

Edexcel IAL Biology A-level

8.11-8.16 - Plant Hormones, Coordination and the Brain

Flashcards

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What are plant growth factors and where are they produced?



What are plant growth factors and where are they produced?

- Chemicals that regulate plant growth response to directional stimuli
- Produced in plant growing regions (apical meristems)
- Diffuse from cell to cell/ phloem mass transport



What is phytochrome?



What is phytochrome?

Plant photoreceptor with bilin chromophore group.

Converts between 2 forms:

- Biologically inactive **Pr** absorbs red light and is abundant in darkness.
- Biologically active **Pfr** absorbs far-red light and is abundant in sunlight.

Ratio of Pr:Pfr enables plant to detect how long days are.



What effect does phytochrome have on plants?



What effect does phytochrome have on plants?

Phytochromes are a regulatory group of hormones which have effects on plant growth and development. They regulate aspects of development such as flowering and the synthesis of chlorophyll.



What is photomorphogenesis?



What is photomorphogenesis?

The pattern of plant growth and development determined by light intensity



How does phytochrome control photomorphogenesis?



How does phytochrome control photomorphogenesis?

Transition from Pr to Pfr controls: localization of proteins within cells, transcription of certain genes, phosphorylation of proteins.

Therefore affects: germination, circadian rhythm, flowering.



How does phytochrome control flowering?



How does phytochrome control flowering?

Pr absorbs red light and converts to Pfr, which stimulates flowering (signifies that light intensity is great enough for photosynthesis).



How does phytochrome affect gene transcription?



How does phytochrome affect gene transcription?

The active form of phytochrome (Pfr) can **enter the nucleus** where it can bind to transcription factors like **PIF** (phytochrome interacting factor) which **activates the transcription of genes** such as those involved in the synthesis of chloroplast proteins like RuBisCo.



What is Indole Acetic Acid (IAA)?



What is Indole Acetic Acid (IAA)?

A type of **auxin** which is mainly produced at growing plant tips which is used to promote cell growth and elongation.



List the functions of auxins in plants.



List the functions of auxins in plants.

- Involved in trophic responses e.g. IAA
- Control cell elongation
- Suppress lateral buds to maintain apical dominance
- Promote root growth e.g. in rooting powders



What is apical dominance?



What is apical dominance?

Phenomenon where during the growth of the shoot, the growth of side shoots does not take place. Maintained by the action of auxin, abscisic acid and cytokinins.



How is germination stimulated?



How is germination stimulated?

1. Seed absorbs water, activating embryo to secrete gibberellins.
2. Gibberellins diffuse to aleurone layer, which produces amylase.
3. Amylase diffuses to endosperm layer to hydrolyse starch.
4. Hexose sugars act as respiratory substrate to produce ATP as 'energy currency'.



How does IAA affect gene transcription?



How does IAA affect gene transcription?

Certain transcription factors related to auxin-controlled genes are found in the nucleus. They are typically blocked by other proteins from enhancing transcription. When auxin levels rise, these proteins are broken down and the transcription factors can promote transcription.



Explain why shoots show positive phototropism



Explain why shoots show positive phototropism

1. Indoleacetic acid (IAA) diffuses to shaded side of shoot tip.
2. As IAA diffuses down shaded side, it causes active transport of H^+ ions into cell wall.
3. Disruption to H-bonds between cellulose molecules & action of expansins make cell more permeable to water (acid growth hypothesis).
4. Cells on shaded side elongate faster due to higher turgor pressure.
5. Shoot bends towards light.



Explain why roots show positive
gravitropism



Explain why roots show positive gravitropism

1. Gravity causes IAA to accumulate on lower side of the root.
2. IAA inhibits elongation of root cells.
3. Cells on the upper side of the root elongate faster, so the root tip bends downwards.



What are gibberellins?



What are gibberellins?

Plant hormones that control stem elongation, trigger the growth of the pollen tube during fertilisation and stimulate the mobilisation of food storage reserves during seed germination.



List the functions of gibberellins



List the functions of gibberellins

Gibberellins stimulate:

- Germination
- Elongation at cell internodes
- Fruit growth
- Rapid growth/ flowering



How do gibberellins affect gene transcription?

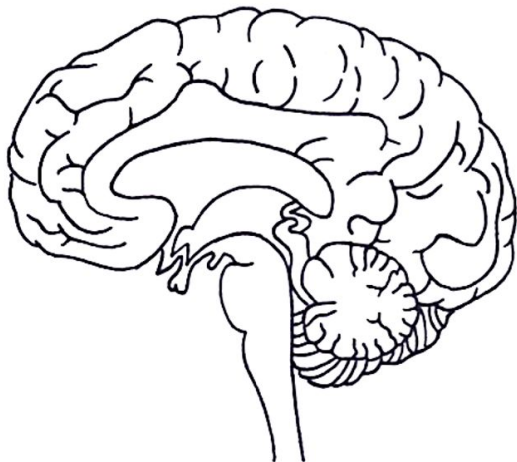


How do gibberellins affect gene transcription?

- Gibberellins bind to **receptors** found mostly in the nucleus.
- This **gibberellin and receptor complex binds to transcription factors** which inhibit the transcription of certain genes responsible for processes such as seed germination
- The binding of this receptor/gibberellin complex to the transcription factor causes the **transcription factors** to be **broken down** which allows processes like seed germination to occur.



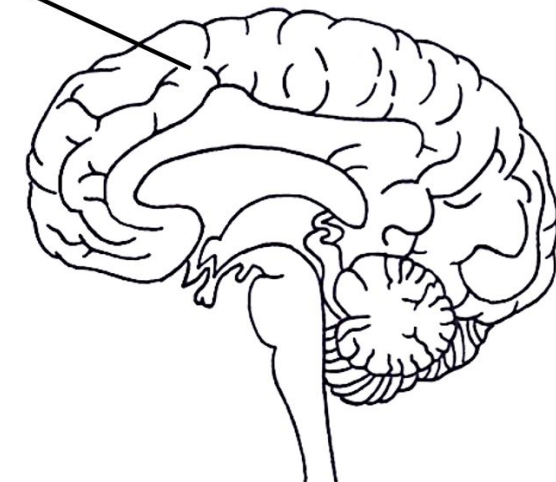
Identify the location and function of the cerebrum



Identify the location and function of the cerebrum

Responsible for all voluntary behaviour, memory, personality, learning and reasoning.

Cerebrum



What is the function of each cerebral hemisphere?

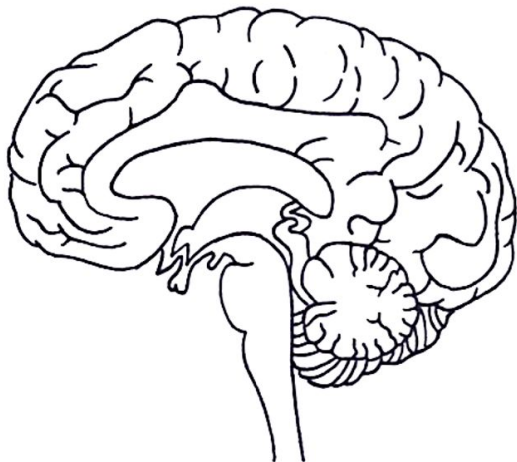


What is the function of each cerebral hemisphere?

- Left hemisphere receives sensory information from the right side of the body and controls muscle coordination on the right.
- Right hemisphere receives sensory information from the left side of the body and controls muscle coordination on the left.

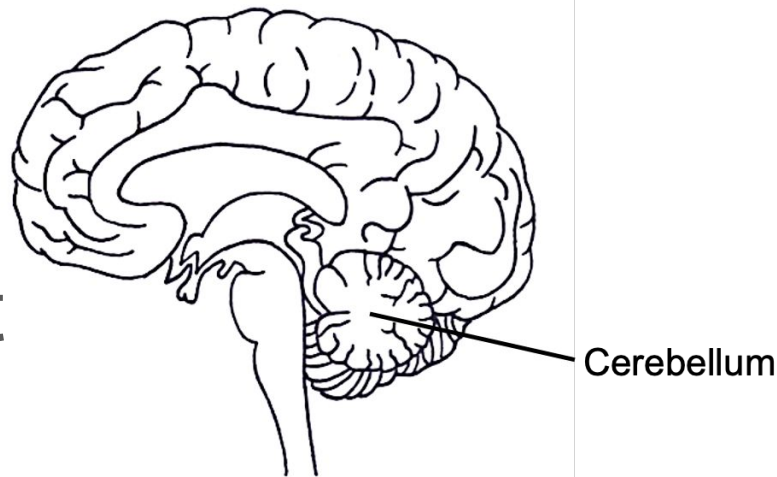


Identify the location and function of the cerebellum

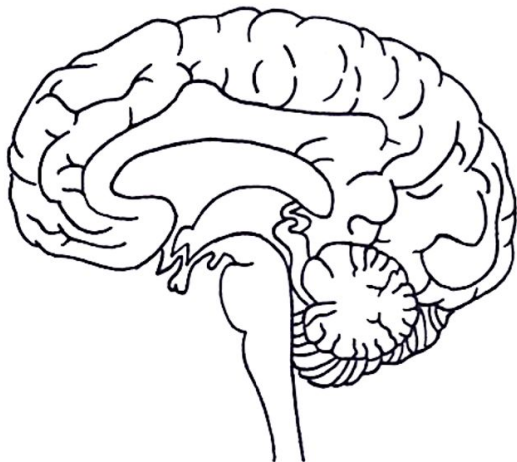


Identify the location and function of the cerebellum

Controls muscle coordination and non-voluntary movement (e.g. balance, posture).

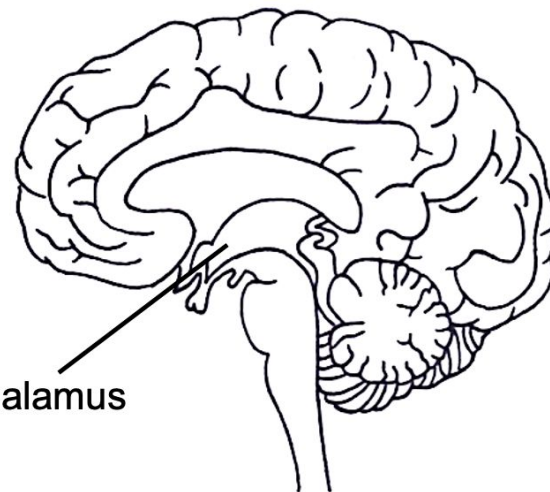


Identify the location and function of the hypothalamus

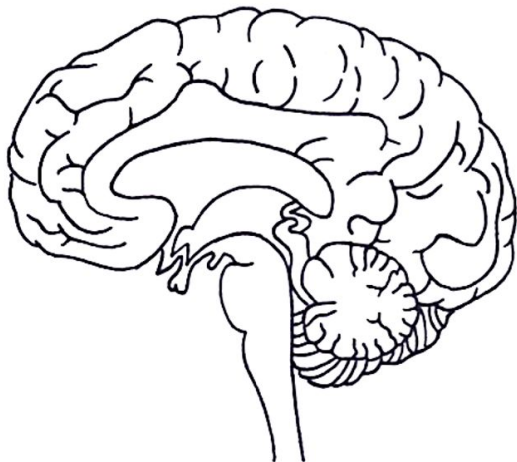


Identify the location and function of the hypothalamus

- Control centre for autonomic nervous system
- Responsible for hormone production, regulation of the water potential of body fluids and control of behavioural patterns
- Links nervous and endocrine systems

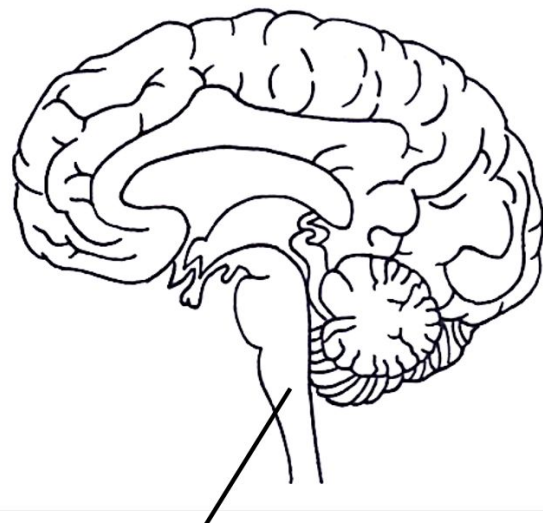


Identify the location and function of the medulla oblongata



Identify the location and function of the medulla oblongata

Regulates autonomic activities such as ventilation, heart rate and peristalsis.



Medulla oblongata



Name four brain imaging techniques



Name four brain imaging techniques

- Magnetic resonance imaging (MRI)
- Functional magnetic resonance imaging (fMRI)
- Positron emission tomography (PET)
- Computerised tomography (CT)



How does an MRI scan work?



How does an MRI scan work?

Uses a powerful **magnetic field** to cause protons from hydrogen atoms in water molecules to align. **Radio waves** then knock protons out of alignment. Radio waves turned off. Protons realign and emit radiation to receivers. Signals used to produce a 3D cross-sectional image.



Describe the advantage of using an MRI scan



Describe the advantage of using an MRI scan

High resolution distinguishes tissues and provides more detail than ultrasound or CT scans.



How does an fMRI scan work?



How does an fMRI scan work?

- Uses radio waves and a magnetic field to assess brain function through the visualisation of **blood flow** in brain capillaries
- Shows where most aerobic respiration occurs and changes in brain activity



How does a PET scan work?



How does a PET scan work?

- A **radioactive isotope** (e.g. carbon) with a **short half-life** is injected and used by the body to synthesise molecules
- Isotope decays and emits **gamma radiation** to a detector. Active areas show higher radioactivity



What is a CT scan?



What is a CT scan?

A medical imaging technique that uses specialised X-ray equipment and computer software to create detailed images of internal organs.



What is Parkinson's disease?



What is Parkinson's disease?

Neurodegenerative disorder affecting movement & cognitive function.

Loss of dopaminergic neurons in cerebral cortex of brain.
Characterised by formation of Lewy bodies (clumps of alpha synuclein protein).

Results in fewer threshold impulses to neurons in motor cortex.



What causes Parkinson's disease?



What causes Parkinson's disease?

The death of dopamine producing cells within the basal ganglia of the midbrain. The exact cause of this cell death is unknown but it may be caused by a mix of genetic and environmental factors.



What is depression?



What is depression?

As defined by the World Health Organisation*:

Depression is a common mental disorder characterized by persistent sadness and a lack of interest or pleasure in previously rewarding or enjoyable activities.

*<https://www.who.int/health-topics/depression>



Describe the link between serotonin and depression



Describe the link between serotonin and depression

Correlation between low serotonin levels and depression. May be caused by low serotonin production, a problem with postsynaptic receptors or other linked variables.

Evidence shows that drugs which increase serotonin levels in synaptic cleft e.g. selective serotonin reuptake inhibitors (SSRIs) are effective treatments.

