Edexcel (A) Biology A-level

8.2 + 8.5 to 8.7 - Responses to Stimuli

Flashcards

Outline the general stages that cause a response to a stimulus.

Outline the general stages that cause a response to a stimulus.

Receptors detect stimulus → Sensory neuron → Relay neuron in central nervous system → Motor neuron → Muscle or gland acts as effector

How does the pupil dilate?

How does the pupil dilate?

Radial & circular muscles in iris work antagonistically.

When low levels of light reach photoreceptors, sympathetic nervous system stimulates radial muscles to contract. Circular muscles relax.

How does the pupil contract?

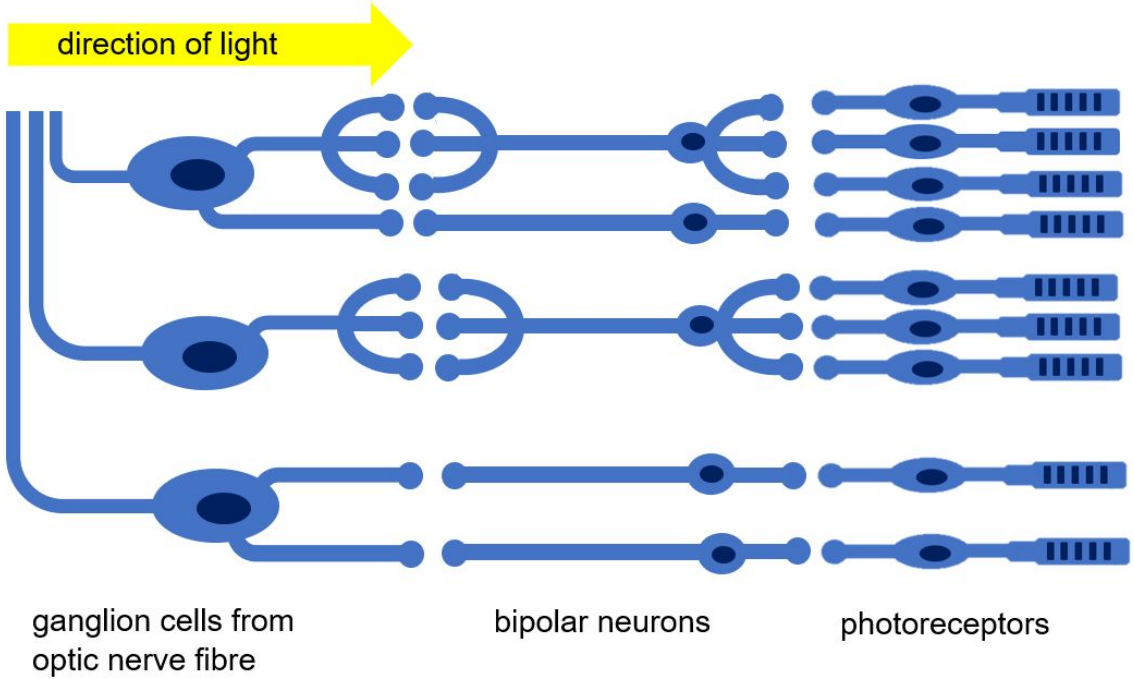
How does the pupil contract?

Radial & circular muscles in iris work antagonistically.

When high levels of light reach photoreceptors, parasympathetic nervous system stimulates circular muscles to contract. Radial muscles relax.

Describe the structure of the human retina.

Describe the structure of the human retina.



Name the 2 types of photoreceptor cell located in the retina.

Name the 2 types of photoreceptor cell located in the retina.

1. Cone cells
2. Rod cells

Where are rod and cone cells located in the retina?

Where are rod and cone cells located in the retina?

Rod: evenly distributed around periphery but NOT in central fovea.

Cone: mainly central fovea

No photoreceptors at blind spot where ganglion axon fibres form optic nerve.

Explain why rod cells do not generate action potentials in the dark.

Explain why rod cells do not generate action potentials in the dark.

1. Na^+ enters outer segment of rod cell via non-specific cation channels. Active transport of Na^+ out of inner segment = rod cell is slightly depolarised.
2. Action potential = voltage-gated Ca^{2+} channels open. Triggers exocytosis of glutamate.
3. Glutamate acts as inhibitory neurotransmitter to hyperpolarise bipolar neuron.

Explain how rod cells generate an action potential in the light.

Explain how rod cells generate an action potential in the light.

1. Rhodopsin pigment bleaches when it absorbs light & breaks down into opsin + retinal.
2. Opsin closes cation channels via a hydrolysis reaction. Active transport of Na^+ out of inner segment continues.
3. Rod cell becomes hyperpolarised. No glutamate is released, so no inhibitory signal.
4. Bipolar neuron depolarises.

Outline the pathway of light from a photoreceptor to the brain.

Outline the pathway of light from a photoreceptor to the brain.

Photoreceptor → Bipolar neuron →

Ganglion cell of optic nerve → Brain

Describe the pigments in rod and cone cells.

Describe the pigments in rod and cone cells.

Rod: rhodopsin absorbs all wavelengths of light = monochromatic vision.

Cone: 3 types of iodopsin which absorb red, blue or green wavelengths of light = tricolour vision.

Describe the visual acuity of rod and cone cells.

Describe the visual acuity of rod and cone cells.

Rod: many rod cells synapse with 1 bipolar neuron = low resolution.

Cone: 1 cone cell synapses with 1 bipolar neuron so there is no retinal convergence = high resolution.

Describe the light sensitivity of rod and cone cells.

Describe the light sensitivity of rod and cone cells.

Rod: very sensitive due to spatial summation of subthreshold impulses = vision in low-light conditions.

Cone: less sensitive = vision in bright light.

What is bleaching?

What is bleaching?

Sudden exposure to high light intensity causes rhodopsin to break down faster than it can reform.

Describe the process of light and dark adaptation in the eye.

Describe the process of light and dark adaptation in the eye.

Light adaptation: as rhodopsin reforms after bleaching, retinal sensitivity decreases.

Dark adaptation: rod cells become functional, retinal sensitivity increases.

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.

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.

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 is phytochrome?

What is phytochrome?

Plant photoreceptor with bilin chromophore group. Converts between 2 forms:

- Biologically inactive Pr absorbs red light.
- Biologically active Pfr absorbs far-red light.

State the time of day when each form of phytochrome is most abundant.

State the time of day when each form of phytochrome is most abundant.

In darkness: Pr abundant

In sunlight: Pfr abundant

Enables plant to detect how long days are.

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 high enough for photosynthesis).

What is photomorphogenesis?

What is photomorphogenesis?

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.

What are long and short day plants?

What are long and short day plants?

Long day: flower when sunlight hours exceed a critical value.

Short day: flower when darkness hours exceed a critical value.

How do phytochrome and IAA affect transcription?

How do phytochrome and IAA affect transcription?

Can bind to proteins in the cytoplasm.

The complex formed can act as a transcription factor.

Name the 2 systems in animals that control coordination.

Name the 2 systems in animals that control coordination.

- Nervous system
- Endocrine system (hormones)

Contrast mammalian hormones and plant growth factors. (CASTS)

Contrast mammalian hormones and plant growth factors. (CASTS)

Feature	Mammalian hormone	Plant growth factor
Concentration	response not always dependent on concentration	response proportional to concentration
Action	target complementary proteins	can affect all cells
Synthesis	specialised glands	various tissues in growing regions
Transport	circulatory system	diffusion or phloem translocation
Speed	faster-acting (homeostasis)	slower-acting (plant growth)

Why is there a time lag between hormone production and response by an effector?

Why is there a time lag between hormone production and response by an effector?

It takes time to:

- Produce hormone
- Transport hormone in the blood
- Cause required change to the target protein