1 This question is about types of muscle and how the nervous system and hormones control their activity.

(a) There are three types of muscle within the human body. These differ in their cellular structure and in their function.

Complete Table 2.1 to show how each type of muscle **differs from the other two** types.

Table 2.1

	voluntary (skeletal) muscle	involuntary (smooth) muscle	cardiac muscle
cellular structure			
function			

[6]

(b) The human thorax is the area between the base of the neck and the base of the rib cage. All three types of muscle can be found within this area.

For each type of muscle, identify where **in the thorax** this type of muscle may be found.

voluntary .....

involuntary .....

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

(c) Fig. 2.1 shows a vertical section through the human brain.

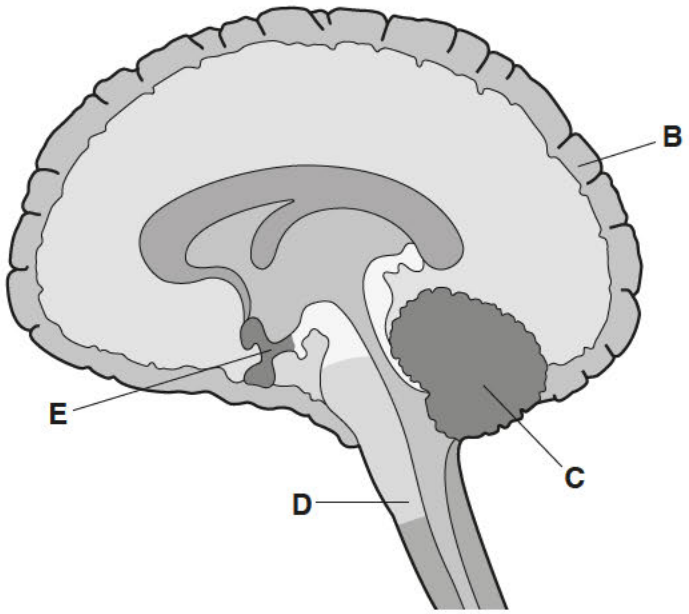


Fig. 2.1

Use Fig. 2.1 to state the letter (**B** to **E**) of the part of the brain that would be involved in the following:

adjusting the rate of contraction of cardiac muscle .....

clapping the hands together .....

automatically correcting balance when riding a bicycle ..... **[3]**

(d) Movement disorders are conditions in which people lose the ability to control their body movements.

Scientists have discovered that inserting electrodes to stimulate parts of the brain can help to cure some movement disorders. This discovery has resulted from experimental work with monkeys, which has made the research controversial.

Suggest why monkeys rather than other laboratory animals, such as rats, were used for this work **and** comment on whether their use in this way is justified or not.

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

(e) The 'fight or fl t nated by the nervous and endocrine systems.

Describe and explain how the activation of the 'fight or flight' response affects voluntary, involuntary and cardiac muscle.



In your answer, for each type of muscle, you should give a named structure in which it is found and explain how the nervous and endocrine systems affect its response.

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.....

2 **(a)** State the term used to describe:

(i) a directional growth response of a plant

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

(ii) a signalling molecule that enables **plants** to respond to environmental change

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

(iii) plants that lose their leaves seasonally

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

(iv) the process of managing an ecosystem sustainably to protect biodiversity

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

(v) organisms that return inorganic minerals from the bodies of dead organisms to the abiotic environment

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

(vi) the conversion of nitrogen gas to ammonium compounds in the soil.

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

(b) Describe briefly **one** example of each of the following types of **animal** behaviour:

(i) habituation

.....

.....

.....

.....

.....

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

(ii) operant conditioning

.....

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.....

.....

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

(iii) social behaviour in primates and its importance.

.....

.....

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.....

.....

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

[Total: 15]

3 Fig. 4.1 shows a junction between two neurones where the neurotransmitter is dopamine. Fig. 4.2 shows a neuromuscular junction.

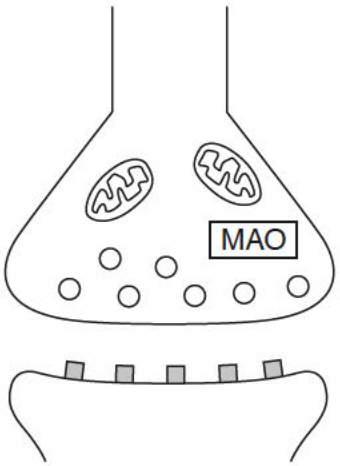


Fig. 4.1

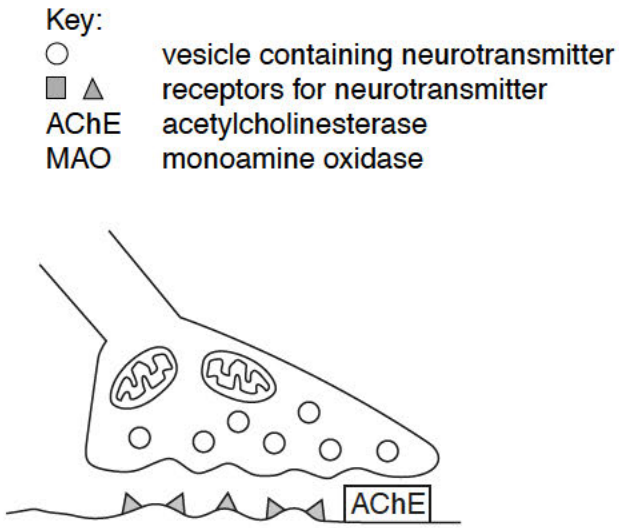


Fig. 4.2

(a) Complete Table 4.1 below to compare the structure and function of the dopamine synapse and the neuromuscular junction.

Table 4.1

	similarity	difference
structure		
function		

[4]

(b) The sequence of events at a dopamine synapse is given below:

- dopamine molecules bind to the protein receptors on the postsynaptic membrane and trigger a response
- dopamine leaves the receptors and moves back into the presynaptic neurone
- some dopamine is repackaged into vesicles
- some dopamine is broken down by the enzyme monoamine oxidase (MAO).

Table 4.2 summarises the action of some drugs that affect dopamine synapses.

Table 4.2

drug	action at synapse
phenothiazine	binds to and blocks dopamine receptors
phenelzine	acts as an inhibitor of MAO
amphetamine	binds to and activates the dopamine receptor and causes release of stored dopamine from vesicles

(i) Use the information in Table 4.2 to suggest which drug molecule could have a shape that **differs** from that of the dopamine molecule. Give a reason for your answer.

.....

.....

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

(ii) Schizophrenia is a condition in which there is a higher than usual level of dopamine in certain areas of the brain.

Suggest why phenothiazine is used to treat schizophrenia.

.....

.....

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

(c) DRD4 is a dopamine receptor in humans. The DRD4 receptor gene has a large number of alleles, of which a single individual can only have two.

(i) Explain why one individual can only have two of the different alleles of the DRD4 gene.

.....

.....

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

(ii) Name a technique that would reveal differences in the lengths of the different forms of the DRD4 receptor gene.

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

(d) Three alleles of DRD4 have the following alterations:

- a single base-pair substitution
- a 21 base-pair deletion
- a 13 base-pair deletion.

Suggest which of the three mutations will have the most serious consequences for the structure of the protein receptor. Give a reason for your choice.

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

(e) One allele of DRD4 has been found more frequently amongst individuals whose personality is described as 'novelty-seeking' and whose behaviour tends to be exploratory and impulsive.

Suggest how this particular allele of the DRD4 receptor could have become common in the human population.

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

[Total: 18]

4 **(a)** Plant responses to environmental changes are co-ordinated by plant growth substances (plant hormones).

Explain why plants need to be able to respond to their environment.

.....

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.....

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

(b) The following investigation was carried out into the effects of plant growth substances on germination:

- a large number of lettuce seeds was divided into eight equal batches
- each batch of seeds was placed on moist filter paper in a Petri dish and given a different treatment.

The different treatments are shown in Table 6.1. Each tick represents one of the eight batches of seeds.

Table 6.1

	treatment	concentration of gibberellin (mol dm^{-3})			
		0.00	0.05	0.50	5.00
A	water	✓	✓	✓	
B	abscisic acid	✓	✓	✓	

The batches of seeds were left to germinate at 25 °C in identical conditions and the percentage germination was calculated.

Fig. 6.1 shows the results of this investigation.

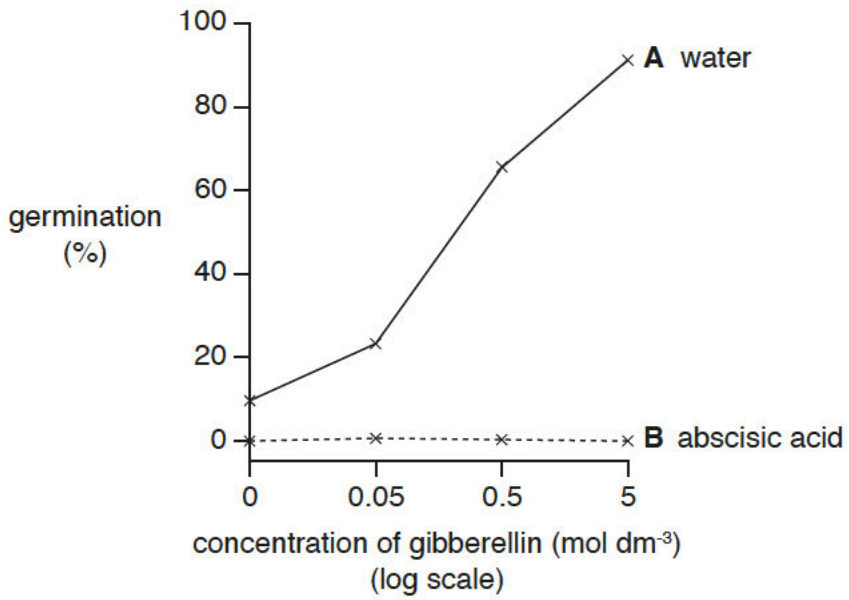


Fig. 6.1

(i) Describe, with reference to Fig. 6.1, the effects of the plant growth substances on the germination of lettuce seeds.

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

(ii) Explain why all the lettuce seeds were kept at 25 °C.

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

(iii) State **three** variables, **other than temperature**, that needed to be controlled in the investigation.

1 .....

2 .....

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

(c) State **two** commercial uses of plant growth substances.

.....

.....

.....

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

[Total: 13]