

Neuronal Communication

Question Paper 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Communication, homeostasis and energy
Topic	Neuronal communication
Booklet	Question Paper 2

Time allowed: 47 minutes

Score: /35

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

Which of the following describes the process that happens during **repolarisation** of a neurone during the action potential?

	Sodium channels	Potassium channels	Membrane potential
A	closed	open	decreasing
B	open	closed	decreasing
C	open	closed	increasing
D	closed	open	increasing

[1]

(a) Fig. 2.1 represents the end region of a neurone at a cholinergic synapse.

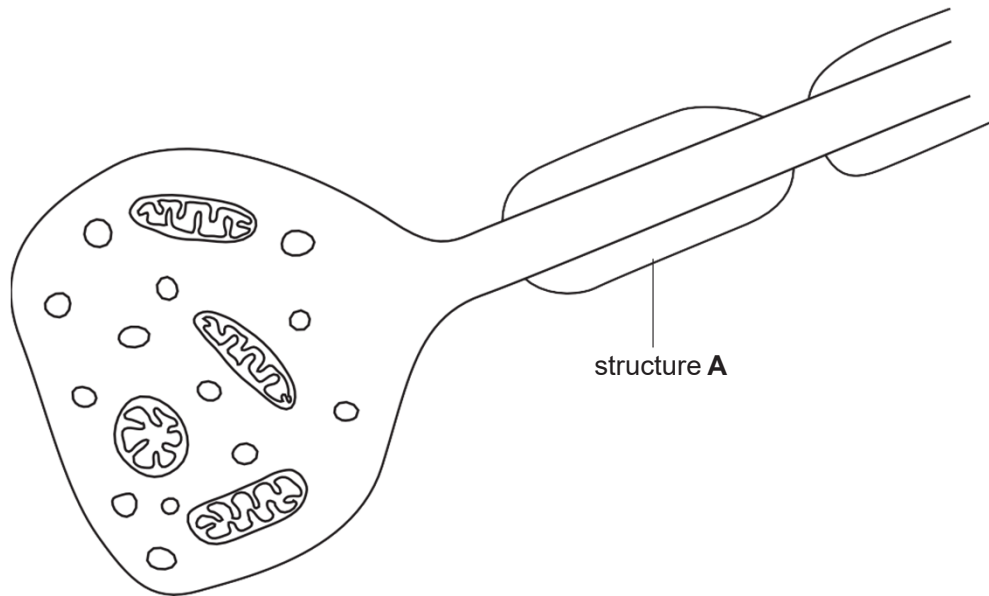


Fig. 2.1

(i) Describe the function of **structure A**.



In your answer, you should use the appropriate technical terms, spelt correctly.

[4]

(ii) Name the process by which acetylcholine leaves the neurone shown in Fig. 2.1. [1]

(iii) Name the process by which acetylcholine travels across the synaptic cleft. [1]

(iv) A feature of synapses is that they allow transmission in only one direction.

State how this is achieved.

[1]

(b) The chemical nature of synaptic transmission makes it susceptible to disruption by toxins.

(i) Atropine is a toxin produced by the deadly nightshade plant, *Atropa belladonna*.

Atropine is a similar shape to acetylcholine. The presence of atropine prevents the initiation of an action potential in the post-synaptic neurone.

Explain how the presence of atropine in the synapse will prevent the initiation of an action potential.

[3]

(ii) Nerve gases have been used as chemical weapons. Some nerve gases act by inhibiting acetylcholinesterase, prolonging the effect of acetylcholine.

Suggest how atropine could act as an antidote to nerve gas.

[2]

[Total: 12]

Question 3

Fig. 5.1 is a trace that shows the changes that occur in the membrane potential of a neurone during the generation of an action potential.

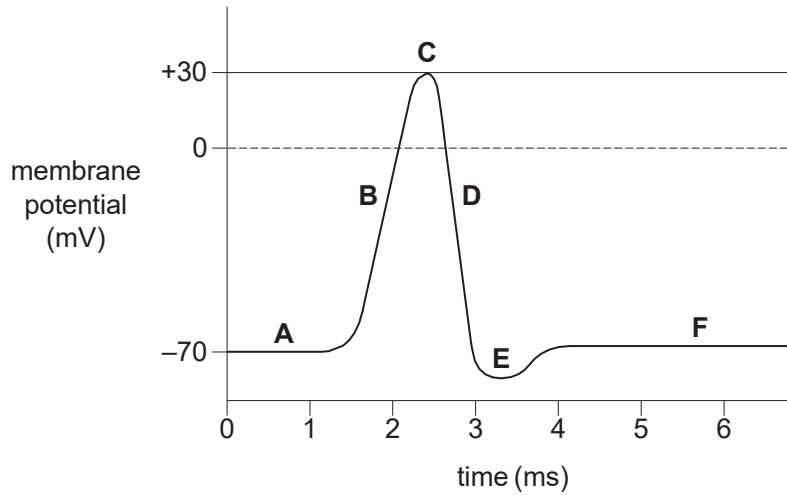


Fig. 5.1

- (a) Using the letters **A** to **F**, indicate the point or points on the trace which correspond to the following:
- (i) hyperpolarisation, [1]

 - (ii) Resting potential, [1]

 - (iii) the membrane is most permeable to potassium ions, [1]

 - (iv) depolarisation. [1]

- (b) Puffer fish, *Fugu spp.*, produce a powerful poison, tetrodotoxin, and some species store it in high concentrations in their body tissues. Unless these fish are correctly prepared, eating them can be fatal.

Tetrodotoxin is poisonous to humans because it blocks **gated** sodium channels in cell membranes, preventing action potentials. This does not happen in the fish themselves.

- (i) With reference to Fig. 5.1, identify, using the appropriate letter, the part of the action potential trace that will be affected by tetrodotoxin. [1]

- (ii) Suggest why tetrodotoxin is **not** toxic to the puffer fish. [1]

- (c) Multiple sclerosis (MS) is an auto-immune condition in which the nervous system is damaged. This damage leads to loss of sensation. One form of damage is shown in Fig. 5.2.

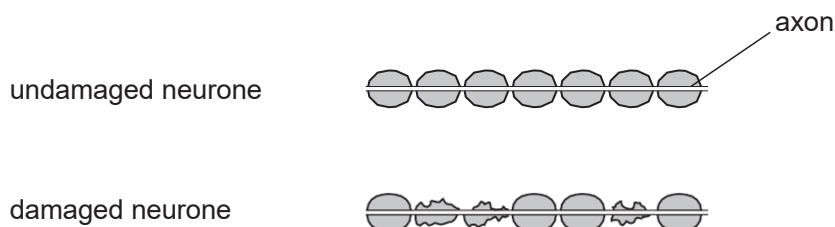


Fig. 5.2

- (i) Suggest why MS is described as an auto-immune condition. [2]

- (ii) Explain why this damage leads to a loss of sensation. [2]

[Total: 10]

(a) Fig. 3.1 represents part of the axon of a neurone.

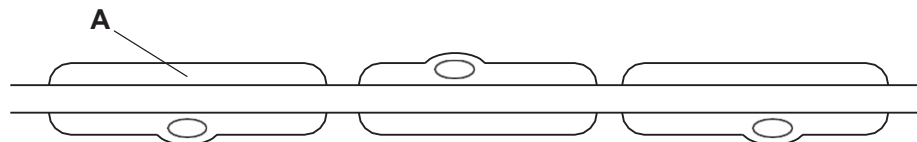


Fig. 3.1

Describe the **structure** of the feature labelled **A**.

[2]

Table 3.1 shows details of the diameter and speed of conduction of impulse along the neurones of different animal taxa.

Table 3.1

type of neurone	axon diameter (µm)	speed of conduction (ms ⁻¹)	animal taxon
myelinated	4	25	mammal
myelinated	10	30	amphibian
myelinated	14	35	amphibian
unmyelinated	15	3	mammal
unmyelinated	1000	30	mollusc

(b) Using **only the data in Table 3.1**, describe the effect of each of the following on the speed of conduction:

(i) myelination,

[2]

(ii) axon diameter. [2]

(c) Temperature also affects the speed of conduction of a nerve impulse.

(i) Suggest why an increase in temperature results in an increase in the speed of conduction.

[1]

(ii) As the temperature continues to increase, it reaches a point at which the conduction of the impulse ceases. Suggest why.

[1]

(d) Outline the sequence of events following the arrival of an action potential at the synaptic knob until the acetylcholine has been released into the synapse.



In your answer, you should use appropriate technical terms, spelt correctly.

[4]

[Total: 12]