nephron	molecule(s)	direction of movement
P	amino acids, glucose and water	from nephron to blood
Q	water	from nephron to blood in the presence of antidiuretic hormone (ADH)
R	water and molecules with a molecular mass of less than 68,000	from blood to nephron

(i) Name the processes, **other than** diffusion, osmosis and active transport, that are occurring at **P**, **Q** and **R**.

P

Q

R

[3]

(ii) Identify the regions of the nephron represented by **P**, **Q** and **R**.

P

Q

R

[3]

- (b) A student cut a fresh kidney lengthways and placed one half in the freezer. After 24 hours, the student examined the kidney section and tested its firmness with a mounted needle.

Sodium chloride concentration affects the freezing point of a solution.

The student drew the diagram in Fig. 6.1 to show an area that had frozen hard and an area that was softer and less frozen.

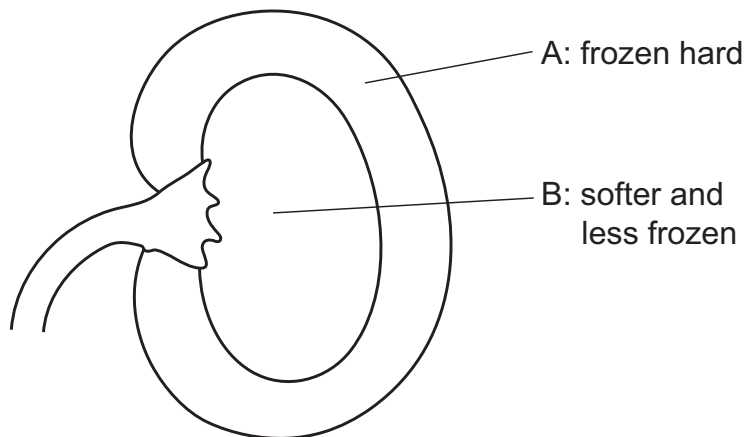


Fig. 6.1

Suggest an explanation for the observations in Fig. 6.1 made by the student.

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..... [2]

[Total: 8]

7 Insulin is an example of a cell-signalling molecule of the endocrine system.

- (a) Outline why insulin can be described as an example of a cell-signalling molecule of the endocrine system.

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..... [4]

- (b) Researchers compared the effect of two types of meal on the mean blood glucose concentration and the mean blood insulin concentration of twelve volunteers. The measurements were made for three hours after the meal.

Meal A contained 55% carbohydrate, 27% fat and 18% protein.

Meal B contained 3% carbohydrate, 90% fat and 7% protein.

Fig. 7.1 shows the results.

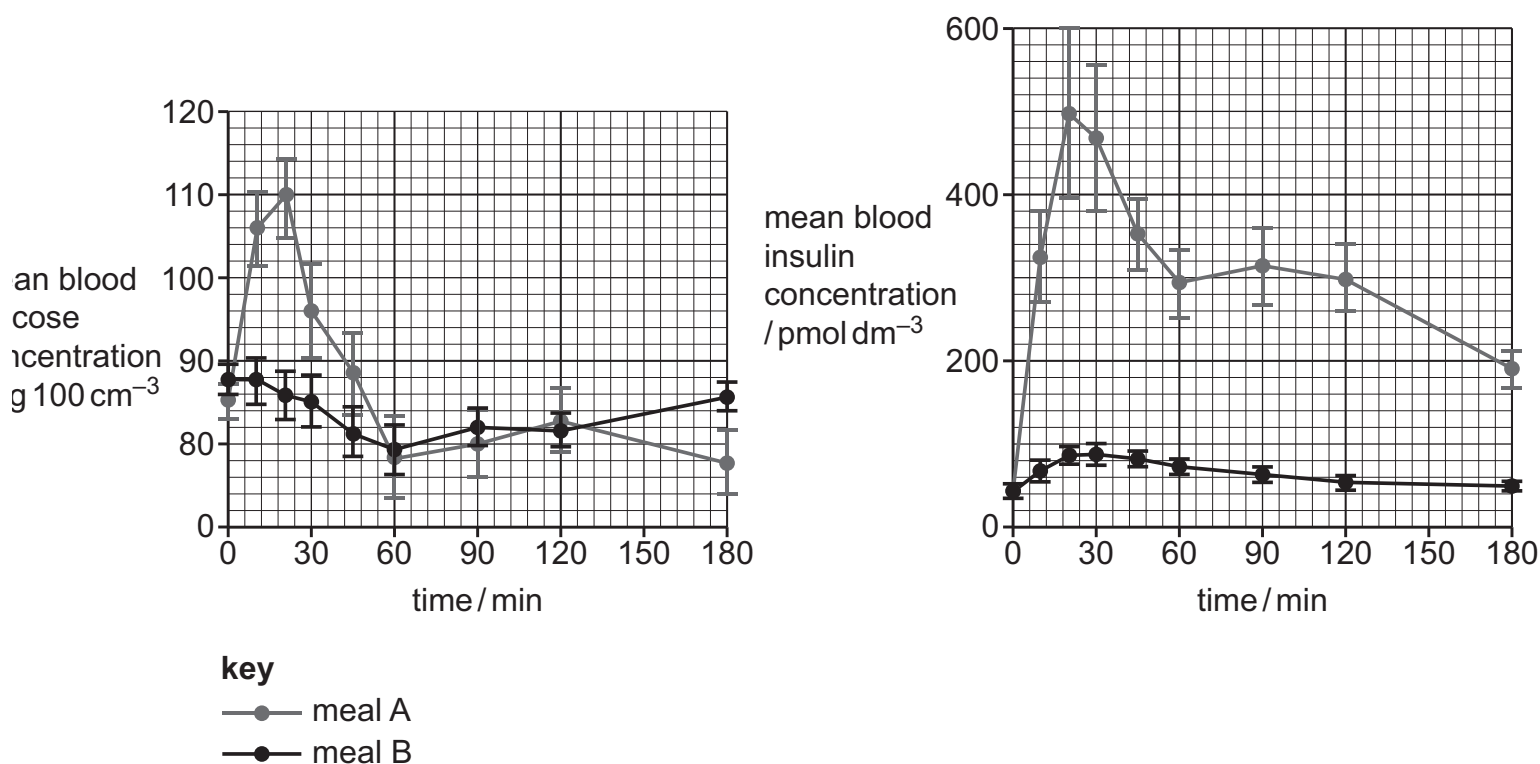


Fig. 7.1

- (i) With reference to Fig. 7.1, explain how negative feedback operates to control mean blood glucose concentration in the volunteers who ate meal A.

[4]

- (ii) Suggest explanations for the changes in mean blood glucose concentration of the volunteers who ate meal B.

[3]

[Total: 11]