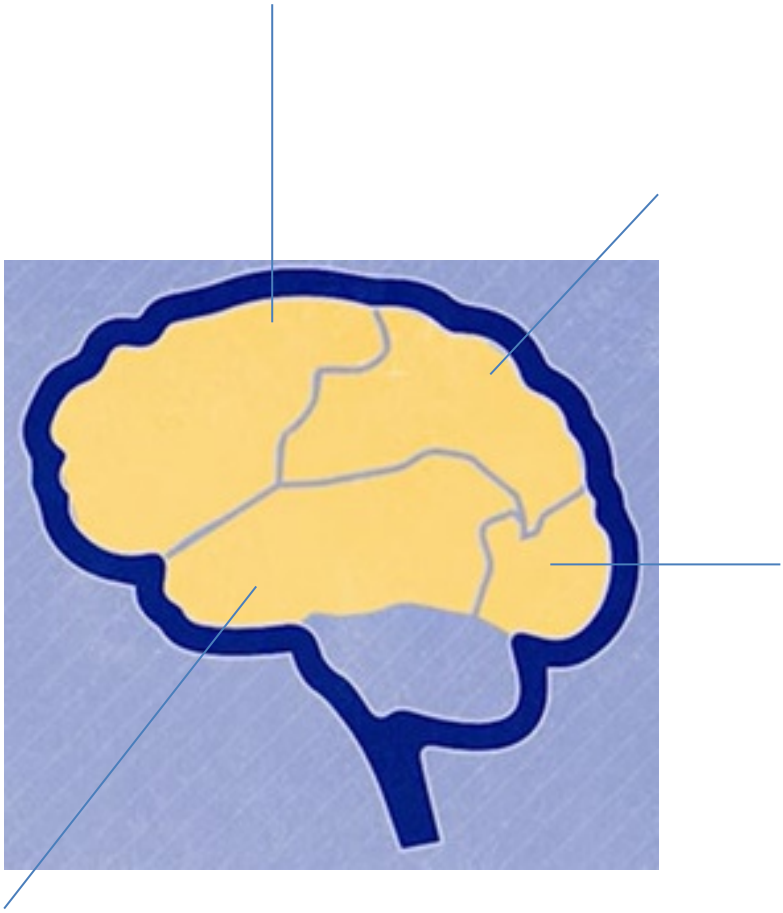
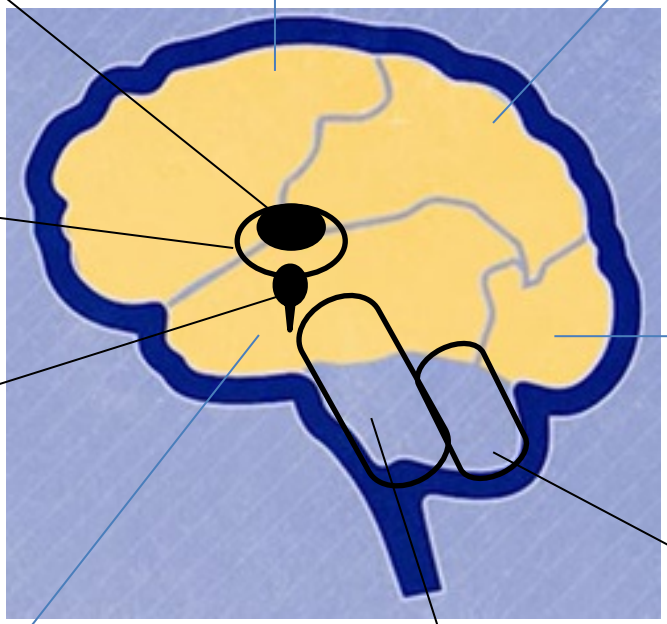
The brain: The body's control centre

Task: Label the ´components` of the cerebrum, sketch and caption the missing parts of the brain. Provide brief notes about the tasks of each of the ´components.`



Sample answer



Frontal lobe (transmits movement impulses from the motor cortex to muscles, actual thinking takes place in the prefrontal cortex)

Thalamus (filters information before it is transmitted to the cerebrum)

Parietal lobe (receives impulses from touch and pain receptors)

Diencephalon (relay function)

Occipital lobe (visual processing centre)

Hypothalamus (metabolism, body temperature, autonomic nervous system)

Cerebellum (coordinates movements)

Temporal lobe (hearing centre, areas for language processing and memory formation)

Brainstem (regulates functions such as the heartbeat and breathing)

The Patch Clamp Technique

Our brains can be compared to computers: Countless pieces of information are constantly being received, selected, passed on and processed. This information is transmitted in the form of electrical impulses via nerve cells to the correct area of the brain. The patch clamp technique, which was developed by Erwin Neher and Bert Sakman, proves that signals are transmitted through ion channels to cell membranes.

Erwin Neher (2018) – Ion channels: Past, Present and Future

"Our approach was to try to not push into the cell but place the measuring pipette touchingly onto the surface of the cell in order to isolate [...] a small patch of membrane for the electrical measurements and hoping to have one or a few of these ion channels, these pore-like structures being present in that patch of membrane. [...] And if that opens and closes it should produce a current which we can measure in the amplifier attached to it. "

Tasks: Find out about the patch clamp technique and answer the following questions:

1. What does the patch clamp technique measure?

2. How can measurements at the cell membrane be visualised? (Sketch an example of the structure.)

3. How should cells be prepared for measurement?

An initial overview:

https://www.deutsches-museum.de/fileadmin/Content/040_BN/PDFs/Prismentexte/Patch-Clamp-Messung.pdf

More detailed information:

https://www.leica-microsystems.com/science-lab/the-patch-clamp-technique/

The Brain: Our Navigational System

Every day we move from place to place, we always know where we are and even how long it will take us to reach our destination. How does our brain actually do this?

Edvard I. Moser (2018): "Where does this place-cell signal come from? Because this is in a way in the middle of the cortex. [...] It's really quite surprising that there is such a sharp signal about position of the rat, because there is no place signal in the outer world. You don't sense place through your fingers or your ears or your eyes. So how is this created? It was a big mystery still. And that's one of the questions that when May-Britt Moser and I started a lab in 1996 in Trondheim in Norway, then this is one of the things we really wanted to understand. "

Task 1: Watch the video ´The Brain: Our Navigational System` and answer the following questions:

- Which types of cells form the structures of our sense of direction?
- What function does each of these cells have?
- Then read an additional article at: https://geog.ucsb.edu/are-google-maps-and-gps-bad-for-our-brains/.

Task 2: Prepare a short presentation on the topic of ´The Brain as a Navigational System. `

The Brain: A Time of its Own

Humans do not have any sensory organ that perceives time. Therefore it is not possible for us to know the exact time at any given moment. Nevertheless, the course of the day helps us delineate chronological sequences. Where does this sense of time come from?

Edvard I. Moser (2018): "Time, unlike space, [...] seems to be distributed among many many neurons. So it's actually quite hard to capture, because each neuron may just have a little bit or trace of it. But it's not like the grid-cells where it's all on one and you can tell immediately that this cell is firing for some aspect of space. "

Task 1: Watch the video ´The Brain: A Time of Its Own` and answer the following questions:

- Which components does the brain use to perceive time?
- Where in the brain can our sense of time be measured?
- Then read an additional article at: https://www.sleepfoundation.org/circadian-rhythm/sleep-drive-and-your-body-clock.

Task 2: Prepare a short presentation on the topic of ´The Perception of Time.`