The brain

4.5.2.2 · Homeostasis and response · revision notes

The main regions of the brain, what each one does, how scientists have found this out, and why brain disorders are hard to investigate and treat. Expect labelling and recall questions plus 'evaluate' questions on brain procedures. This subtopic is in GCSE Biology only, not Combined Science.

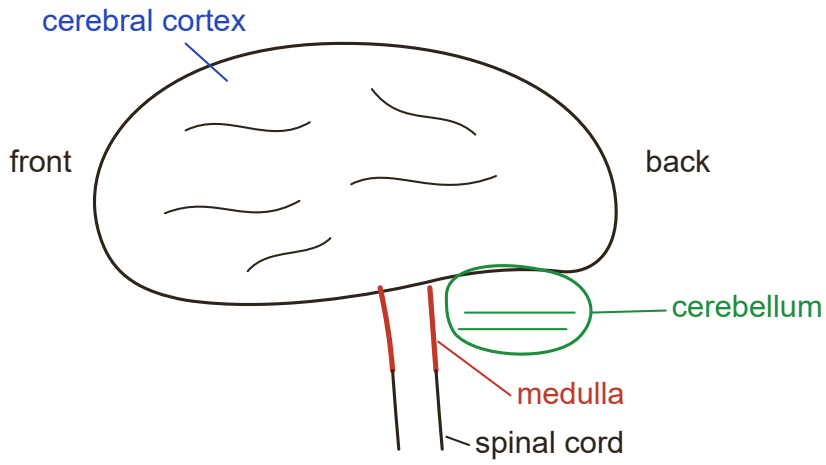
Key facts

- Brain = billions of interconnected neurones; controls complex behaviour
- Cerebellum: coordination of muscular activity (e.g. balance)
- Mapping methods: brain-damaged patients, electrical stimulation, MRI scans
- Cerebral cortex: consciousness, intelligence, memory, language
- Medulla: unconscious activities, e.g. heart rate and breathing
- Brain treatment is hard: complex, delicate, hard to reach, risk of damage to other areas

Notes

Structure of the brain

- The brain controls **complex behaviour**. It is made of **billions of interconnected neurones**.
- Different regions of the brain carry out different functions.
- **Cerebral cortex**: the large, folded outer layer. It is responsible for **consciousness**, **intelligence**, **memory** and **language**.
- **Cerebellum**: at the back of the brain, below the cerebral cortex. It coordinates **muscular activity**, such as balance and smooth, precise movement.
- **Medulla**: at the base of the brain, where it joins the spinal cord. It controls **unconscious activities** such as heart rate and breathing rate.



The brain from the side: cerebral cortex, cerebellum and medulla.

How scientists map the brain

- **Studying patients with brain damage**: if damage to one area affects one ability (e.g. speech), that area is probably involved in that ability.
- **Electrically stimulating** parts of the brain with electrodes and seeing what happens, e.g. a muscle moves or the person recalls a memory.
- **MRI scanning**: produces detailed images of the brain without surgery. **Functional MRI (fMRI)** shows which areas are most active while a person carries out a task.

Why treating the brain is difficult

- The brain is **complex** and **delicate**, and it is enclosed in the skull.
- Surgery or other treatment could damage nearby areas, causing problems with movement, speech or memory.
- It can be hard to find exactly which area is causing a problem, and the outcome of treatment can be uncertain.
- So any procedure has to weigh the likely benefit against these risks.

How to answer each type of question

Name the region from its function 1 mark each **Grade 4**

1. Thinking, memory, language or consciousness: cerebral cortex.
2. Balance and coordination of muscles: cerebellum.
3. Heart rate, breathing and other unconscious activities: medulla.

Example. Name the part of the brain that:
(a) controls breathing rate
(b) is responsible for language and memory
(c) coordinates muscular activity.

Model answer.

(a) Medulla (1)
(b) Cerebral cortex (1)
(c) Cerebellum (1)

Suggest the effect of damage to a region 2 marks **Grade 6**

1. State what the damaged region normally does.
2. Describe the effect on the person in the context given.

Example. A person has an injury to their cerebellum.
Suggest how this could affect them.

Model answer. The cerebellum coordinates muscular activity (1), so the person may have poor balance / find it difficult to walk or make precise movements (1).

Describe methods used to map the brain 2 marks **Grade 5**

1. Give one method per mark.
2. Add a few words on what each method shows.

Example. Describe two methods scientists have used to find out which parts of the brain carry out different functions.

Model answer.

Any two from:

studying people with damage to one part of the brain to see which ability they have lost (1)

electrically stimulating a part of the brain and observing the response, e.g. which muscle moves (1)

using MRI scans to see which areas are active when a person does a particular task (1)

Evaluate a procedure on the brain 4 marks **Grade 7**

1. Give the benefit to the patient.
2. Give the risks, linked to the brain being complex and delicate.
3. Finish with a conclusion that weighs the two sides.

Example. A patient has frequent seizures that do not respond to drugs. Scans show that the seizures start in one small area of the brain. Surgeons could remove this area.
Evaluate this treatment.

Model answer.

Any three from:

the seizures may stop or become less frequent, improving quality of life (1)

the brain is complex and delicate, so nearby tissue could be damaged (1)

this could affect speech, memory or movement (1)

surgery carries a risk of infection or bleeding (1)

plus a justified conclusion, e.g. it is worth considering because drugs have not worked, as long as scans show the area can be removed without damaging important regions (1)

Don’t lose marks

- Mixing up cerebellum and cerebral cortex because the names look alike.
- Saying the medulla controls conscious actions. It controls unconscious ones, such as heart rate.
- Saying MRI scans 'show what people are thinking'. They show which areas are active.
- In evaluate questions, giving only risks or only benefits, or leaving out a conclusion.

More tips

Memory tricks

- Cerebral Cortex = Clever and Conscious: thinking, memory, language.
- Cerebellum = balance: picture a tightrope walker.
- Medulla = the automatic 'maintenance' part: heart and breathing keep going without you thinking.
- Three ways to map the brain: damage, zapping (electrical stimulation) and scanning.

Exam technique

- Practise labelling a simple brain diagram until it is automatic: these are quick marks.
- For 'suggest' questions about damage, state the region's function first, then the effect in context.
- In 'evaluate' questions, give both sides and finish with a justified conclusion.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Label the three main brain regions**
Identify the cerebral cortex, cerebellum and medulla on a diagram of the brain.

Grade 4 — **State the function of each region**
Cerebral cortex: consciousness, intelligence, memory, language. Cerebellum: coordinates muscles. Medulla: unconscious activities.

Grade 5 — **Describe how brain regions have been mapped**
Studying patients with brain damage, electrically stimulating the brain, and MRI scanning.

Grade 6 — **Predict the effect of damage to a region**
Link the damaged region to its function and describe the likely effect on the person.

Grade 6 — **Explain why brain disorders are hard to treat**
The brain is complex and delicate, so it is hard to reach one area without damaging others.

Grade 7 — **Evaluate the benefits and risks of brain procedures**
Weigh possible benefits against risks such as damage to other areas, infection and uncertain results.

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