AQA B5a Homeostasis and Response: Nervous Control
BIOLOGY TRIPLE (page 1 of 2)

Required Practical - Reaction Time

The Sense Organs	
Sense Organ	**Receptors sensitive to…**
ears	Sound and changes in position for balance
eyes	Light
skin	Touch, pressure, pain, temperature
nose and tongue	Chemicals for smell and taste

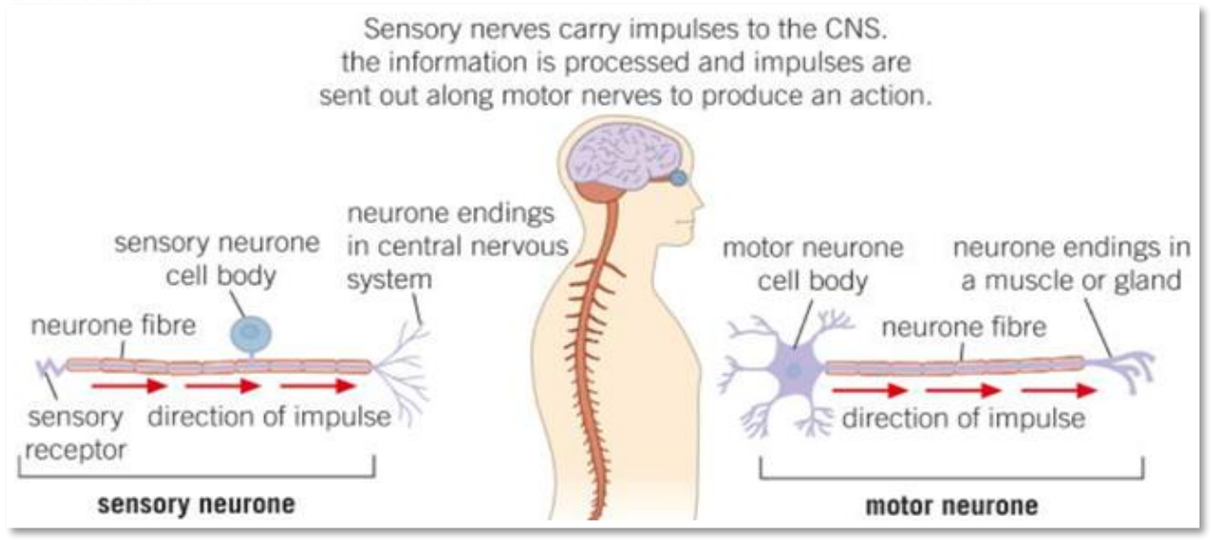
Homeostasis is the **regulation** of the **internal conditions** of a cell or organism to **maintain optimum conditions** for function, in response to internal and external changes. Homeostasis maintains optimal conditions for enzyme action and all cell functions. Human control systems include:

Receptor cells	Coordination centres	Effectors
These detect stimuli (changes in the environment)	E.g. brain, spinal cord and pancreas that receive information from receptors	Muscles or glands, which bring about a response to restore optimum levels

Reflex actions are **automatic** and **rapid**; they do not involve the conscious part of the brain and can **protect** humans from harm. They involve a **relay neurone** instead of the CNS.

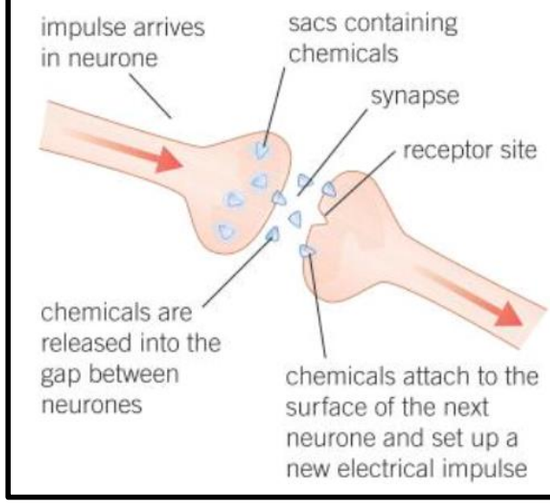
The Nervous System

This system enables humans to react to their surroundings and coordinate their behaviour.



Synapse

This is a gap where neurones meet. A chemical message is used involving a neurotransmitter.



Reflex Arc Pathway

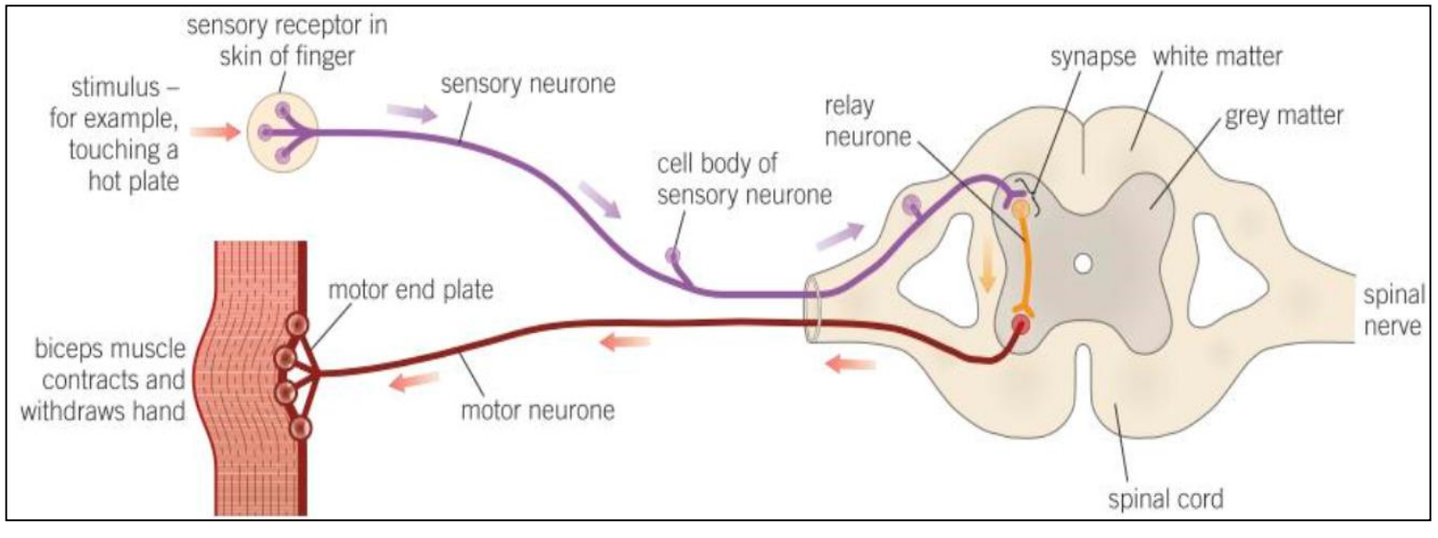
Pathway	Example
stimulus	Touch hot plate
receptor	Cells in finger
sensory neurone	Long - carries impulse from receptor to relay neurone in spinal cord
relay neurone	Allows impulses to travel between the sensory neurone and the motor neurone in the spinal cord
motor neurone	Long carries impulse to effector
effector	Biceps muscle contracts
response	Withdraw hand

The Nervous System Voluntary Response Pathway

Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS). The CNS coordinates the response of the effectors which may be muscles contracting or glands secreting hormones.

Pathway	Example
stimulus	Lights switch on
receptor	Cells in retina (eye)
sensory neurone	Carries impulse to coordinator
coordinator	Central nervous system (CNS) – brain or spinal cord
motor neurone (very long)	Carries impulse to effector
effector (muscle or gland)	Muscles connected to iris
response	Pupils get smaller

The Reflex Arc



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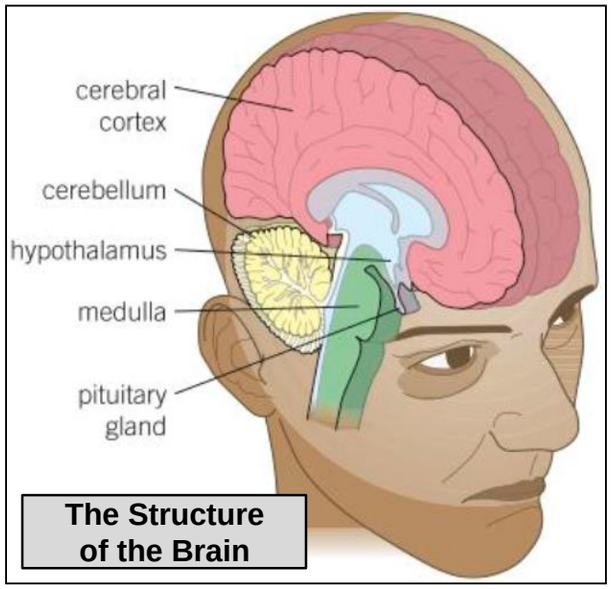
The Brain

The brain controls complex behaviour. It is made of billions of interconnected neurones. The brain has different regions that carry out different functions.

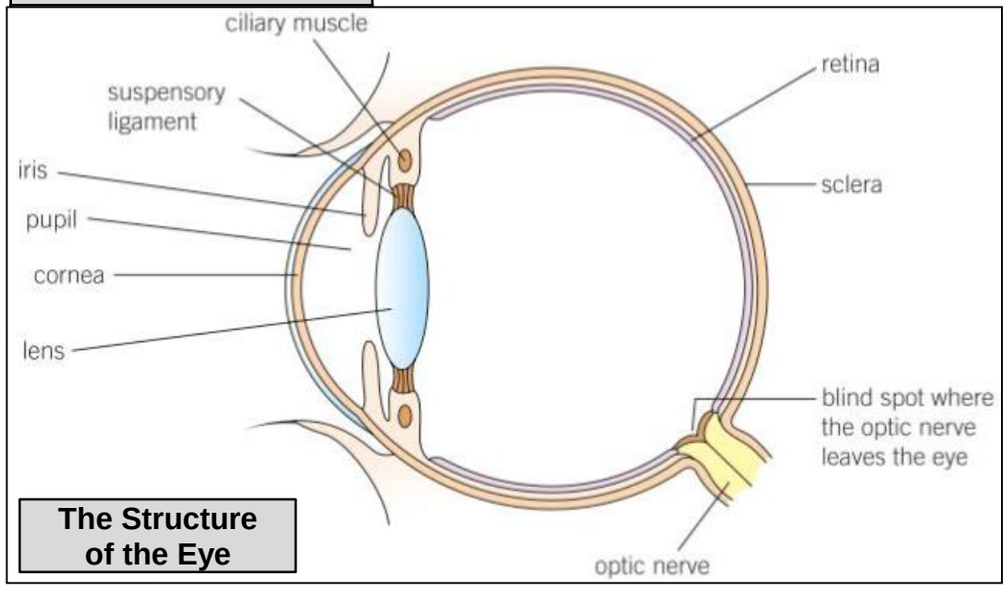
Region of Brain	Function
cerebral cortex	Largest part of human brain. Higher thinking skills (eg, speech, decision making)
cerebellum	Balance and voluntary muscle function (eg, walking, lifting)
medulla	Involuntary (automatic) body functions (eg, breathing, heart rate)

The complexity and delicacy of the brain makes investigating and treating brain disorders very difficult.

Neuroscientists have been able to map the regions of the brain to particular functions by studying patients with brain damage, electrically stimulating different parts of the brain and using MRI scanning techniques.



The Structure of the Brain



The Structure of the Eye

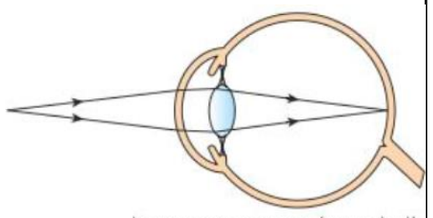
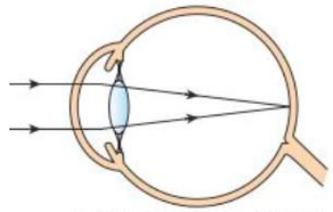
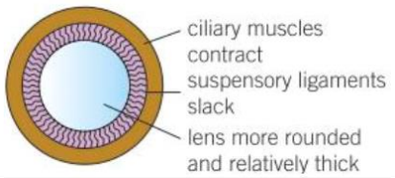
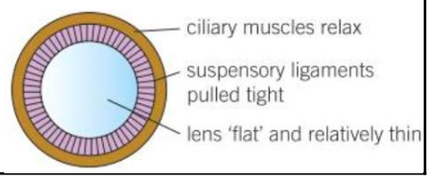
The Eye

The eye is a sense organ containing receptors sensitive to light intensity and colour.

Structure of Eye	Function
retina	Light sensitive cell layer
optic nerve	Carries impulse to brain
sclera	Protects the eye
cornea	Transparent layer that covers pupil and iris
iris	Pigmented layer that controls size of pupil
ciliary muscles	Controls thickness of lens
suspensory ligaments	Connects lens to ciliary muscle

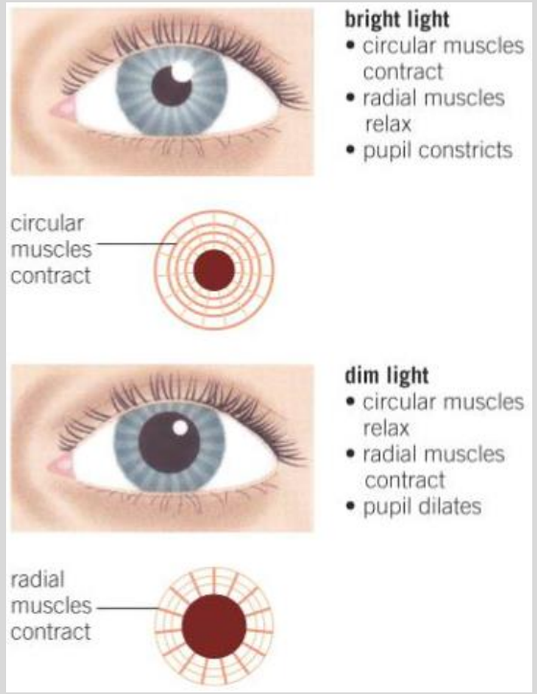
Accommodation

Accommodation is the process of changing the shape of the lens to focus on near or distant objects.

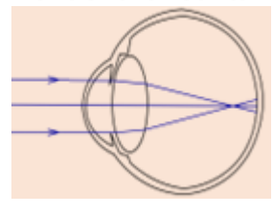
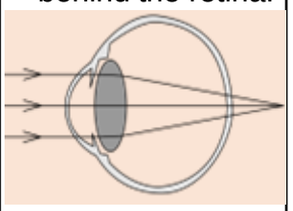
Focus on Near Object	Focus on Distant Object
Ciliary muscles contract, suspensory ligaments loosen, lens gets thicker, light is more refracted	Ciliary muscles relax, suspensory ligaments tighten, lens pulled thin, light is only slightly refracted
 lens more convex (rounded)	 lens less convex (flatter)
 ciliary muscles contract; suspensory ligaments slack; lens more rounded and relatively thick	 ciliary muscles relax; suspensory ligaments pulled tight; lens 'flat' and relatively thin

New technologies to overcome the problems of myopia and hyperopia now include hard/soft contact lens, laser surgery to change the shape of the cornea and a replacement lens in the eye.

The circular muscles and radial muscles in the iris can contract and relax to alter the size of the pupil to change the amount of light entering the eye.



Common Eye Defects

Myopia (short sightedness)	Hyperopia (long sightedness)
Light is focussed in front of the retina.	Light is focussed behind the retina.
	
Treated using concave lens so light is focused on the retina	Treated using convex lens so light is focussed on the retina