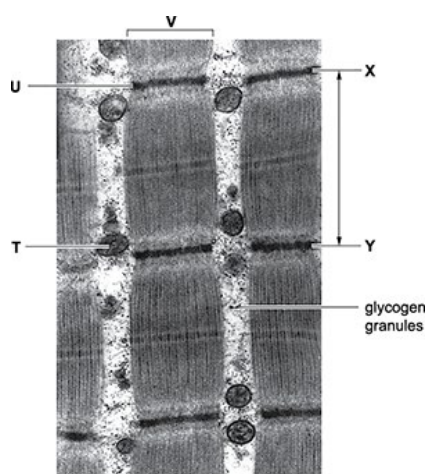


# Animal Responses

1. The image below is a transmission electron micrograph of a section of skeletal muscle.



Which row, **A** to **D**, shows the correct labels?

|          | Organelle T            | Region U | Region V  | Region between X and Y |
|----------|------------------------|----------|-----------|------------------------|
| <b>A</b> | Golgi body             | I-line   | actin     | Z-band                 |
| <b>B</b> | mitochondrion          | Z-line   | myofibril | sarcomere              |
| <b>C</b> | sarcoplasmic reticulum | A-band   | collagen  | I-band                 |
| <b>D</b> | mitochondrion          | I-band   | myosin    | sarcoplasmic reticulum |

Your answer

[1]

2. The drug metoprolol prevents stimulation of post-synaptic receptors in the sympathetic nervous system.

Which of the following conditions could this drug be used to treat?

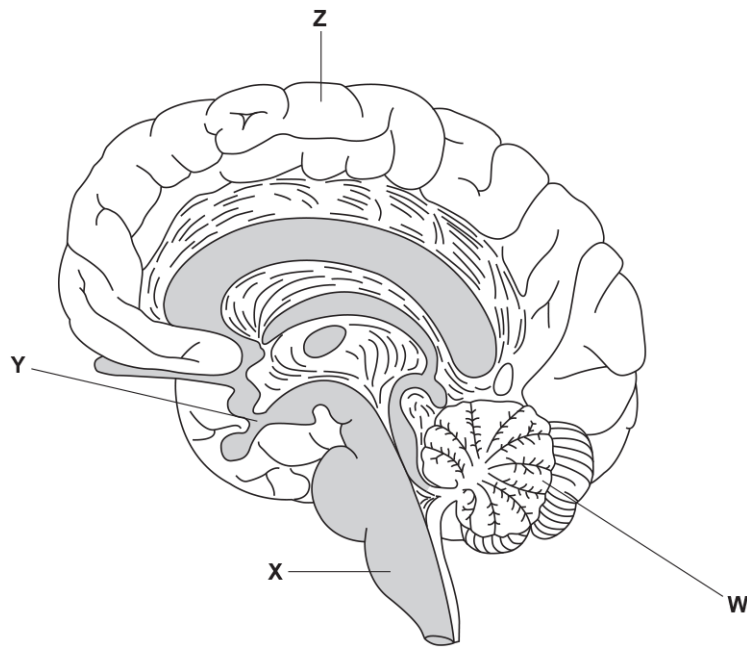
- 1 Muscle fatigue
- 2 Tachycardia
- 3 High blood pressure

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

3. The image below is a diagram of the human brain.



Which of the labelled regions would be directly involved in learning to play a musical instrument?

- A W and X
- B W and Y
- C W and Z
- D Y and Z

Your answer

[1]

4. Collagen is found in tendons. Tendons attach muscles to bones.

Which of the following lists of properties, **A** to **D**, makes collagen suitable for this role?

- A strong, inflexible, insoluble
- B strong, flexible, soluble
- C strong, inflexible, soluble
- D strong, flexible, insoluble

Your answer

[1]

5. Which of the following statements is / are correct?

- 1 The autonomic nervous system contains sensory and motor neurones.
- 2 Somatic and parasympathetic motor neurones use different neurotransmitters.
- 3 Somatic motor neurones stimulate skeletal muscles whereas autonomic motor neurones stimulate only glands.

- A 1, 2 and 3 are correct
- B only 1 and 2 are correct
- C only 2 and 3 are correct
- D only 1 is correct

Your answer

[1]

6. Multiple sclerosis ( ) is an autoimmune disease that damages the nervous system.

Guillain–Barré syndrome is another autoimmune condition in which neurones are damaged and the rate of nervous impulses is reduced.

affects the central nervous system.

Guillain–Barré syndrome affects the peripheral nervous system.

i. Suggest **two** symptoms of      that might **not** be present in people with Guillain–Barré syndrome.

Explain your answers.

**1** -----  
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**2** -----  
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[2]

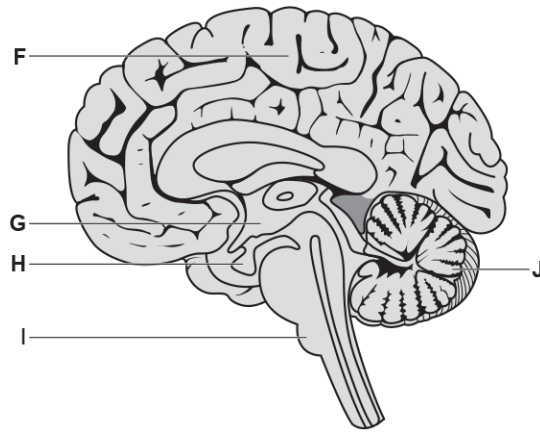
ii. Multiple sclerosis and Guillain–Barré syndrome both cause muscle weakness and loss of muscle function.

Suggest and describe how the function of neuromuscular junctions will be affected by multiple sclerosis and Guillain–Barré syndrome.

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[2]

7. **Fig. 16.2** is a diagram of a section through the human brain.



**Fig. 16.2**

- i. Identify the letter and name of the structure in **Fig. 16.2** that is connected by nerves to structure **A** in **Fig. 16.1**.

Letter

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Name

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[2]

- ii. Normal human resting heart rate is approximately 70 beats per minute (bpm). Cutting the parasympathetic nerve to the heart increases this to approximately 100 bpm.

Suggest **two** conclusions that could be made from this observation about the control of resting heart rate in normal humans.

1

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2

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[2]

iii. Injury to the parts of the brain labelled **G** and **H** in **Fig. 16.2** can lead to a range of symptoms including:

- fatigue
- weight gain
- menstrual irregularities
- low blood pressure or dizziness
- increased sensitivity to cold.

Outline how injury to **G** and **H** is able to cause such a wide range of symptoms.

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**[2]**

iv. Suggest why it can be difficult for a doctor to conclude that the symptoms described in part **(iii)** are definitely caused by damage to parts of the brain.

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**[1]**

8. Fig. 20.1 is a flow diagram that shows the sequence of events in the body once a threat is perceived. The response is often described as the 'fight or flight' response as it prepares the body to respond physically to the threat in the short-term.

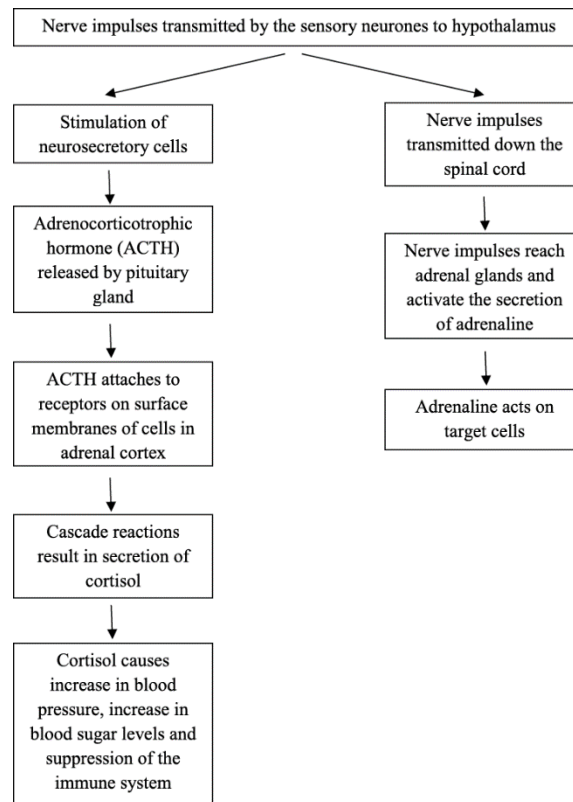


Fig. 20.1

i. Identify **two** signalling molecules named in Fig. 20.1.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

[1]

ii. Adrenaline acts on a variety of cell types with a variety of responses.

Complete the table by stating the effects of stimulating each target cell. The first one has been completed for you.

| Target cell                  | Response       | Role in the 'fight or flight' response                  |
|------------------------------|----------------|---|
| Smooth muscle in bronchioles | Muscle relaxes | Bronchioles dilate and allow more oxygen to reach blood |
| Sino-atrial node             |                |   |
| Liver cell                   |                |   |
| Erector muscle in skin       |                |   |

[6]

iii. Describe the sequence of actions that occur once adenylyl cyclase is activated in the target liver cells.

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[2]

iv. The response in **Fig. 20.1** also occurs when a person is subjected to stress. However, the body does not need to respond physically to the stimulus and so, for example, the bronchioles do not dilate.

From the information given and your own knowledge, suggest the long term adverse effects of continued exposure to stress on body function.

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[2]

9. Reflex actions are rapid responses that protect the body from harm.

The Moro reflex is found in babies up to five months of age, and occurs when the baby feels its head is suddenly no longer supported. The Moro reflex is made up of the following responses:

- The baby spreads out its arms then brings them together rapidly.
- The baby cries.

i. Suggest how the Moro reflex helps to prevent harm to a newborn baby.

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[2]









13. Acetylcholine (ACh) is a neurotransmitter in mammals. Studies have suggested that it also functions as a hormone in some invertebrate species, such as squid.

When ACh comes into contact with specialised cells in squid skin, it causes them to change colour. These colour changes allow the squid to communicate and to camouflage itself.

ACh is made by cells in the centre of the squid's body.

Explain how it is possible for ACh to have an effect on cells in the skin of the squid.

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[2]

14. Fig. 16.1 shows a drawing of a dissected human heart.

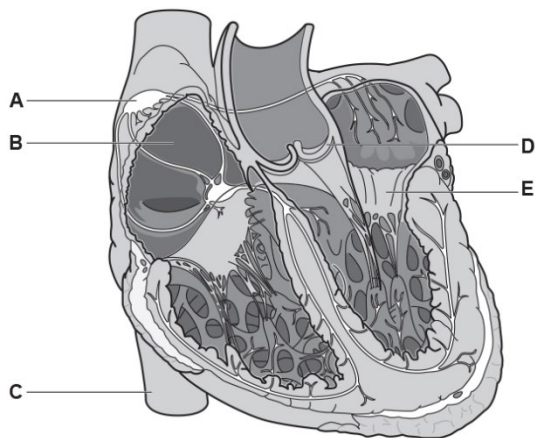


Fig. 16.1

i. Identify the structures labelled A to E on Fig. 16.1.

|   |  |
|---|--|
| A |  |
| B |  |
| C |  |
| D |  |
| E |  |

[5]

ii. State which subdivision of the peripheral nervous system supplies structure A on Fig. 16.1.

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[1]

15. A student investigated the heart rates of smokers and non-smokers.

- Each test subject had their resting heart rate measured using an electronic heart rate monitor.
- They ran 1 km on a running track and their heart rate after running 500 m was recorded.
- Their heart rate was recorded for a third time 3 minutes after the completion of the exercise.

All test subjects were 18 years old. Subjects were tested between 9 am and 4 pm on one day, one at a time. Each test lasted approximately 20 minutes in total. The tests were repeated one week later using the same method. Mean heart rates were calculated for each subject.

The student's plan was to compare the heart rates of smokers and non-smokers using Student's *t*-test.

The student's results are shown in Table 6.

| Student | Smoker? | Gender | Resting heart rate (bpm) | Heart rate during exercise | Heart rate after exercise |
|---------|---------|--------|--------------------------|----------------------------|---------------------------|
| 1       | Y       | Male   | 60.5                     | 130.0                      | 66.5                      |
| 2       | N       | Female | 67.0                     | 145.5                      | 73                        |
| 3       | Y       | Male   | 70.0                     | 120                        | 77.0                      |
| 4       | Y       | Male   | 65.5                     | 100                        | 69                        |
| 5       | Y       | Male   | 66.0                     | 128.5                      | 75.5                      |
| 6       | Y       | Female | 65.5                     | 115.5                      | 74.5                      |
| 7       | Y       | Female | 73.5                     | 120.5                      | 81                        |
| 8       | N       | Female | 63.0                     | 118                        | 66                        |
| 9       | N       | Female | 71.0                     | 95.5                       | 80.5                      |
| 10      | N       | Female | 65.5                     | 110                        | 71                        |
| 11      | N       | Male   | 64.0                     | 145.5                      | 68                        |
| 12      | N       | Male   | 52.5                     | 140.0                      | 58.5                      |
| 13      | N       | Male   | 54.0                     | 137.5                      | 63                        |
| 14      | N       | Female | 73.0                     | 130.5                      | 81                        |
| 15      | N       | Female | 61.5                     | 124                        | 67                        |
| 16      | N       | Female | 71.0                     | 130                        | 81.5                      |
| 17      | N       | Male   | 60.0                     | 122.5                      | 63                        |
| 18      | N       | Female | 64.5                     | 118                        | 69                        |
| 19      | N       | Female | 67.5                     | 130.5                      | 73.5                      |
| 20      | Y       | Male   | 72.0                     | 135                        | 82                        |
| 21      | Y       | Female | 69.5                     | 110                        | 75.5                      |

**Table 6**

Suggest and explain improvements that the student could make to his experimental method **and** his presentation of data.

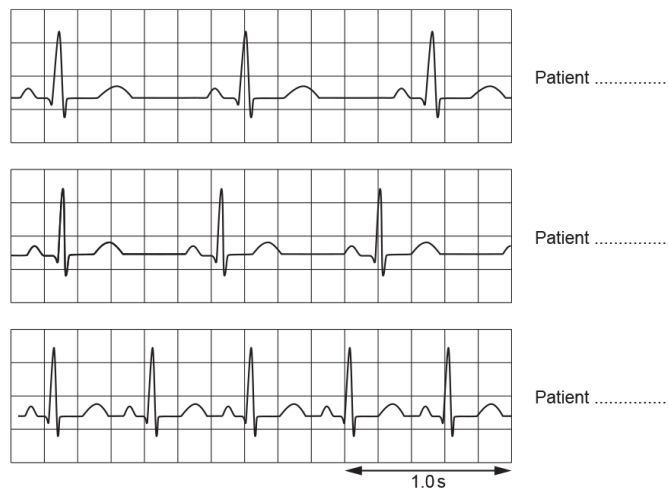
*In your answer you should explain the benefits of your suggested improvements.*



17. Pheochromocytoma is a rare tumour of adrenal gland tissue. It causes increased hormone release from the adrenal glands.

Fig 21.2 shows three ECG traces showing the heart rhythms of three different patients.

- |   |
|---|
| • Patient <b>X</b> has a normal heart rhythm. |
| • Patient <b>Y</b> has pheochromocytoma.      |
| • Patient <b>Z</b> has bradycardia.           |

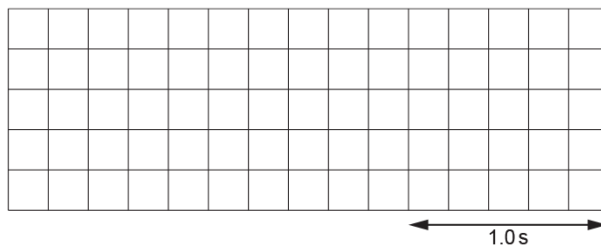


**Fig. 21.2**

i. Identify patients **X**, **Y** and **Z** by labelling the traces in Fig. 21.2.

[2]

ii. Sketch a trace for a patient who has entered atrial fibrillation.



[2]

iii. Suggest why reduced heart rate is sometimes seen in people who are very aerobically fit.

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[2]

**18.** Athletic sprinters require large amounts of energy in short periods of time. Many elite sprinters can run 100 metre races in under 10 seconds.

Under normal conditions, exercise requires an increased rate of breathing. It has been observed that some of the best sprinters only take one breath at the start of the race and do not inhale again until the end of the race.

Suggest how these sprinters can expend so much energy without needing to carry out aerobic respiration.

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[2]

**19.**

- i. Skeletal muscle is one of the main tissues where glucose is removed from the blood in response to insulin.

Name the other tissue.

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[1]

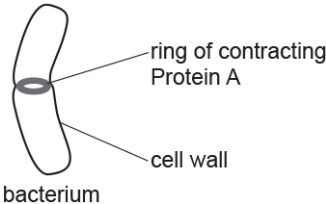
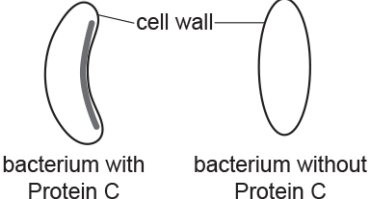
- ii. Explain why glucose is required for the contraction of skeletal muscle.

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[3]

20. Prokaryotic cells have cytoskeletons. The molecules in prokaryotic cytoskeletons are different from the molecules in eukaryotic cytoskeletons.

Table 4.1 lists three molecules present in a prokaryotic cytoskeleton.

| Prokaryotic cytoskeleton molecule | Information  |
|-----------------------------------|--|
| Protein A                         |  <p>ring of contracting Protein A<br/>cell wall<br/>bacterium</p>               |
| Protein B                         | Similar structure to actin.  |
| Protein C                         |  <p>cell wall<br/>bacterium with Protein C      bacterium without Protein C</p> |

**Table 4.1**

i. Suggest the function of Protein A.

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----- [1]

ii. Suggest the function of Protein C.

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----- [1]

iii. An antibiotic called A22 binds irreversibly to Protein B. Despite its antibiotic properties, A22 is not used in humans.

Suggest why scientists have advised that A22 should not be used in humans.

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----- [1]