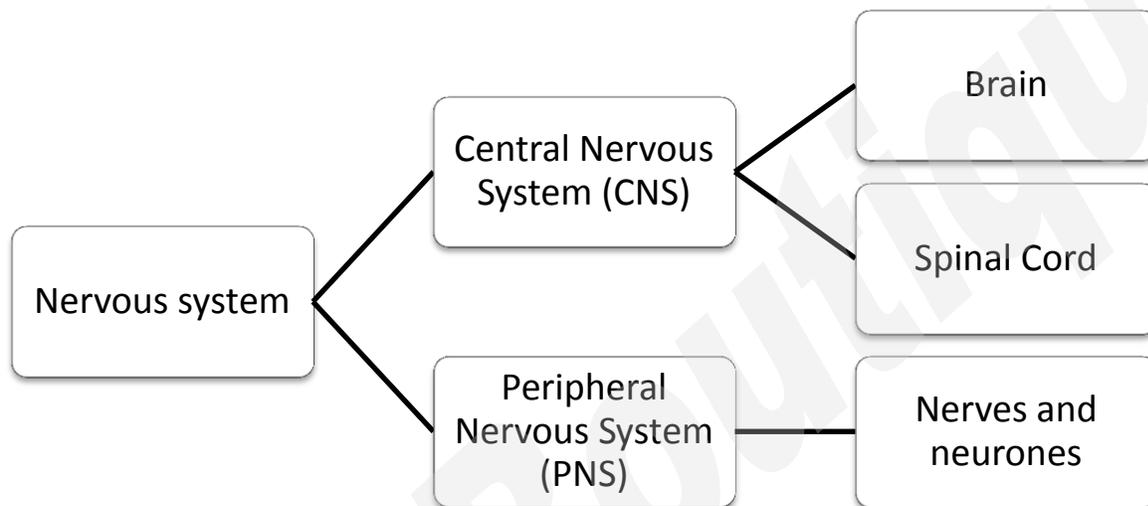


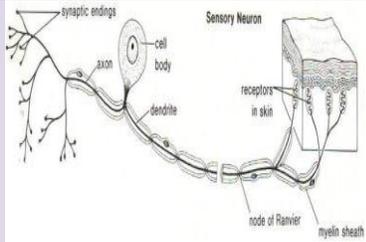
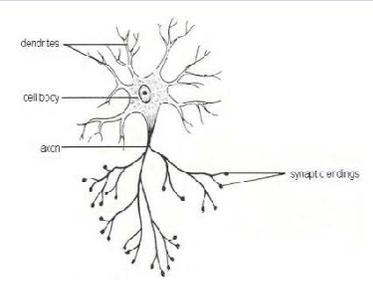
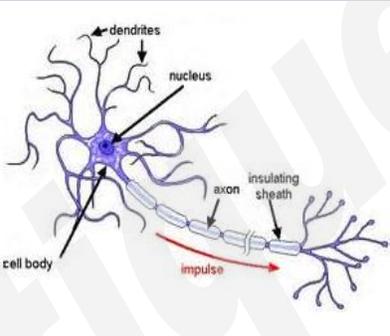
Coordination and Responses – Nervous System (IGCSE Biology Syllabus 2016-2018)

Nervous System



Types of Neurons

- Nerve impulse: an electrical signal that passes along nerve cells

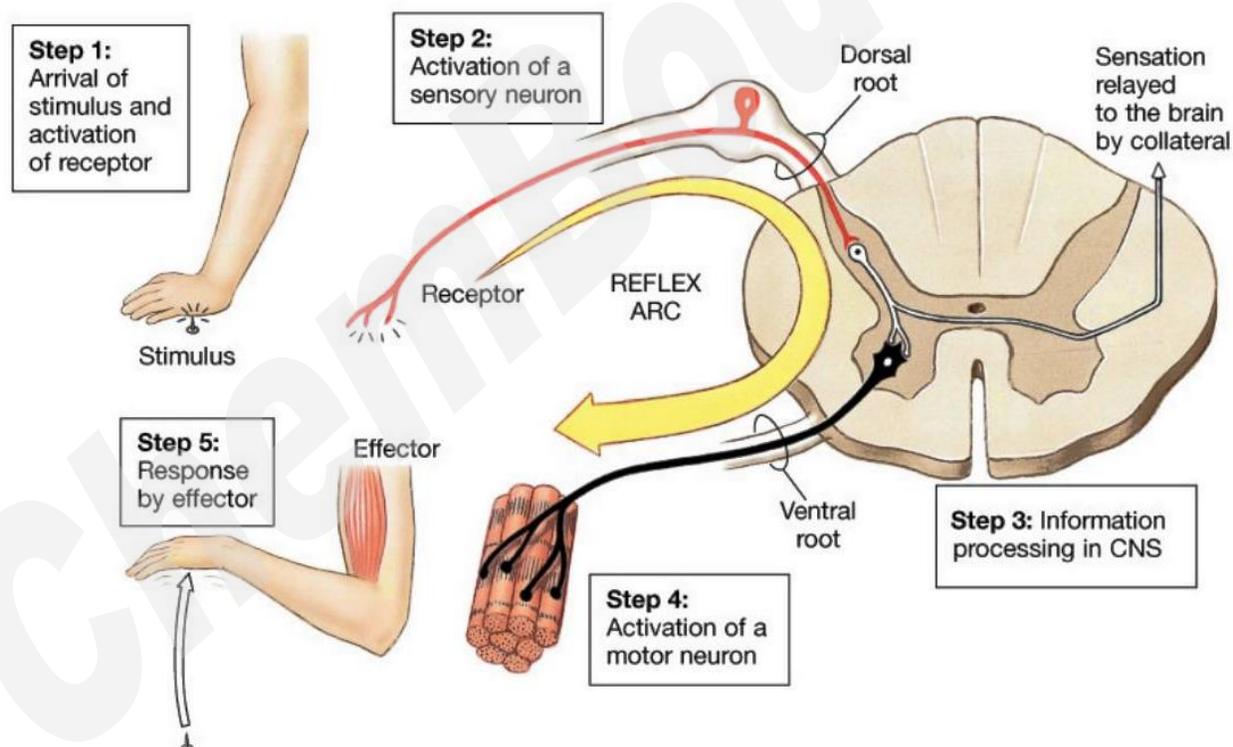
Sensory Neurone	Relay Neurone	Motor Neurone
		
<p>Transmit nerve impulse from receptor to the brain</p>	<ul style="list-style-type: none"> - Inside the brain and spinal cord - Connecting sensory neurone to motor neurone 	<ul style="list-style-type: none"> - Transmit nerve impulse from the brain to the effector

Coordination Response

Sensitivity	The ability to sense and respond to changes in the surroundings.
Stimulus	A change in an organism's surroundings that can be detected by its sense organs
Receptor	A cell that is able to detect changes in the environment, part of a sense organ
Effector	A part of the body that responds to a stimulus

Voluntary Action	Involuntary action
Under conscious thinking	Not under conscious control
Slow response	Fast response
e.g. write, speak	Protect the body from danger
	e.g. Reflex Arc: automatically and rapidly integrating and coordinating stimuli with the responses of effector
Stimulus → Receptor → Sensory Neurone → Brain (Relay Neurone) → Motor Neurone → Effector → Response	Stimulus → Receptor → Sensory Neurone → Spinal Cord (Relay Neurone) → Motor Neurone → Effector → Response

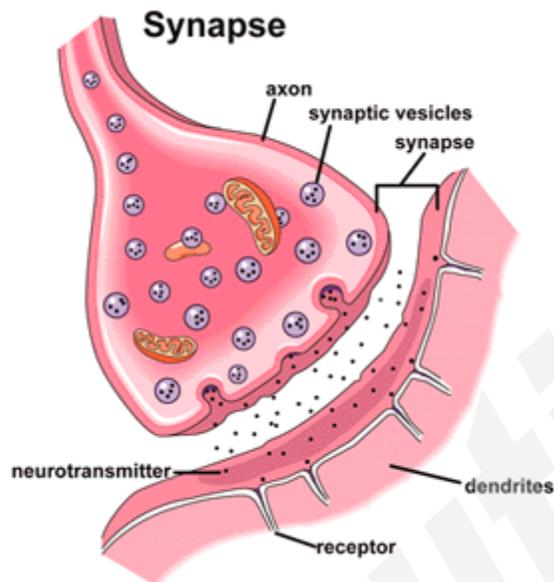
Reflex Arc



Antagonistic muscle: a muscle that contracts while another relaxes

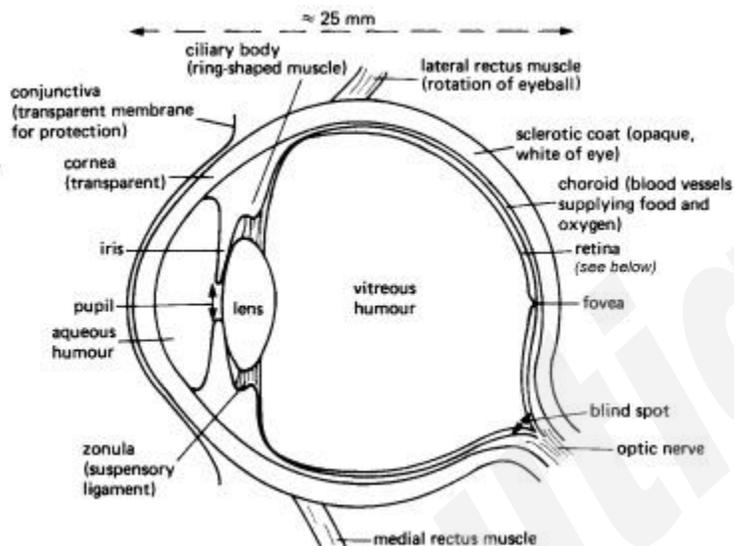
Bending of elbow: Biceps contract and triceps relax

Synapses



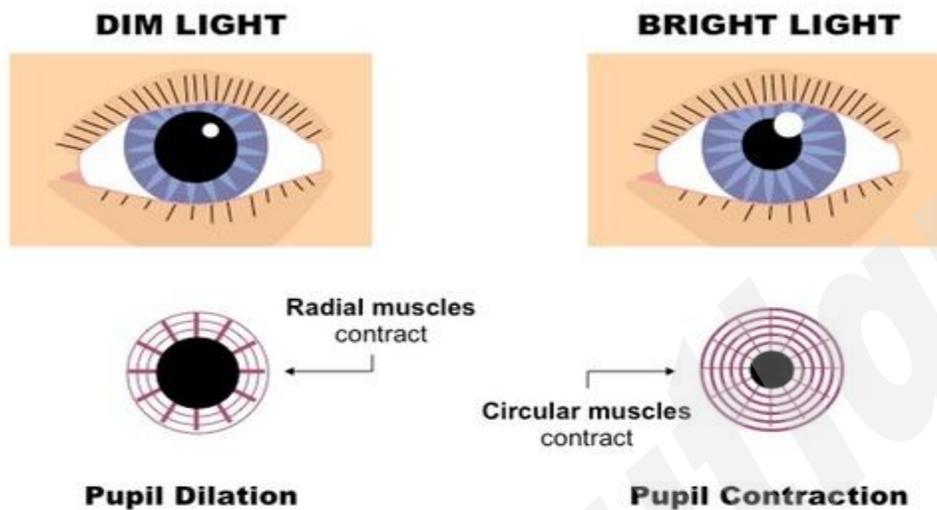
- **Synapse:** a junction between two neurones, consisting of a gap across which impulses pass by diffusion of a neurotransmitter
- **Synaptic cleft:** small gap between each pair of neurone
- **Synaptic vesicle:** vesicles that contain a chemical (neurotransmitter)
 - i. When an impulse arrives at presynaptic neurone
 - ii. the vesicles move to the cell membrane and release their neurotransmitter into the synaptic cleft
 - iii. the neurotransmitter quickly diffuses across the synaptic cleft and attaches to the receptor on the cell membrane of postsynaptic neurone
 - iv. the shape of neurotransmitter and the shape of receptor are complementary to each other

The Eye



- Iris: control eye colour
- Retina: contains light sensitive cells
- Fovea/yellow spot: part of the retina where the receptor cells are pushed most closely together where light is focused
- Optic nerve: carries impulses to the brain
- Lens: focuses light onto retina

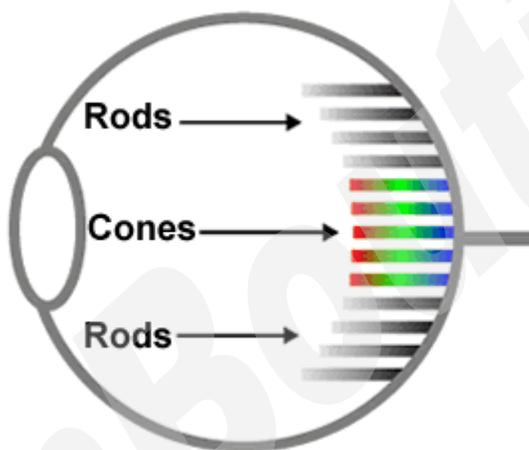
Pupil Reflex



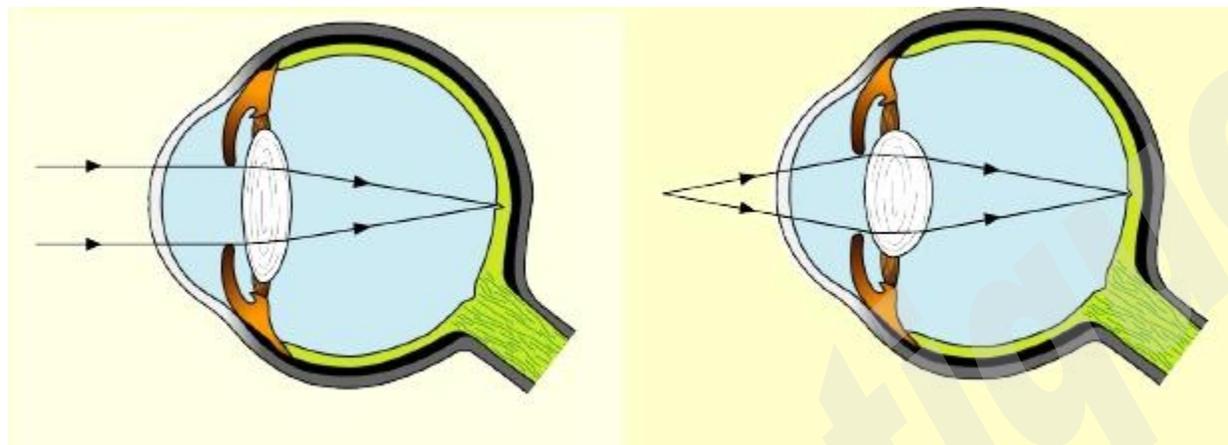
Low Light Intensity	High Light Intensity
<ul style="list-style-type: none"> - radial muscles contract - circular muscles relax - pupil dilates - more light enter 	<ul style="list-style-type: none"> - radial muscles relax - circular muscles contract - pupil constricts - less light enter

Rods and Cones

Rods	Cones
<ul style="list-style-type: none"> - provide black and white images - good for seeing in low intensity light - packed most tightly around the edge of retina so people can see things most clearly when not looking directly at them 	<ul style="list-style-type: none"> - provide detailed, coloured images - work in high light intensity - most tightly packed at the centre of retina so people can see things clearly when directly looked at



Accommodation



Distant Object	Near Object
Suspensory ligaments contract	Suspensory ligaments contract
Ciliary muscle relax	Ciliary muscle contract
Lens becomes long and thin	Lens becomes short and fat

Hormones

- A chemical substance, produced by a gland, carried by the blood, which alters the activity of one or more specific target organs and is then destroyed by the liver

Gland	Hormone	Function
Adrenal gland	Adrenaline	-Increases pulse rate -Makes the glycogen in muscles → glucose and released into blood → increases respiration rate -Breath deeper and more rapidly, increases uptake of oxygen → increases respiration rate -Fight or flight hormone (e.g. bungee jumping)
Pancreas	Insulin Glucagon	Glucose → Glycogen Glycogen → Glucose
Testes	Testosterone	Development of male sexual characteristics
Ovary	Oestrogen Progesterone	Repair uterus lining Maintain uterus lining
Pituitary	Antidiuretic hormone (ADH)	Regulate reabsorption of water at kidney tubule when water intake is low

Nervous and Hormonal Systems

Comparison	Nervous System	Endocrine System
Speed of action	Very rapid	Can be slow
Nature of message	Electrical impulses, traveling along nerves	Chemical messenger (hormones) traveling in bloodstream
Duration of response	Within seconds	May take months or years
Area of response	Localised response (only one area)	Widespread response (in many organs)
Example of process controlled	Reflexes such as blinking	Development of reproductive system

Industry

- Hormones are used in food production
- E.g. oestrogen is used to boost growth rate of chickens
- Disadvantage: may cause human males to develop feminine characteristics

Homeostasis

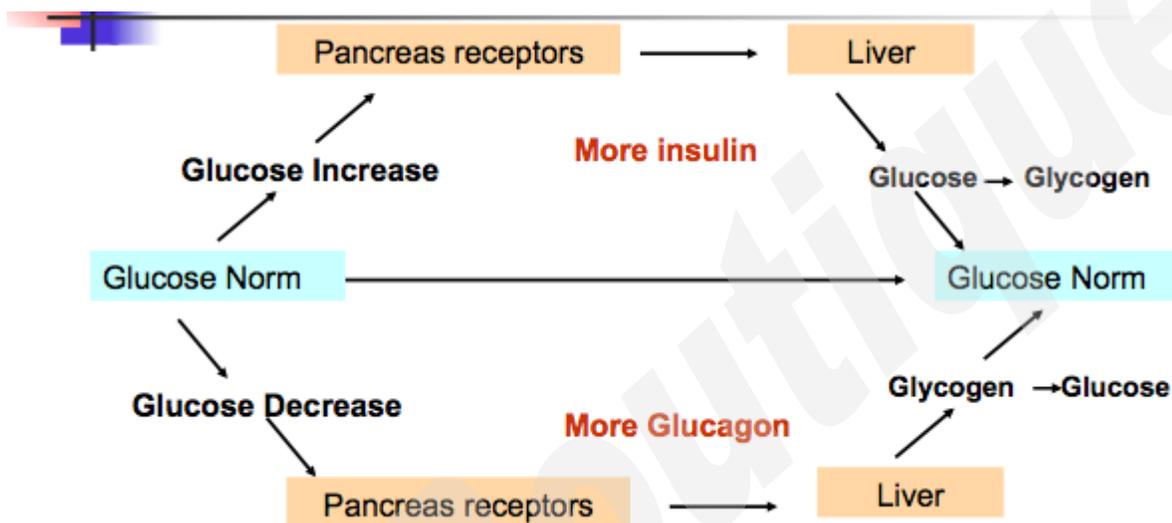
- The maintenance of a constant internal environment

Negative feedback

- When the change in hormone level acts as a signal to cancel out that change, so when blood hormone level is low, hormone production is stimulated, when it is high, it is inhibited. .

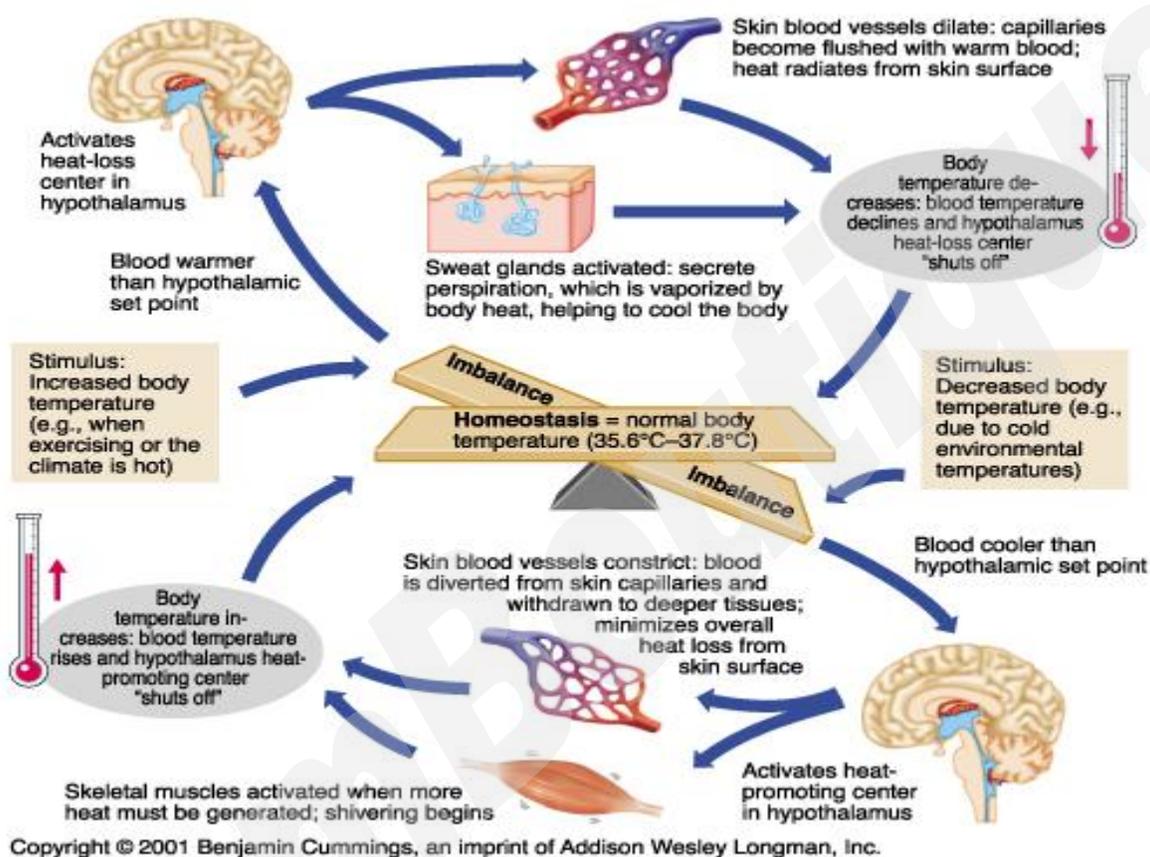
Glucoregulation

- Blood glucose levels are monitored and controlled by the pancreas



- Type 1 diabetes: is caused by the death of cells that secrete insulin (due to attack by body immune system)
- Type II diabetes: people with type II diabetes make insulin, but their cells don't use it (insulin resistance)
- Symptoms: feel unwell, dry mouth, blurred vision and feel thirsty
- Treatment: insulin injection

Thermoregulation



Too hot	Too cold
Vasodilation: when it is hot, the arterioles which supply blood to the skin surface capillaries, dilate to allow more blood near to skin surface to increase heat loss (face redder)	Vasoconstriction: when it is cold, arterioles, which supply blood to the skin-surface capillaries, constrict (become smaller) to allow less blood near to skin surface to decrease heat loss
Sweating: the water evaporates giving a cooling effect	Shivering: muscular activity generates heat
Hairs lie flat	Hairs stand: to capture heat from the atmosphere