

Class X: Biology

Chapter 2: Control and coordination.

Chapter Notes

Key learnings:

- 1) A system of control and coordination is essential in living organisms so that the different body parts can function as a single unit to maintain homeostasis as well as respond to various stimuli.
- 2) In animals, the nervous system and hormonal system are responsible for control and coordination.
- 3) Neurons are specialized cells of the nervous system. They use electrical and chemical signals for transferring information.
- 4) Receptors are specialized tips of the nerve fibres that collect the information to be conducted by the nerves.
- 5) Nerve impulses travel in the following manner from one neuron to the next : Dendrites → Cell body → Axon → Nerve endings at the tip of axon → Synapse → Dendrite of next neuron.
- 6) Chemicals released from axon tip of one neuron, cross the synapse or neuromuscular junction to reach the next cell (neuron or muscle fibre).
- 7) Nerve impulses from many neurons interact to carry out the complex process of thinking.

- 8) Central nervous system and peripheral nervous system are parts of our nervous system.
- 9) Central nervous system is made up of the brain and spinal cord.
- 10) Spinal cord controls the reflex actions and conducts messages between different parts of the body and brain.
- 11) Reflex action is an automatic, rapid and immediate reaction to a stimulus and is below the level of consciousness. No thinking is involved in reflex action.
- 12) Reflex arc is the neural pathway that mediates a reflex action.
Pathway of reflex arc : Receptor → Sensory neuron → Relay neuron → Motor neuron → Effector
- 13) The sensory neurons of reflex arcs synapse in the spinal cord which then activates the spinal motor neurons without delay to execute a quick action, especially in case of emergencies. The brain also receives the information while the reflex action occurs.
- 14) The 3 main parts of the brain are forebrain, midbrain and hindbrain.
- 15) The largest part of the brain, the forebrain, is the main thinking region. It is made up of cerebrum, hypothalamus and thalamus. Cerebellum, pons and medulla constitute the hindbrain.
- 16) Cerebrum is the largest part of the brain whereas the cerebellum is the second largest part.

17)

Cerebrum	Governs intelligence, thinking, memory and other mental abilities, voluntary actions, sensations,
Hypothalamus	Coordinates messages from the autonomous nervous system, controls certain involuntary actions, as well as the sexual and emotional behaviour and forms an axis with the
Thalamus	Functions as major coordinating center for sensory and motor
Midbrain	Acts as the coordinating centre between forebrain and hindbrain; also controls certain involuntary
Cerebellum	Responsible for precision and fine control of voluntary movements as well as maintaining posture and
Pons	Relays impulses between the lower cerebellum and spinal cord, and higher parts of the brain like the cerebrum and mid brain; also
Medulla	Contains vital centres for controlling blood pressure, respiration, swallowing, salivation, vomiting,

- 18) Brain is protected by a bony box called cranium, within which are present 3 layers of fluid-filled membranes for absorbing shock.

- 19) Peripheral nervous system consists of cranial nerves and spinal nerves and assists in transmitting information between central nervous system and rest of the body.
- 20) Reflex actions, voluntary actions and involuntary actions are the various types of responses shown by the nervous system.
- 21) The sense organs detect changes in surroundings and pass this information to the central nervous system, which after processing the information, acts through the muscles.
- 22) The movements of muscle tissues are brought about by the contraction and relaxation of the contractile proteins in response to nerve impulses.
- 23) Plants lack nervous and muscular system.
- 24) Plants respond to stimuli by showing 2 types of movements – growth independent and growth dependent.
- 25) Growth independent movements are usually quicker than growth dependent ones, and involve the use of electrochemical signals by the plant. To achieve this movement, the plant cells change shape by altering their water content.
- 26) Growth dependent movements or tropic movements are slow, occurring either towards or away from the stimulus.
- 27) Tropic movements are shown in response to environmental factors such as light, gravity, water and chemicals.

- 28) Plant roots are positively geotropic and negatively phototropic whereas plant shoots are usually negatively geotropic and positively phototropic.
- 29) Pollen tubes show chemotropism by growing towards the ovules.
- 30) In addition to electrochemical signals, plants and animals use hormones for control and coordination.
- 31) Important plant hormones are auxin, gibberellin, cytokinin, abscisic acid and ethylene.

- 32) Auxin causes the bending of plant stem towards light as well as the curling of plant tendrils around a support.
- 33) Animal hormones do not bring about directional growth depending on environmental cues, but promote controlled growth in various areas to maintain the body design.
- 34) The various endocrine glands in humans are hypothalamus, pineal gland, pituitary gland, thyroid gland, parathyroid glands, thymus, pancreas, adrenal glands, ovary (in female) and testis (in males).

35) Some important hormones and their functions in human body:

Hormone	Endocrine gland	Function
Growth hormone	Pituitary	Regulates growth and development of body
Thyroxin	Thyroid gland	Controls carbohydrate, protein and fat metabolism
Adrenaline	Adrenal gland	Prepares the body to deal with emergency situations
Insulin	Pancreas	Regulates blood sugar levels
Testosterone	Testis	Causes development of sexual organs and secondary sexual characteristics in males
Oestrogen	Ovary	Causes development of sexual organs and secondary sexual characteristics in females

35) In case of flight or fight reaction to an emergency situation, Adrenal glands → release adrenaline into blood → which acts on heart and other tissues → causes faster heart beat → more oxygen to muscles → reduced blood supply to digestive system and skin → diversion of blood to skeletal muscles → increase in breathing rate.

36) Deficiency of iodine causes goiter whereas deficiency of growth hormone and insulin causes dwarfism and diabetes respectively.

37) Feedback mechanisms are present to regulate the hormone action.

38) Difference between nervous and endocrine system

	Nervous system	Endocrine system
Mode of communication	Electrical impulses	Chemical compounds

Speed of	Very quick	Slow
Can reach	Only cells connected by	All cells of the body
Continuity	Cannot continuously	Can act steadily and

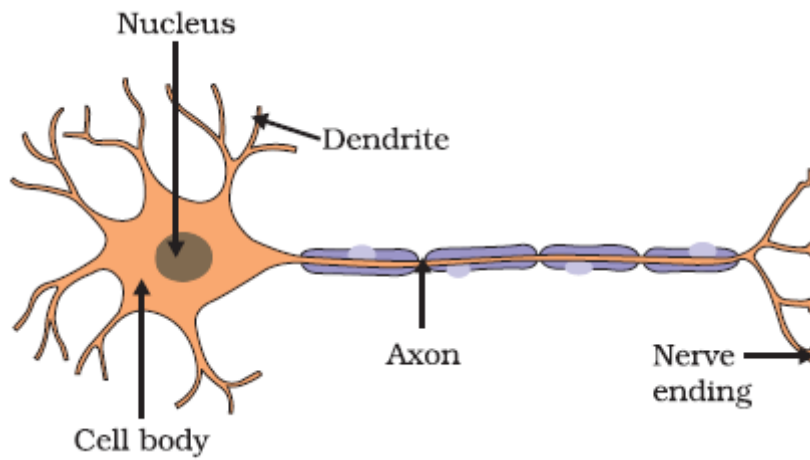
Top Definitions

- 1) Receptors – Specialized structures at the ends of the nerve fibres that collect the information to be conducted by the nerves, and are located in the sense organs.
- 2) Gustatory receptors – Receptors present in tongue and capable of detecting taste.
- 3) Olfactory receptors – Receptors present in nose and capable of detecting smell.
- 4) Synapse – A specialized junction between two neurons, across which nerve impulse passes.
- 5) Neuromuscular junction – The junction between a nerve fiber and the muscle cell it supplies.

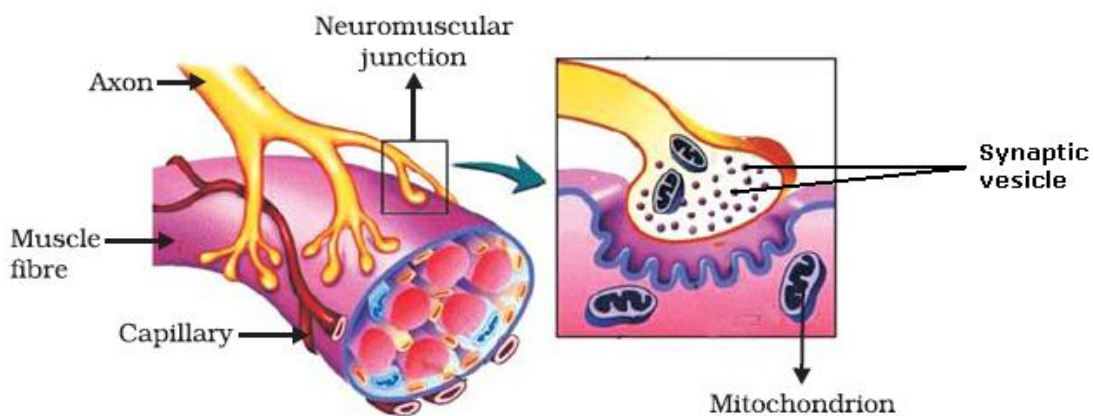
- 6) Nerve impulse – An electrochemical signal that travels through a neuron in response to a stimulus.
- 7) Effectors – A muscle, gland, or organ capable of responding to a stimulus, especially a nerve impulse.
- 8) Sensory neuron – A neuron that conducts impulses from a receptor organ to the central nervous system.
- 9) Motor neuron – A neuron that conducts impulses from the central nervous system to muscle or gland.
- 10) Relay neuron – A neuron which connects sensory neurons with motor neurons in neural pathways.
- 11) Reflex action - An automatic, rapid, involuntary and immediate reaction to a stimulus.
- 12) Reflex arc – The neural pathway that mediates a reflex action.
- 13) Cranial nerves – Nerves arising from the brain
- 14) Spinal nerves – Nerves arising from the spinal cord.
- 15) Tropic movements – The directional movements shown by plants in response to environmental factors.
- 16) Hormone – The secretion of an endocrine gland that is transmitted by blood to specific tissues in the body.

- 17) Phototropism – The movement of a plant towards or away from light.
- 18) Hydrotropism – The movement of a plant either towards or away from water.
- 19) Geotropism – The directional movements shown by plants in response to gravity.
- 20) Chemotropism – Movement or growth of an organism or part of an organism in response to a chemical stimulus.
- 21) Endocrine gland – A ductless gland that secretes hormones directly into the bloodstream.
- 22) Feedback mechanism – A type of self-regulating mechanism in which the level of one substance in body influences the level of another.

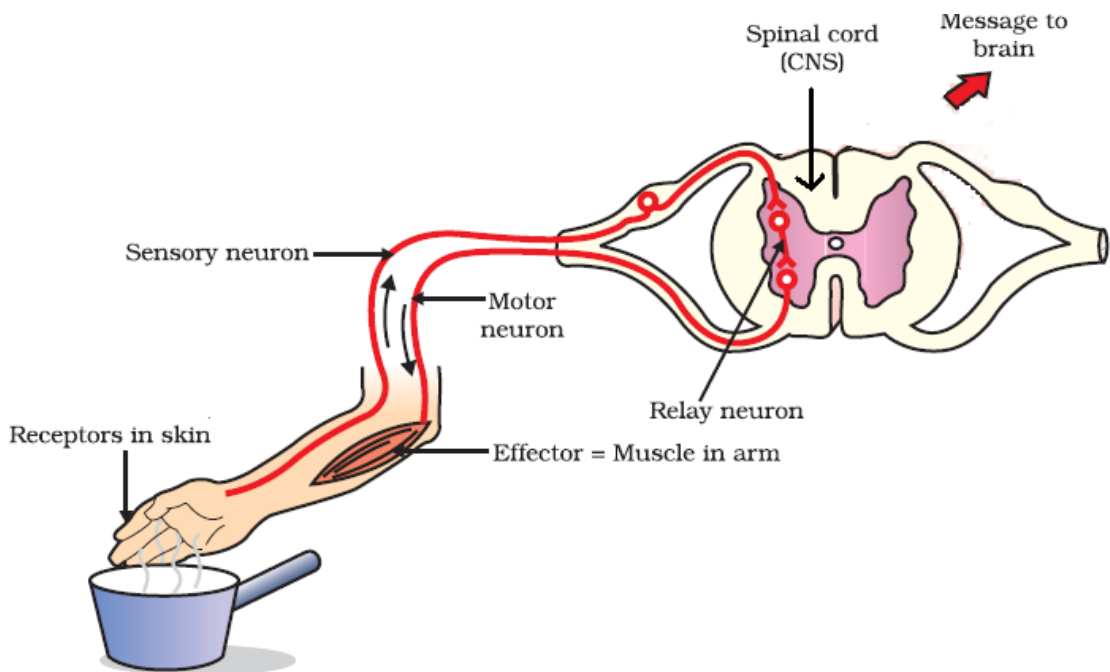
Top diagrams



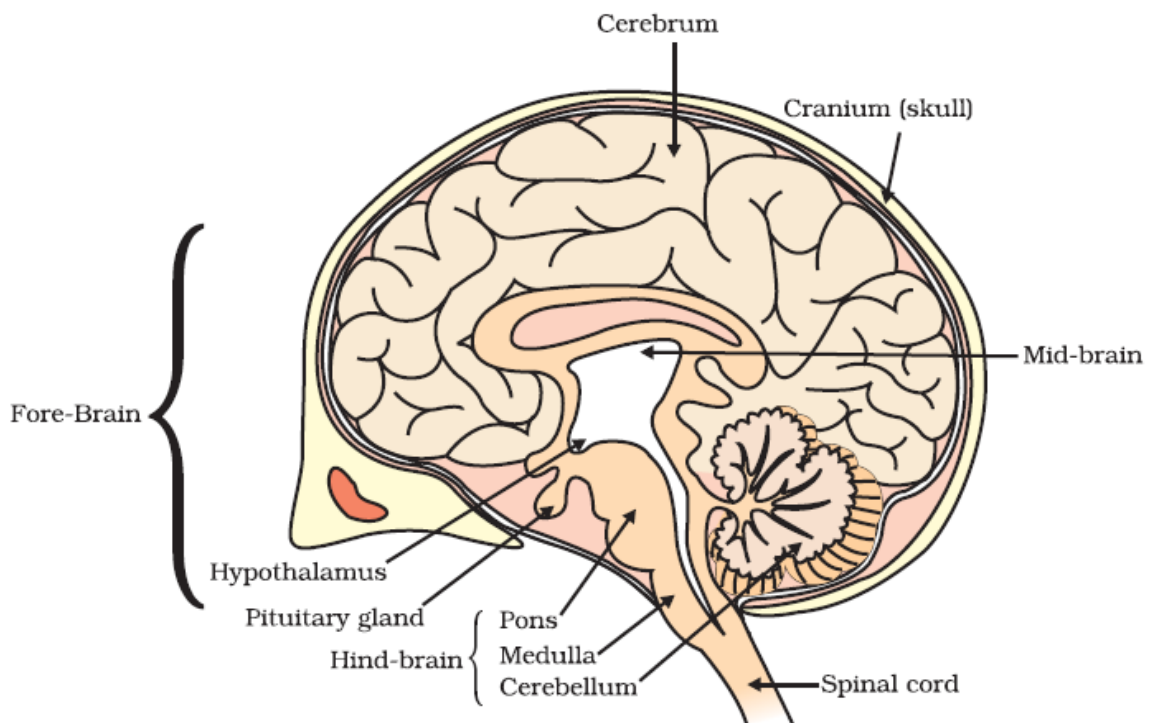
Structure of neuron



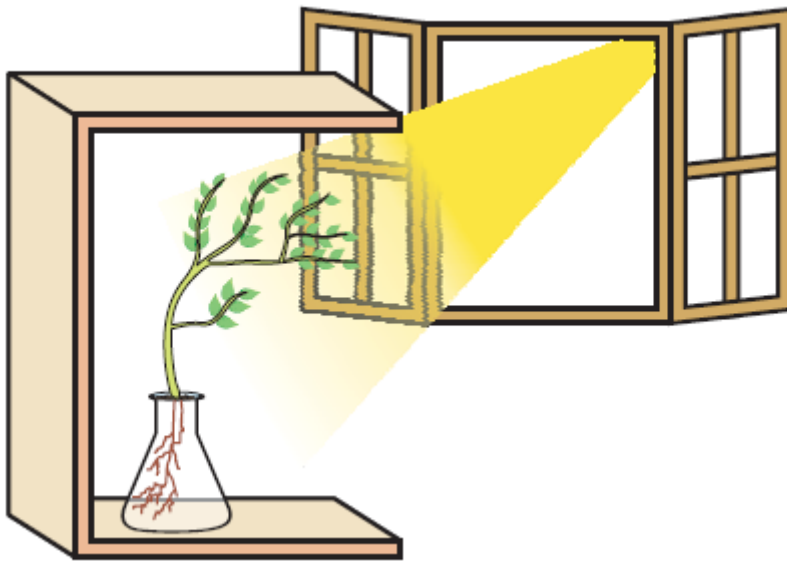
Neuromuscular junction



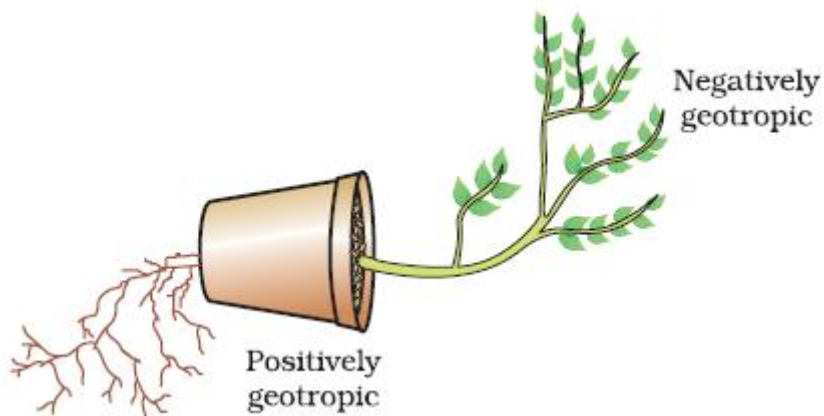
Reflex arc



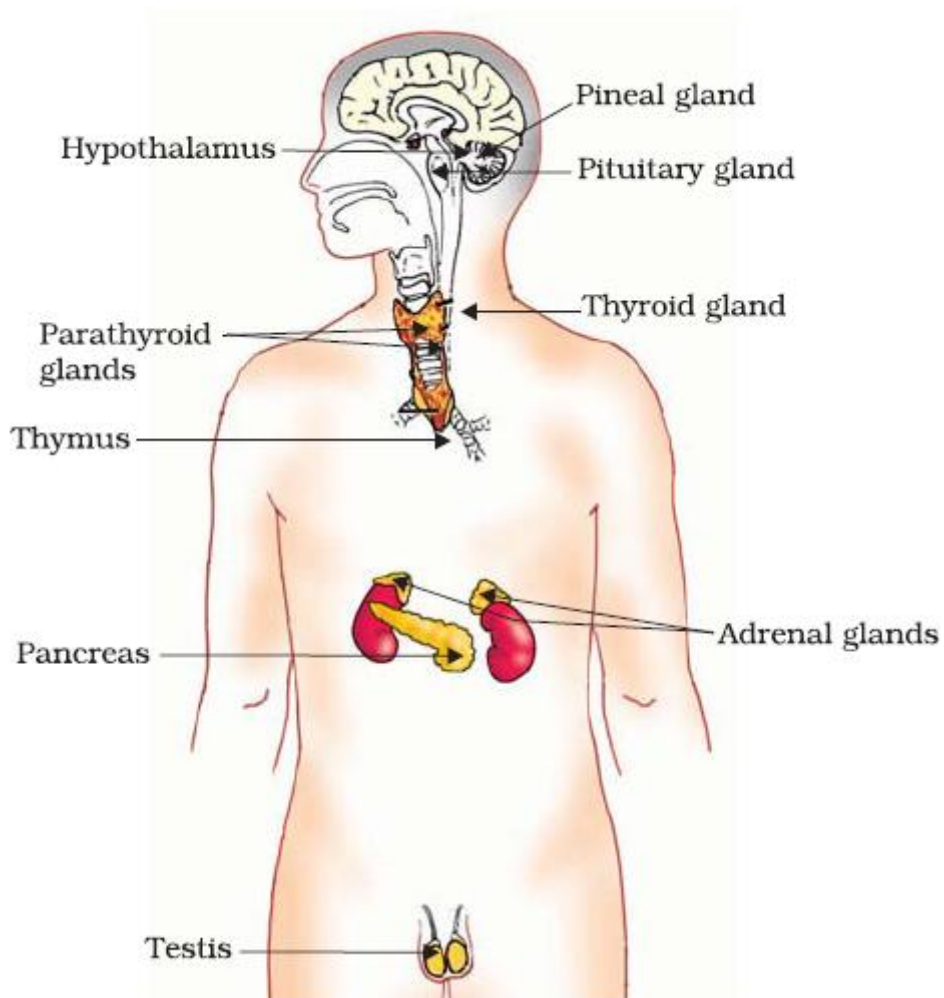
Human brain



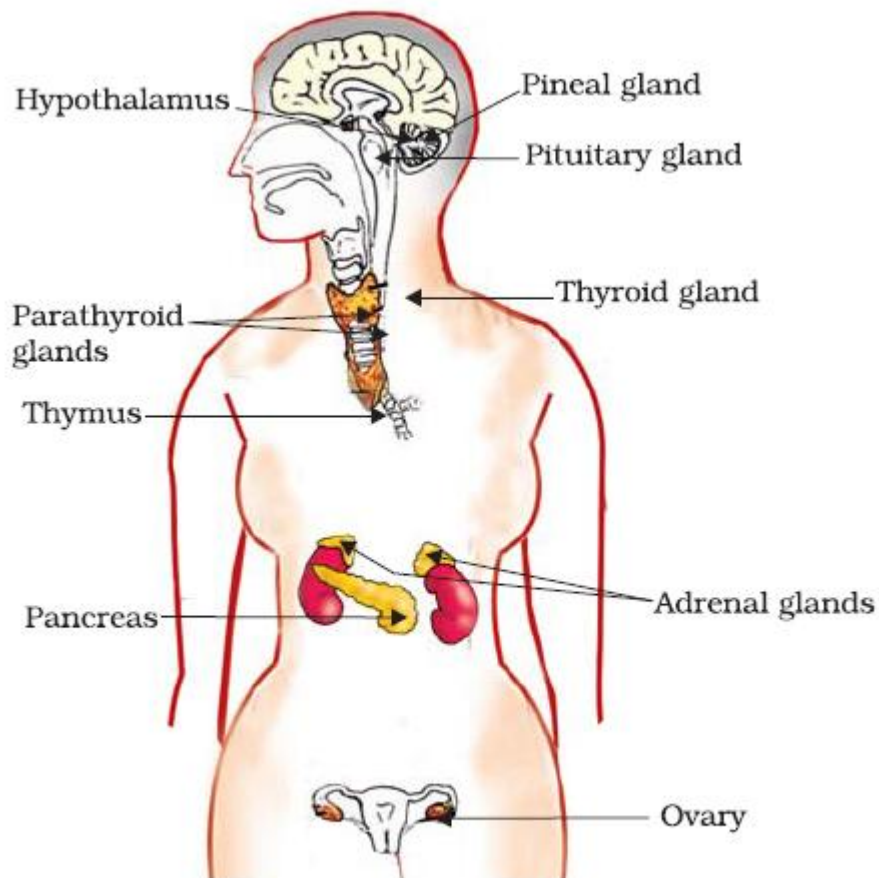
Plant showing phototropism



Plant showing geotropism



Endocrine glands in human male



Endocrine glands in human female