1 **(a)** The cells of the body need to communicate with one another.

State the name given to this process of communication.

..... **[1]**

(b) Fig. 1.1 is an electron micrograph of the junction between two neurones.

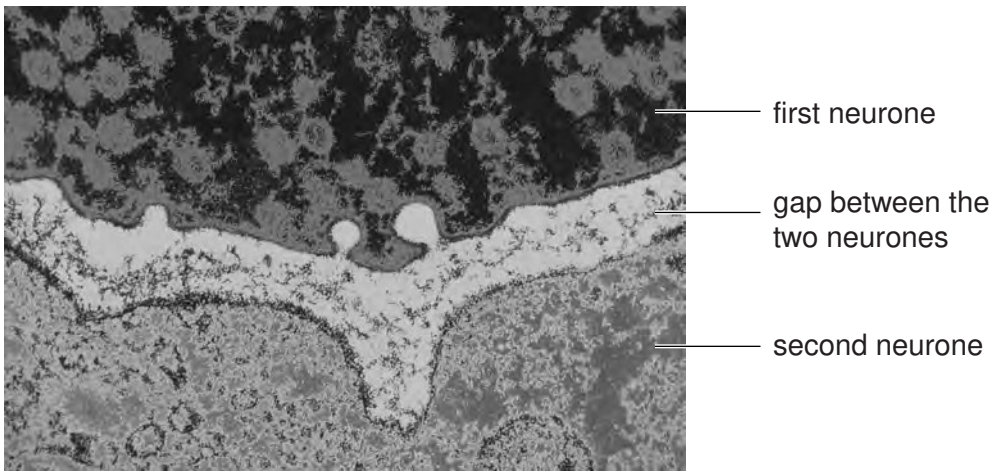


Fig. 1.1

(i) State the name given to the gap between the two neurones at this junction.

..... **[1]**

(ii) Outline how the first neurone communicates with the second neurone across the gap.

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

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..... **[3]**

(iii) Outline the importance of the junctions between neurones in the functioning of the nervous system.

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..... **[3]**

The nervous system and the hormonal system are involved in the maintenance of core body temperature.

(c) Give the **most suitable** word or term that has the same meaning as each of the following descriptions:

(i) animals that are able to regulate and maintain their core body temperature within narrow limits;

..... **[1]**

(ii) the increase in the diameter of the lumen of an arteriole to allow more blood to flow through.

..... **[1]**

(d) **(i)** Name a hormone that increases the metabolic rate and so generates heat.

..... **[1]**

(ii) Name the part of the brain where the thermoregulatory centre is located.

..... **[1]**

[Total: 12]

2 **(a)** The nervous system is made up of a number of different types of neurone, which transmit electrical impulses.

Complete the table below by stating **three** differences in the structure of motor and sensory neurones.

motor neurone	sensory neurone

[3]

(b) Complete the following passage, using the most appropriate term(s) in each case.

When an impulse is not passing along a neurone, a resting potential of .....mV is established. When the neurone is stimulated, it causes ..... of the cell surface membrane. This will not generate an action potential unless it is large enough to exceed the ....

A neurone will either conduct an action potential or not; this is described as the ..... - ..... - ..... law.

Action potentials all have the same ..... . The only way in which the intensity of a stimulus can be interpreted is by the ..... of the action potential. **[6]**

[Total: 9]

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

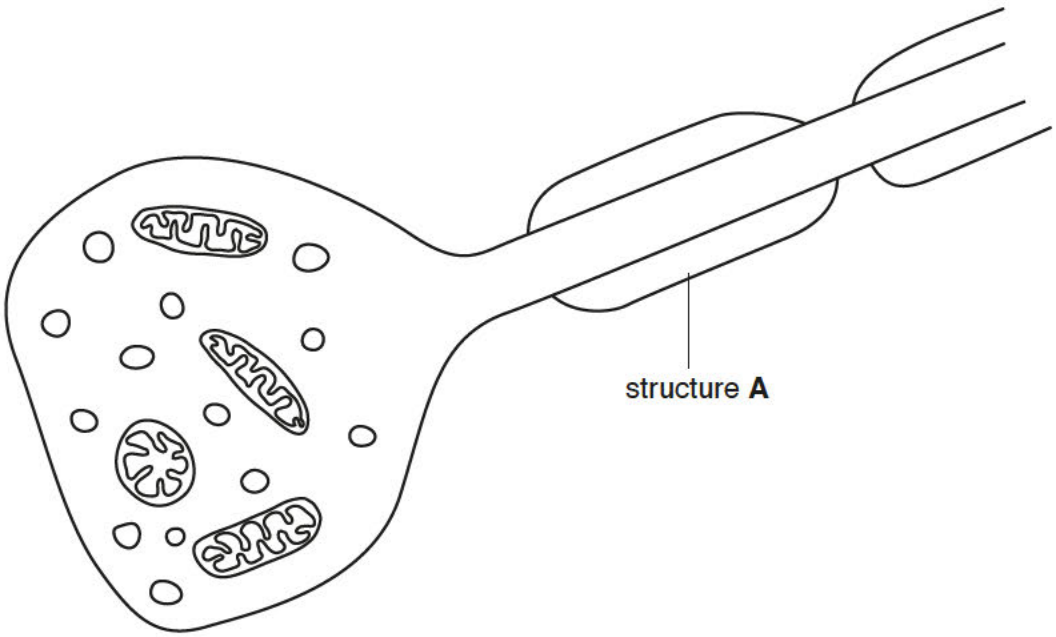


Fig. 2.1

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

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

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..... **[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.

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..... **[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.

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..... **[2]**

[Total: 12]

4 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.

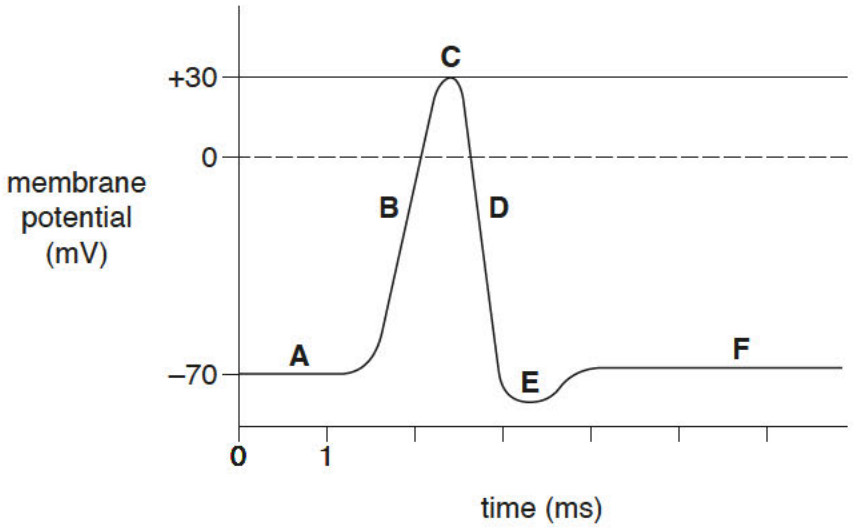


Fig. 5.1

(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, tetradotoxin, and some species store it in high concentrations in their body tissues. Unless these fish are correctly prepared, eating them can be fatal.

Tetradotoxin 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 tetradotoxin.

..... **[1]**

(ii) Suggest why tetradotoxin 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.

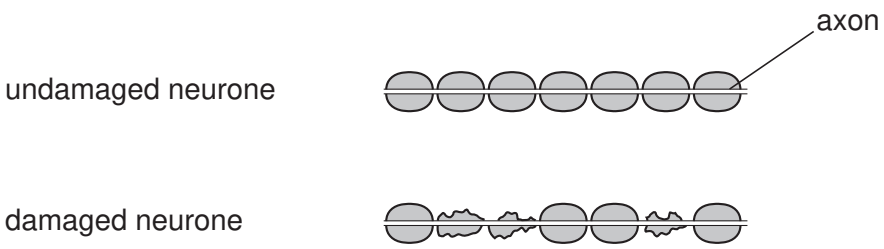


Fig. 5.2

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

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..... **[2]**

(ii) Explain why this damage leads to a loss of sensation.

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..... **[2]**

[Total: 10]

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

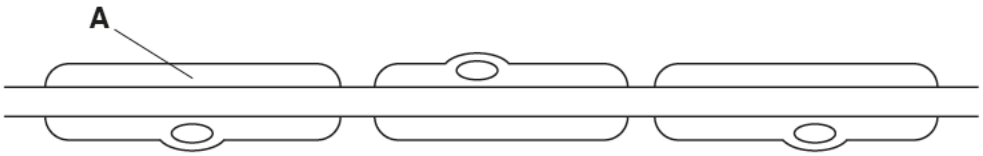


Fig. 3.1

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

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..... **[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 ($m\,s^{-1}$)	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,

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..... **[2]**

(ii) axon diameter.

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..... **[2]**

(c) The speed of conduction of a nerve impulse is also affected by temperature.

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

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.....

..... **[1]**

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

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..... **[1]**

(d) Outline the 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.

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..... **[4]**

[Total: 12]

6 In order to survive, animals need to be able to respond to changes in the internal and external environment.

(a) Complete the following passage by using the most appropriate word(s) or term(s).

Specialised cells that are able to detect stimuli can be found both within and at the surface of an animal's body. These specialised cells can be found singly or in groups and are known as sensory ..... .

Each cell is specialised to respond to a particular type of stimulus. Some specialised cells in the retina of the eye respond to the ..... and wavelength of light. Groups of specialised cells in the nose and on the tongue detect ..... stimuli and this results in the ability to smell and taste.

When specialised cells receive an appropriate stimulus which is above the threshold ..... , the cells are able to convert this energy into a nerve ..... . **[5]**

(b) Following the detection of a stimulus, sensory and motor neurones co-ordinate the body's response to this stimulus.

State **one** way in which:

(i) the **structure** of a motor neurone differs from that of a sensory neurone

.....

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..... **[1]**

(ii) the **function** of a motor neurone differs from that of a sensory neurone.

.....

.....

..... **[1]**

[Total: 7]