

CHAPTER 07

Control

&

Coordination

Acknowledgment

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Contents

Neuron

Reflex Action

CNS

Coordination in
plants

Activity 7.2

Trophic movement

Coordination in
animals

Endocrine glands

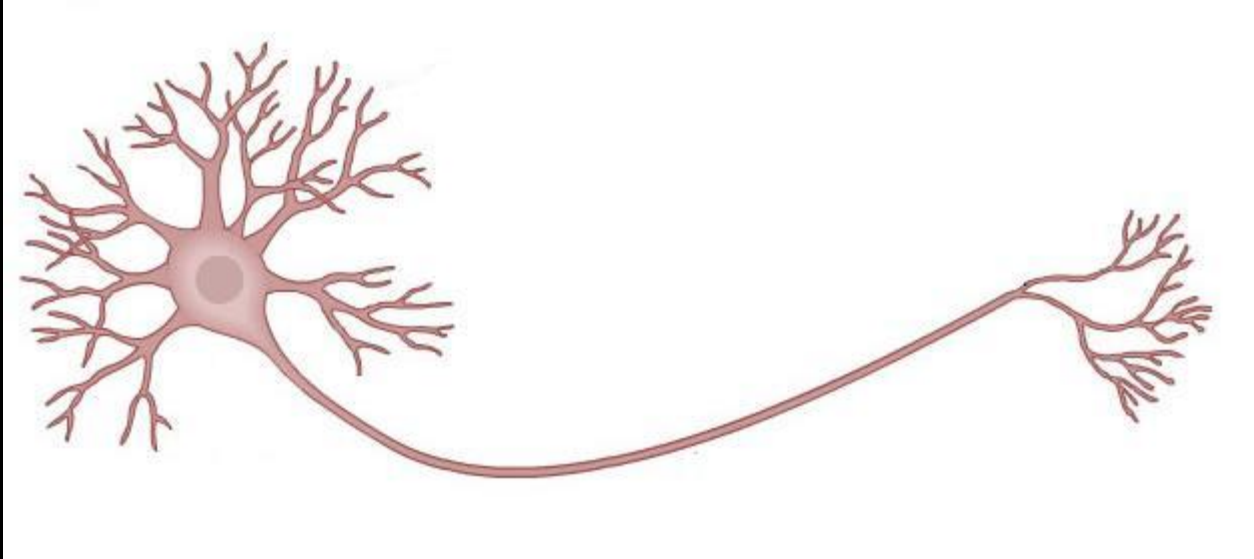
Exercise (MCQ)

Need for control & coordination

In animals, the control and coordination movements are provided by nervous and muscular systems. The nervous system sends messages to and away from the brain. The spinal cord plays an important role in the relay of messages. In the absence of this system of control and coordination, our body will not be able to function properly.

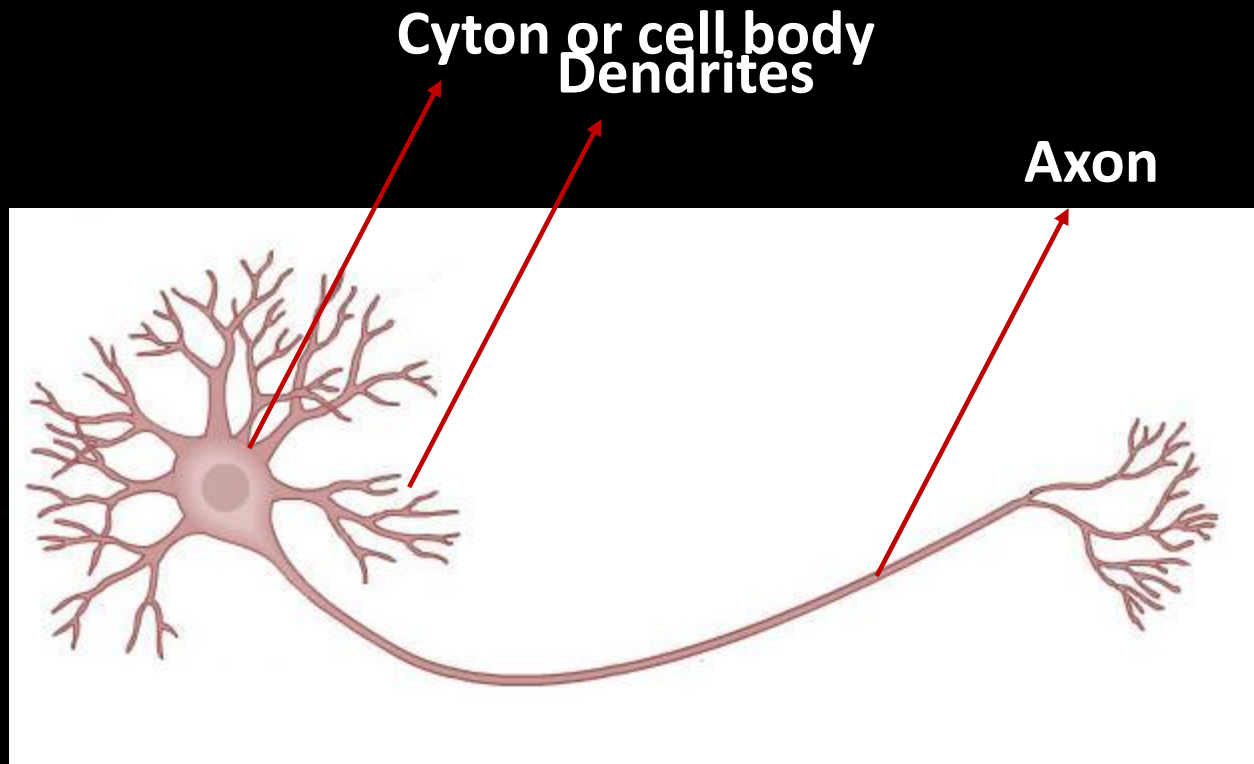
Neuron

Neuron is the basic unit of the nervous system.



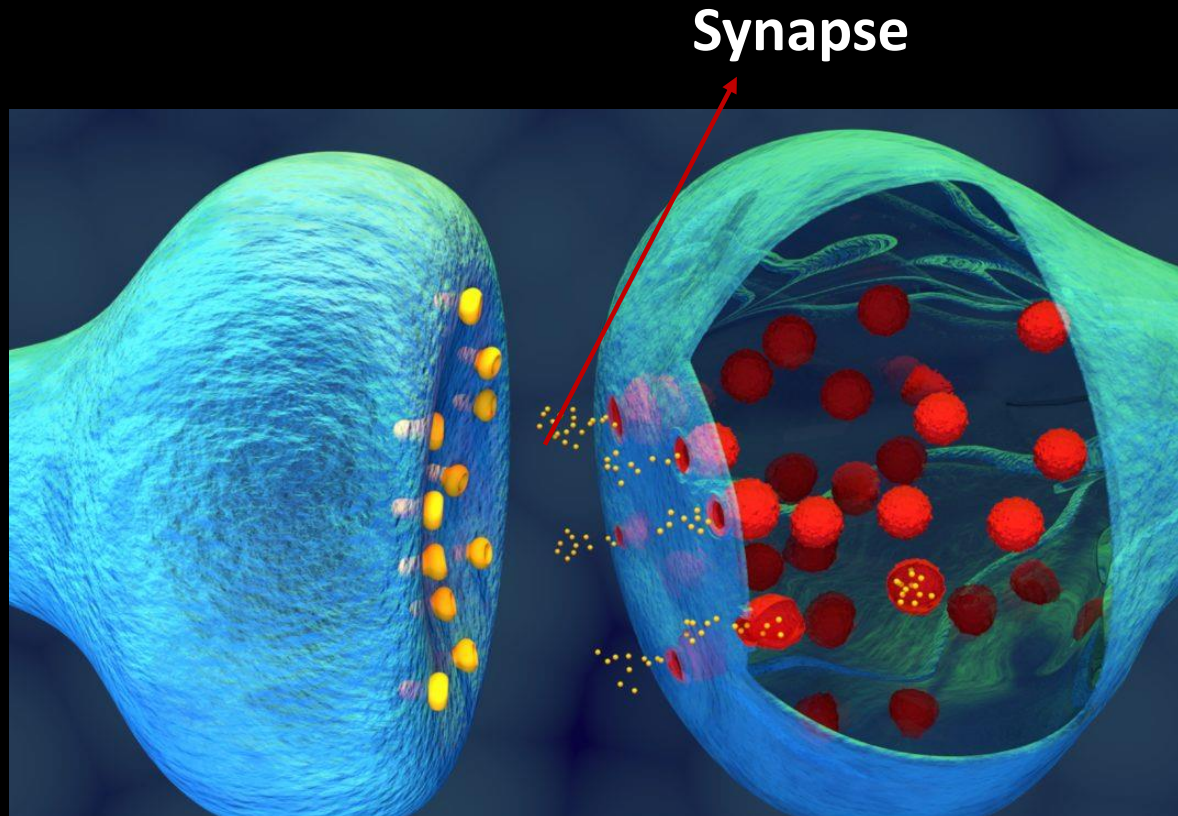
Parts of Neuron

The parts of a neuron are cyton or cell body, dendrites and axon.



Synapse

The very fine gap between axon of one neuron and dendrite of another neuron is called **synapse**.



What happens at the synapse?

Synapse acts as a one way valve to transmit impulses in one direction only. This uni-direction transfer of impulses occurs as the chemicals are produced in only one side of the neuron

Functions of parts of neuron

1. Dendrite – It carries impulse towards cyton.
2. Axon – It carries impulse from cyton to effector organs like muscles and glands.

Receptors

Receptors are sensory structures (organs/tissues or cells) present all over the body. The receptors are either grouped in case of eye or ear, or scattered in case of skin.

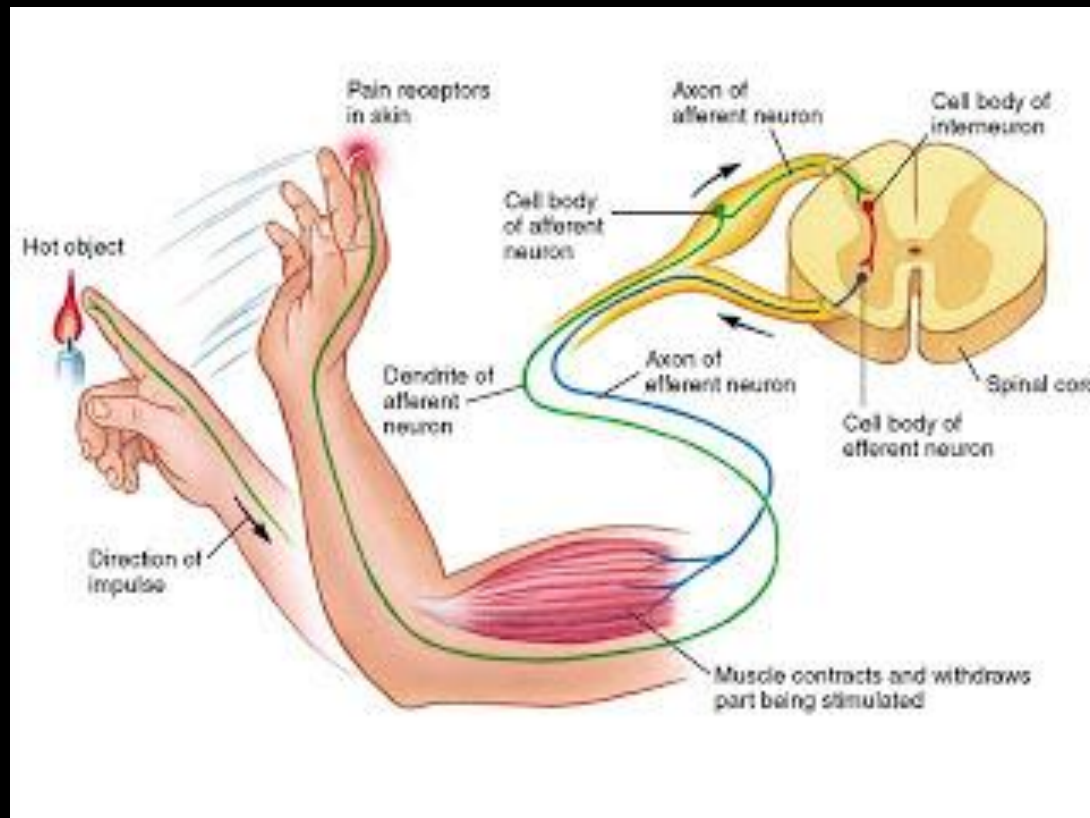
How do we detect that we are touching a hot object?

The receptors of skin sets off chemical reaction that creates an electric impulse. This impulse travels from neurons to other cells and reaches the brain or spinal cord.



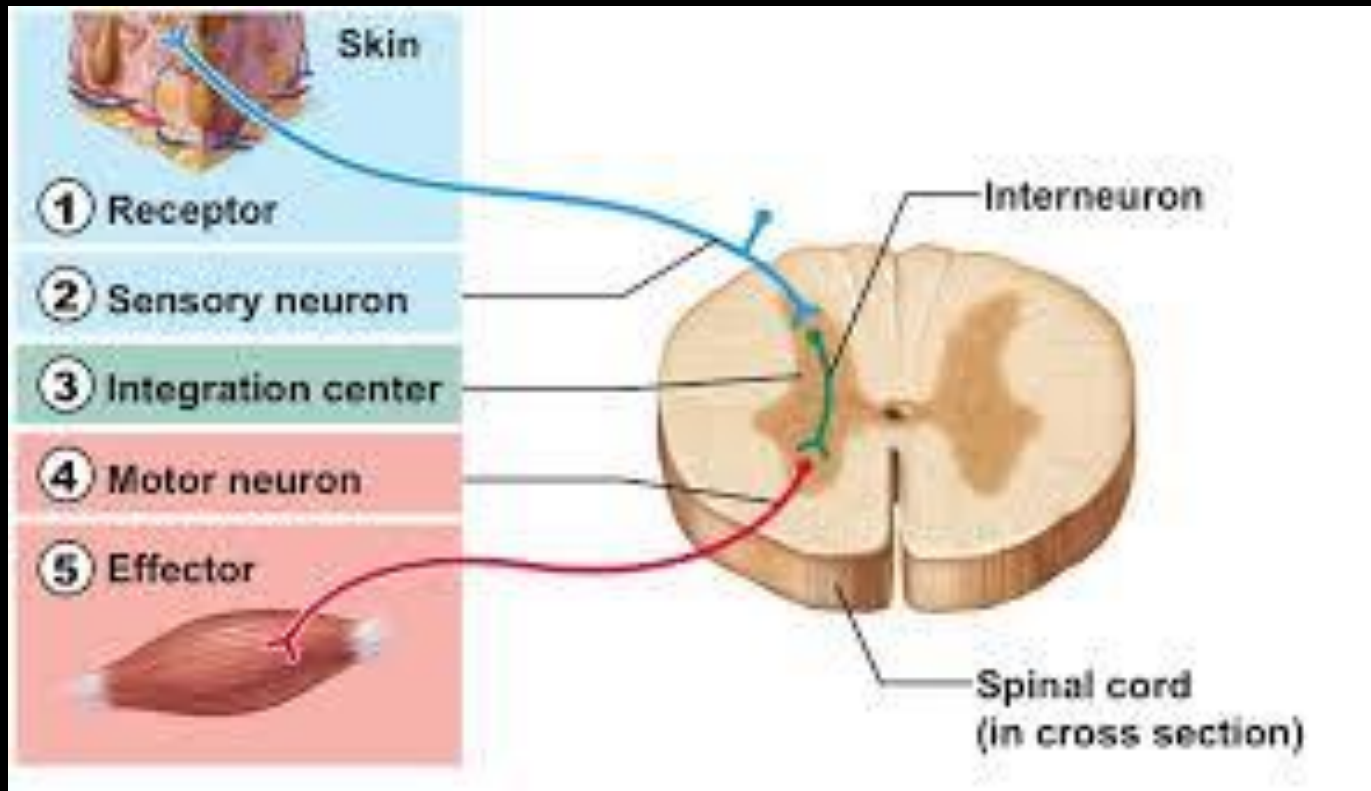
Reflex Action

Reflex action is a quick automatic response to a stimulus without the involvement of the brain.

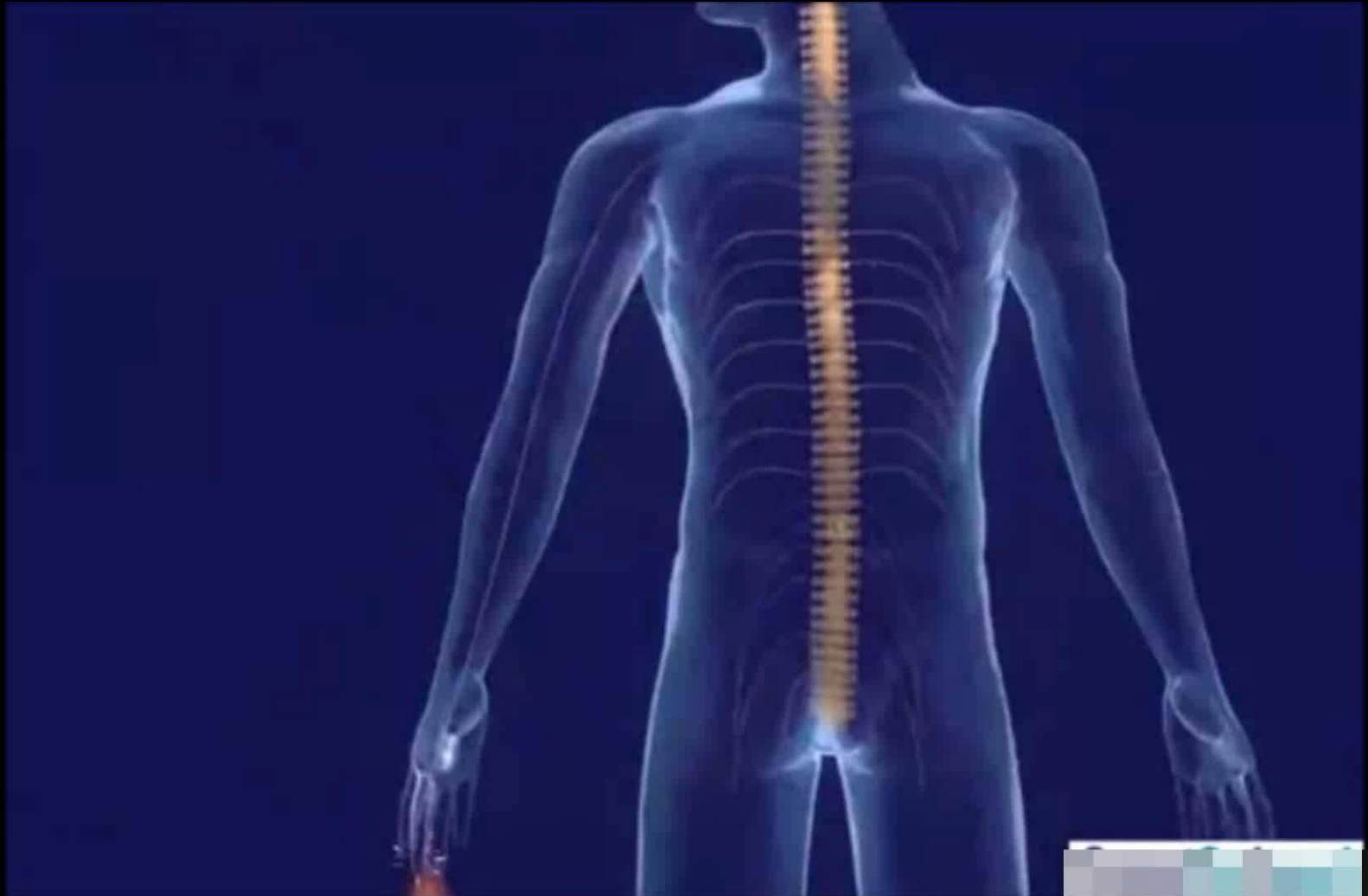


Reflex Arc

The path that an impulse takes in a reflex action is called reflex arc.



Reflex Arc

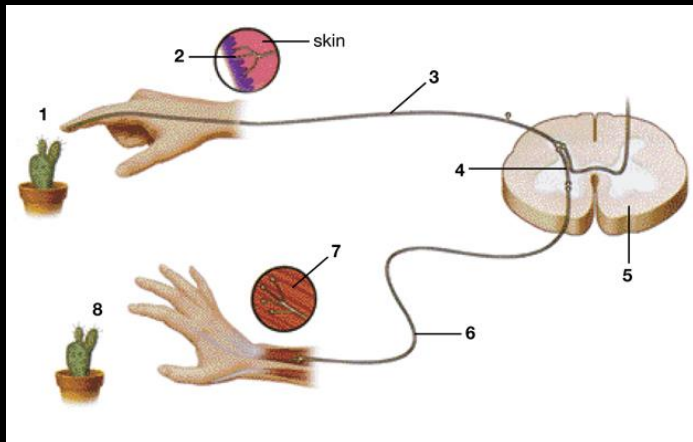


Trace the sequence of events when a hot object is touched

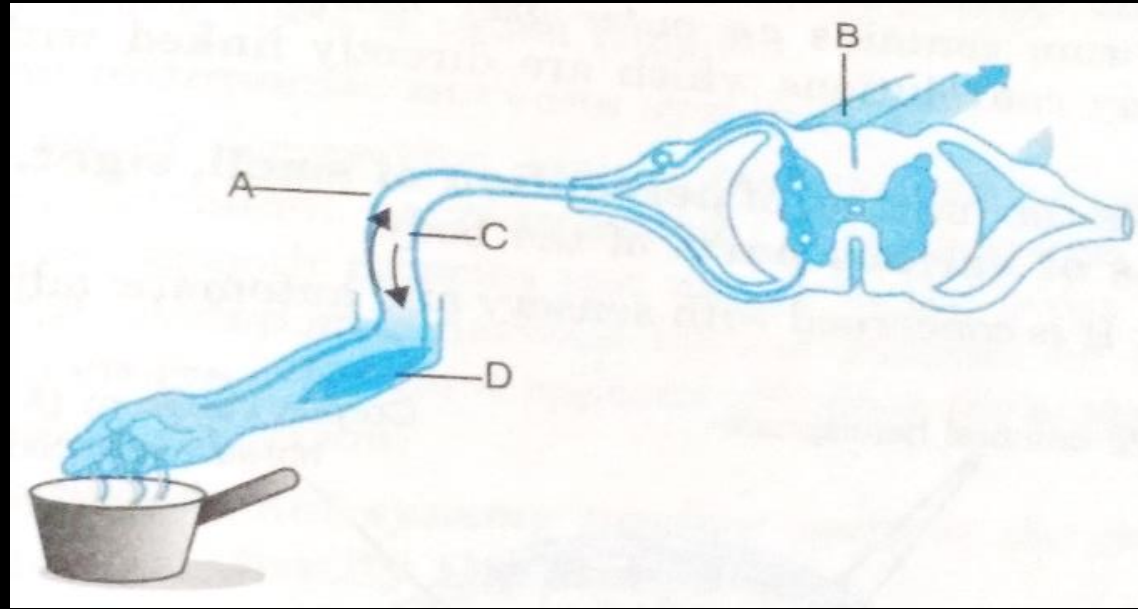
Heat/pain receptors in the
Skin → Sensory neuron → Relay neuron
→ Motor neuron → Muscle in the
arms.

Difference between reflex action & Walking

A reflex action is a rapid, automatic response to a stimulus. It does not involve any thinking. Walking is a voluntary action. It is under our conscious control.



Identify the parts of the reflex arc



- A – Sensory neuron
- B – Spinal cord (CNS)
- C – Motor neuron
- D – Effector (muscle in arm)

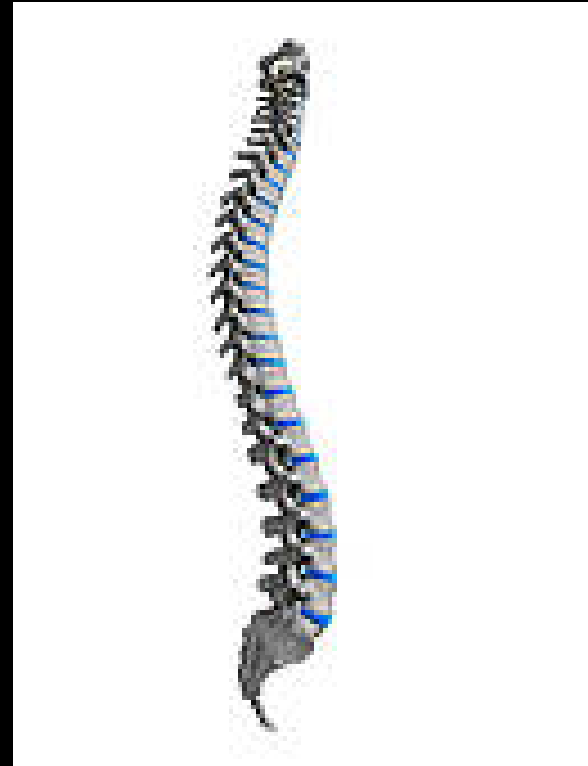
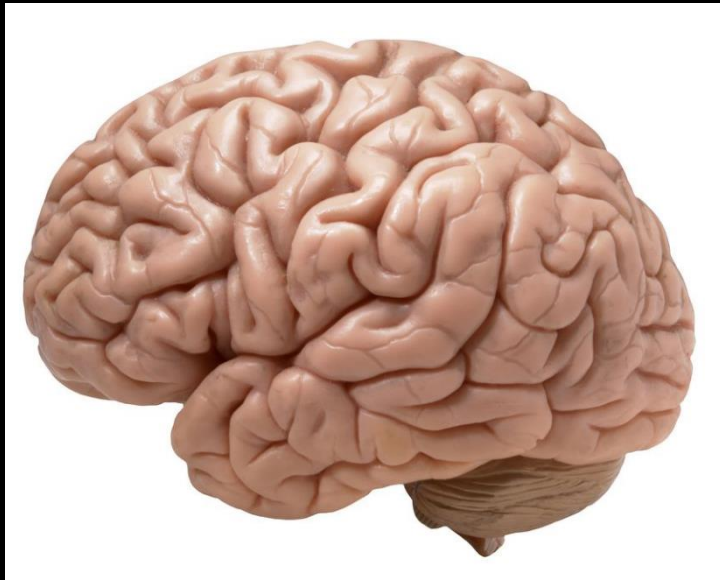
Divisions of human nervous system

The human nervous system consists of three components namely

- a) Central Nervous System (CNS)
- b) Peripheral Nervous System (PNS)
- c) Autonomic Nervous System (ANS)

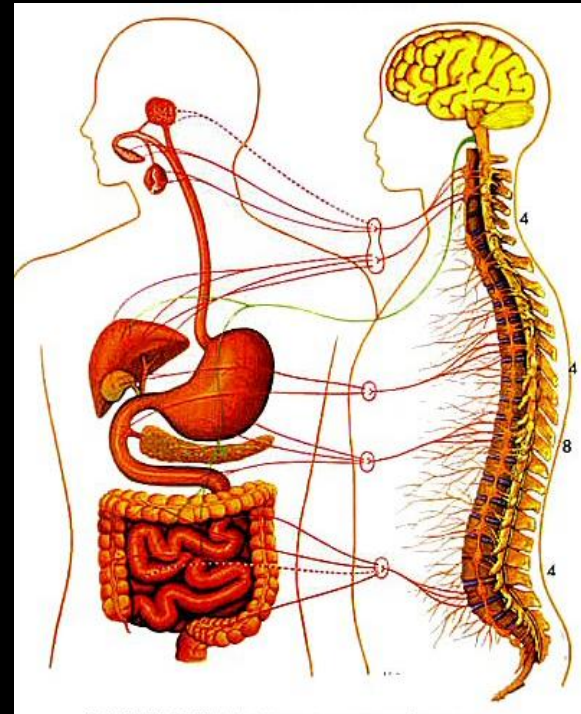
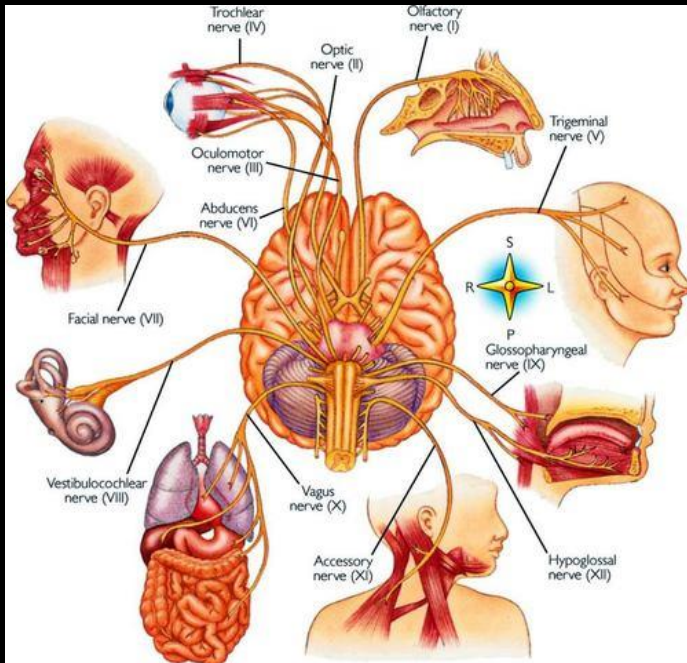
Central Nervous System

Central nervous system consists of brain and spinal cord.



Peripheral Nervous System

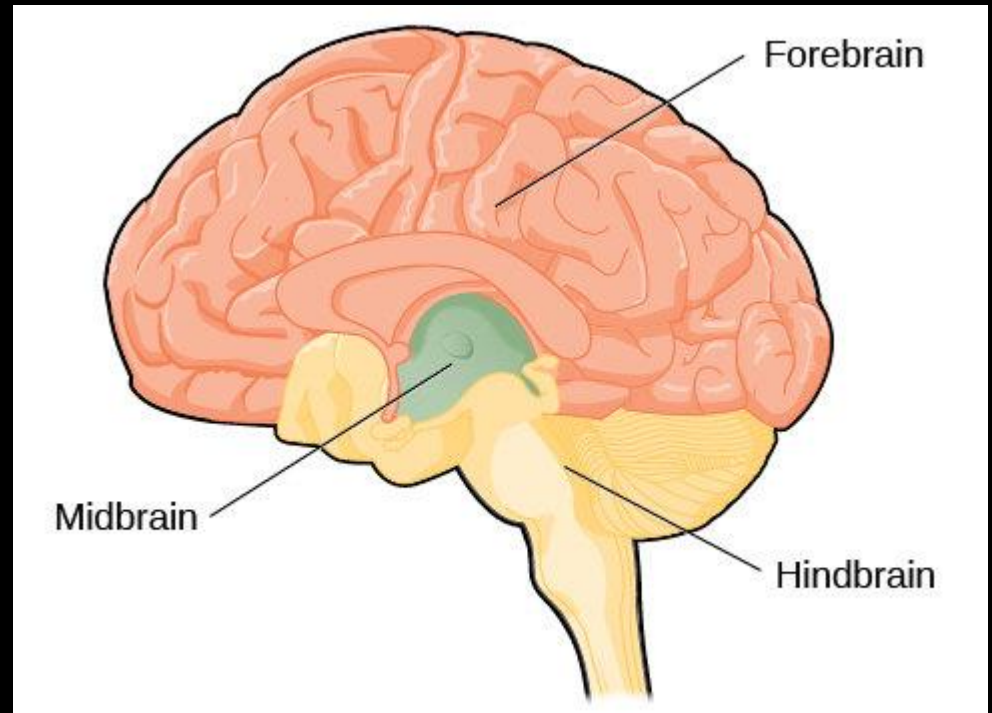
Peripheral nervous system consists of cranial nerves arising from the brain and spinal nerves arising from the spinal cord.



Parts of the brain

Brain is divided into three parts –

- Fore brain
- Mid brain
- Hind brain.



Functions of the brain

1. Brain receives information from all parts of the body and integrates it.
2. It is involved in the voluntary actions like writing, talking, etc.
3. It sends messages to the muscles.
4. The brain allows us to think and take actions based on that thinking.

Functions of the fore-brain

1. The fore-brain is the main thinking part of the brain.
2. It has regions which receives sensory impulses from various receptors.
3. It has separate areas for hearing, smell, sight, etc.

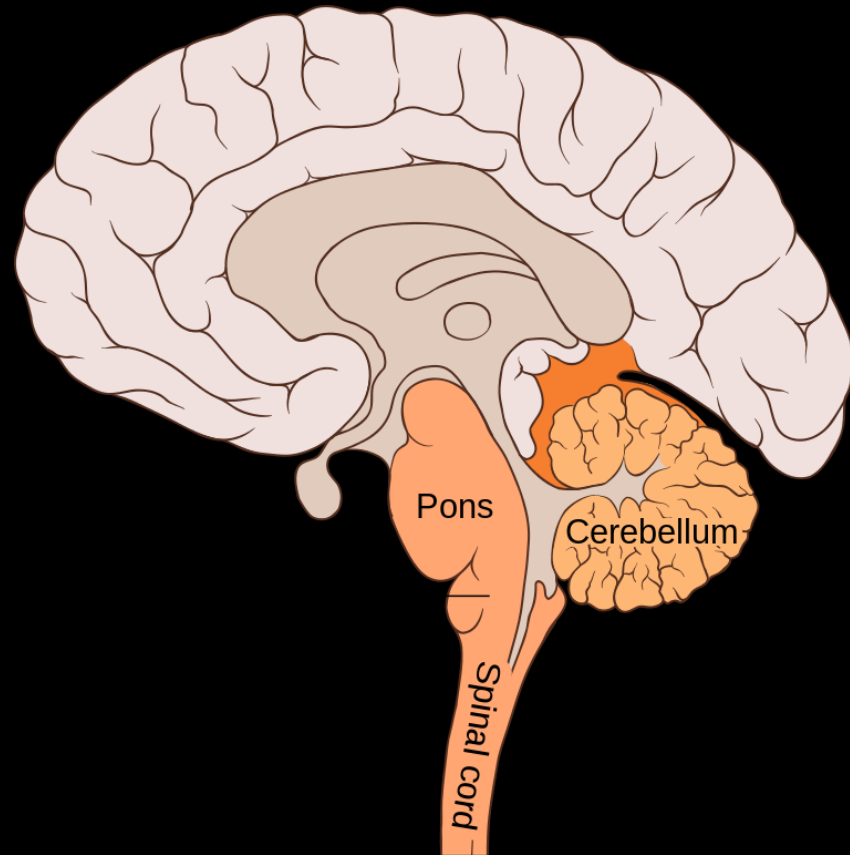
Functions of the fore-brain



The lobes and functions of the brain

Parts of hind brain

- Pons
- Medulla
- Cerebellum



Functions of the hind brain

All involuntary actions including blood pressure, salivation, vomiting are controlled by medulla in the hind-brain.

Functions of the cerebellum

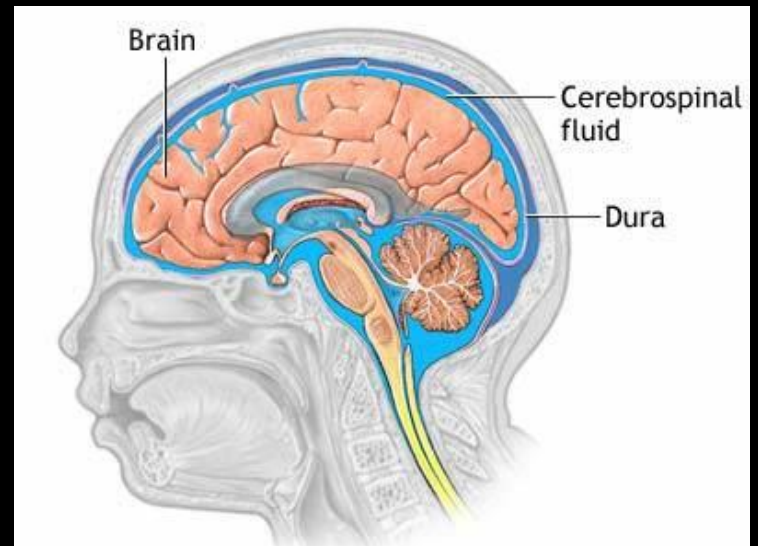
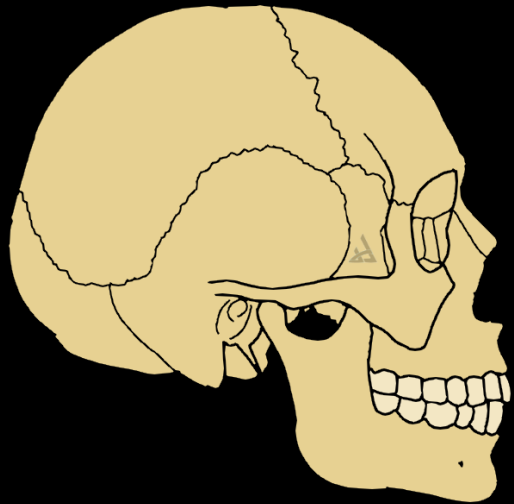
- a) Cerebellum controls activities like walking in a straight line, riding a bicycle, picking up a pencil, etc.
- b) It is responsible for precision of voluntary actions and maintaining the posture and balance of the body.

Walking of drunkard



Protection of brain

- a) Brain sits inside a bony box.
- b) Brain is contained in a fluid-filled balloon which provides further shock absorption.



Mention the part of the brain involved in the following.

- a) Walking in a straight line - Cerebellum
- b) Picking up a pencil - Cerebellum
- c) Blood pressure – Hind brain
- d) A question is being asked by the teacher in a class –cerebrum (fore brain)
- e) Change in size of the pupil in response to intensity of light – Mid brain

Types of movement in plants

- a) Movement dependent on growth
- b) Movement independent of growth.

Movement dependent on growth

The directional movement of a seedling is caused by growth.



Movement independent on growth

The leaves of the sensitive plant move very quickly in response to touch.



Coordination in plants

How does the plant detect the touch and how do the leaves move in response?

In plants there is no specialized tissue in plants for the conduction of information. The plants use electrical-chemical means to convey this information from cell to cell.

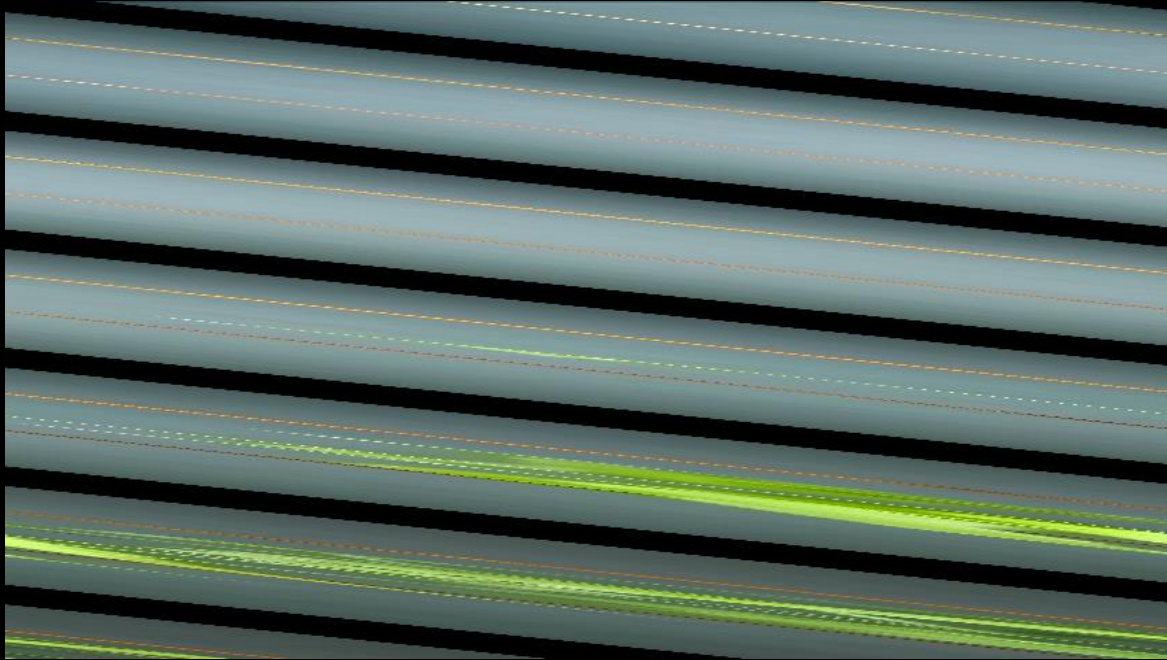
Plant cells change shape by changing the amount of water in them, resulting in swelling or shrinking, and therefore in changing shapes.

Growth in pea plants

In plants like the pea plant climb up other plants or fences by means of tendrils.

These tendrils are sensitive to touch. When they come in contact with any support, the part of the tendril in contact with the object does not grow as rapidly as the part of the tendril away from the object. This causes the tendril to circle around the object and thus cling to it.

Growth in pea plants



State how concentration of auxins stimulates the cells to grow on the side of the shoot which is away from light.

When growing parts detect light, a hormone called auxin is synthesized at the shoot tip which helps the cells to grow longer. When the light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light.

(Activity 7.2) Fill a conical flask with water. Cover the neck of the flask with a wire mesh. Keep two or three freshly germinated bean seeds on the wire mesh. Take a cardboard box which is open from one side. Keep the flask in the box in such a manner that the open side of the box faces light coming from a window. After two or three days, you will notice that the shoots bend towards light and roots away from light. Now turn the flask so that the shoots are away from light and the roots towards light. Leave it undisturbed in this condition for a few days.

Have the old parts of the shoot and root changed direction?

The old parts of the roots and shoots change directions.

Are there differences in the direction of the new growth?

New growth in shoot is in direction of sunlight.

What can we conclude from this activity?

Shoot shows growth towards the light.

Phototropic movement

The growth in a plant part in response to light is called phototropic movement.



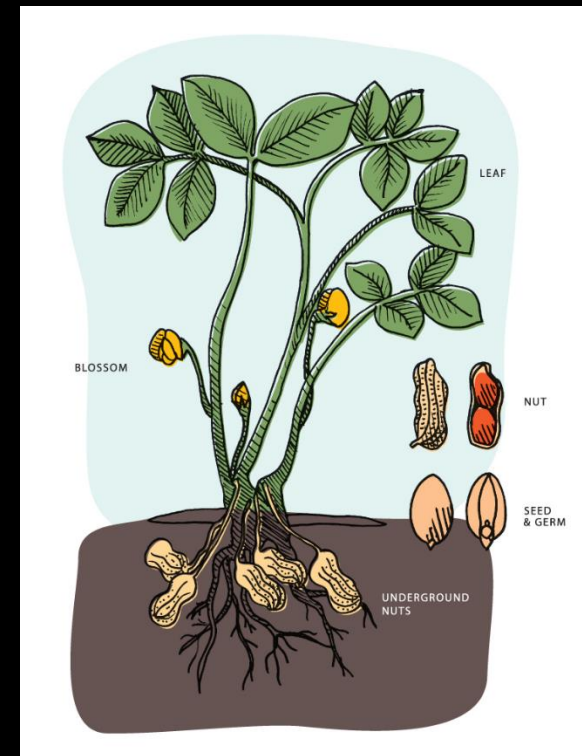
Phototropic movement

The flower head of sunflower is positively phototropic and hence it moves from east to west along with the sun.



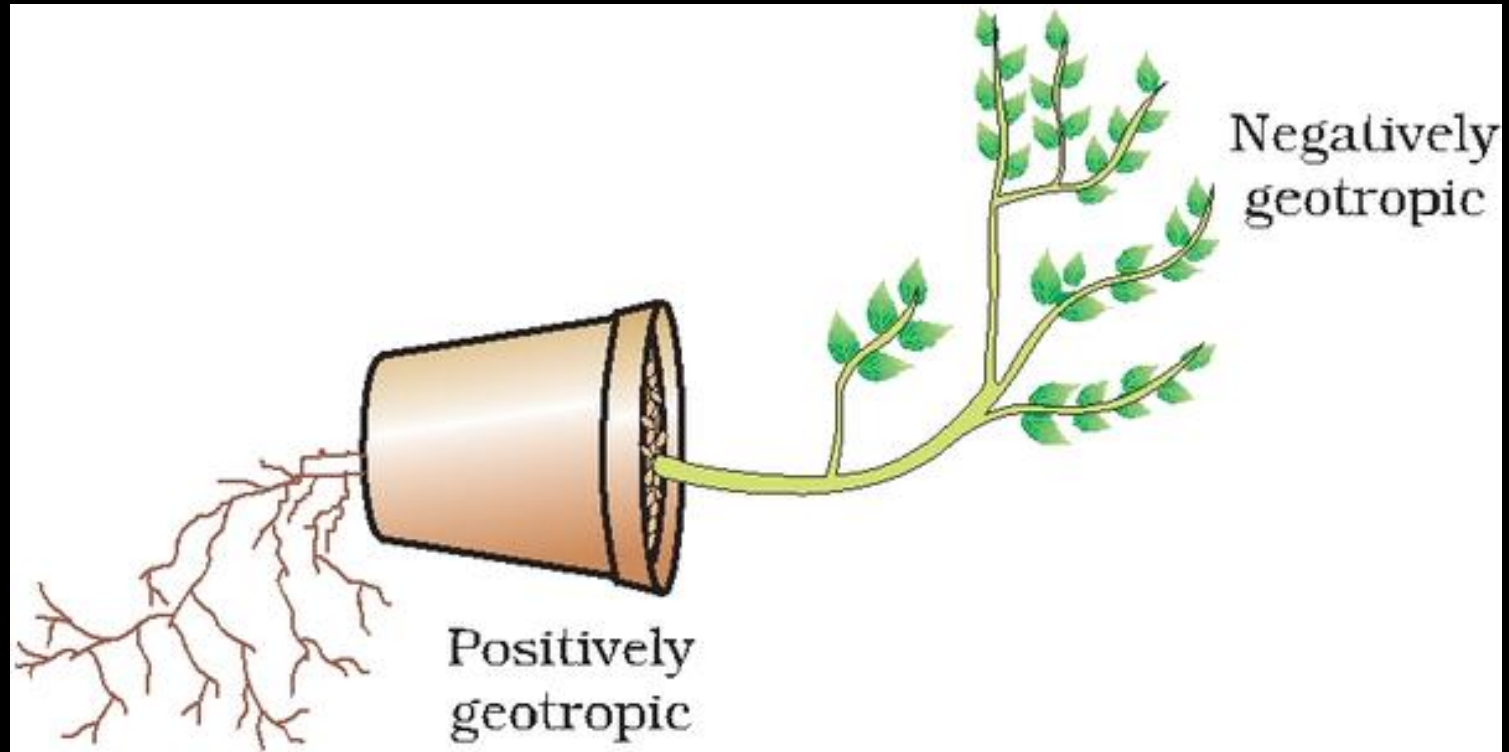
Phototropic movement

The ovary stalk of groundnut is positively phototropic before fertilization and becomes negatively phototropic after fertilization, so that the fruit is formed underground.



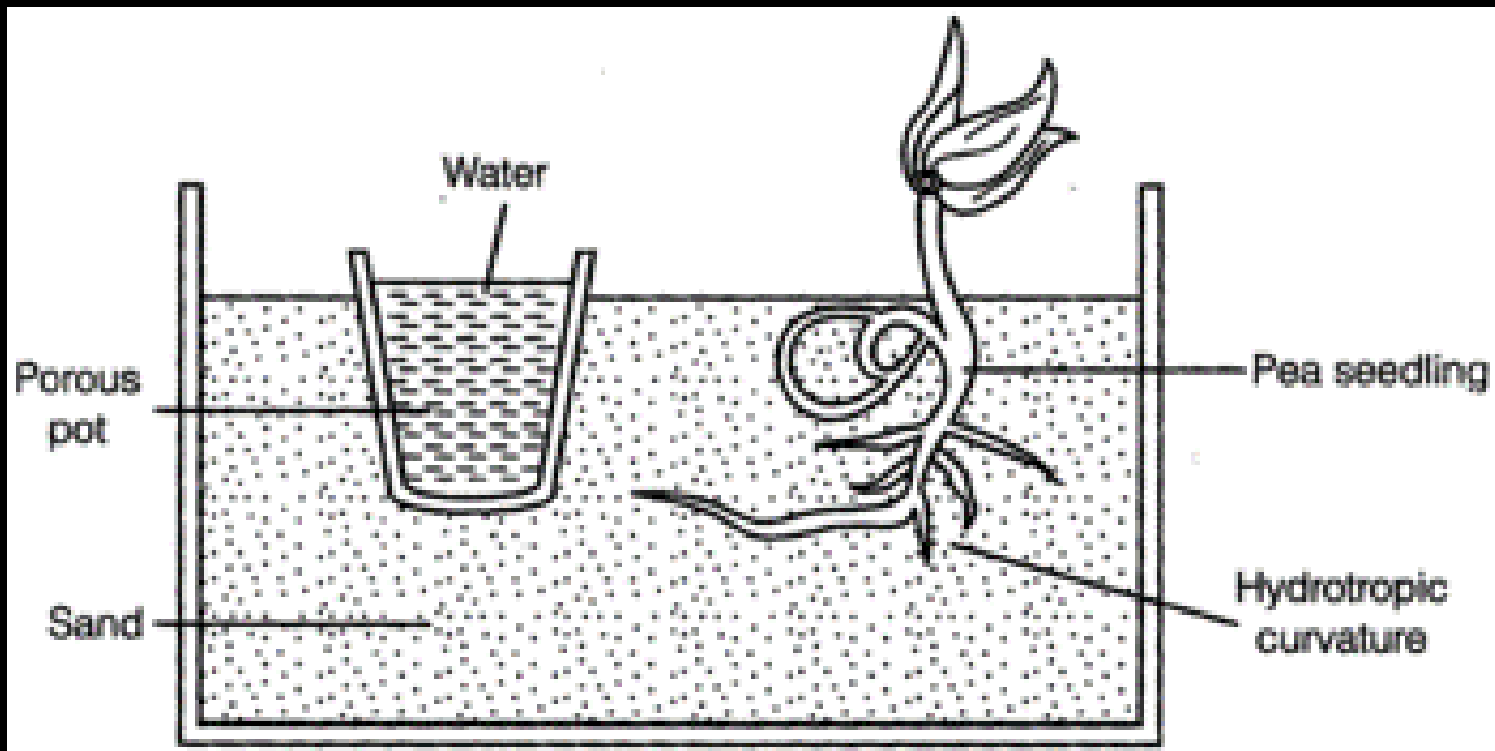
Trophic movement

The growth in a plant part in response to the gravity is called geotropic movement.



Hydrotropism

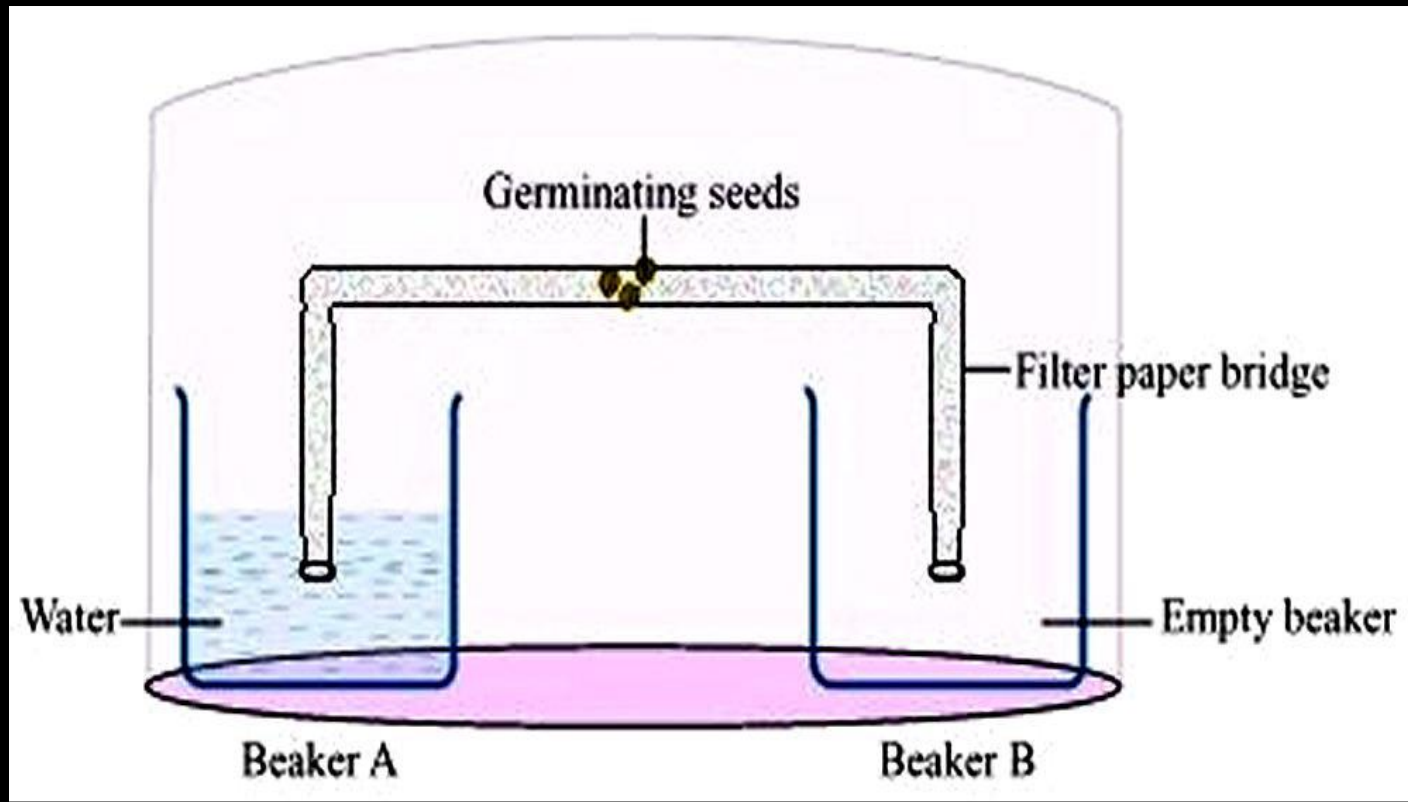
The growth of roots in the soil towards the nearest source of water is called hydrotropism.



Experiment to demonstrate Hydrotropism

Take two small beakers and label them as A and B. Fill beaker A with water. Now make a cylindrical-shaped roll from a filter paper and keep it as a bridge between beaker A and beaker B, as shown in the figure. Attach few germinating seeds in the middle of the filter paper bridge. Now, cover the entire set-up with a transparent plastic container so that the moisture is retained.

Experiment to demonstrate Hydrotropism

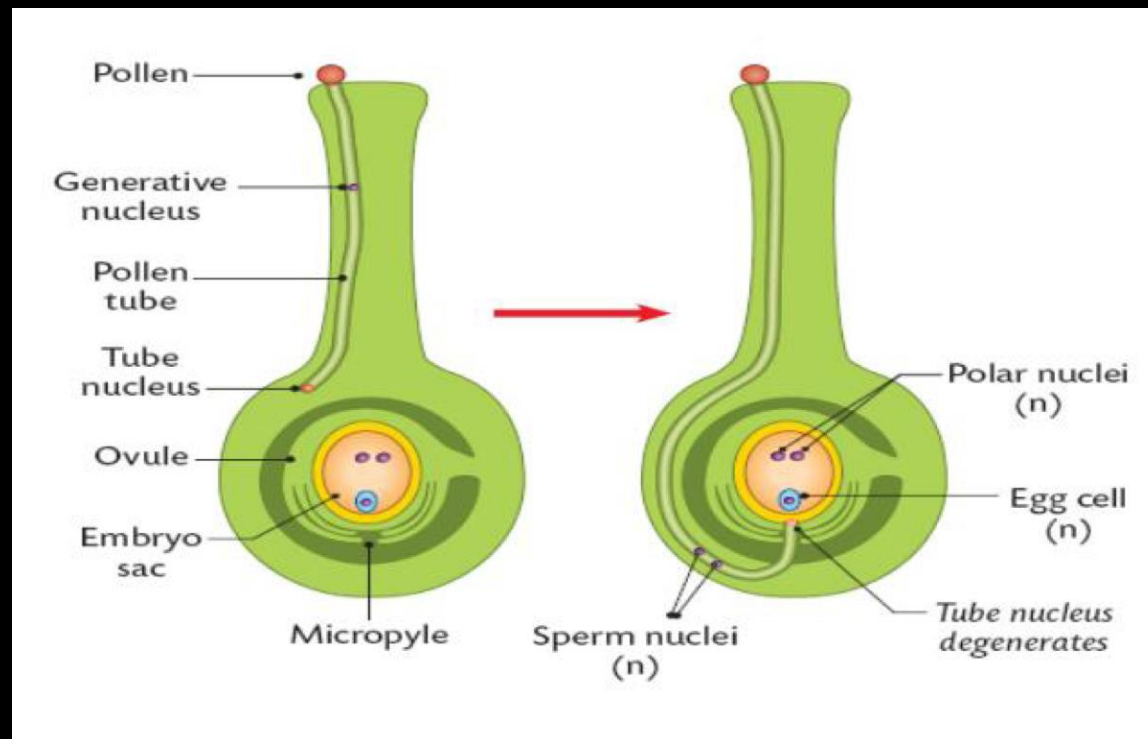


Observation:

The roots of the germinating seeds will grow towards beaker A. This experiment demonstrates the phenomenon of hydrotropism.

Chemotropism

The growth or movement of a plant or plant part in response to a chemical stimulus is called chemotropism.



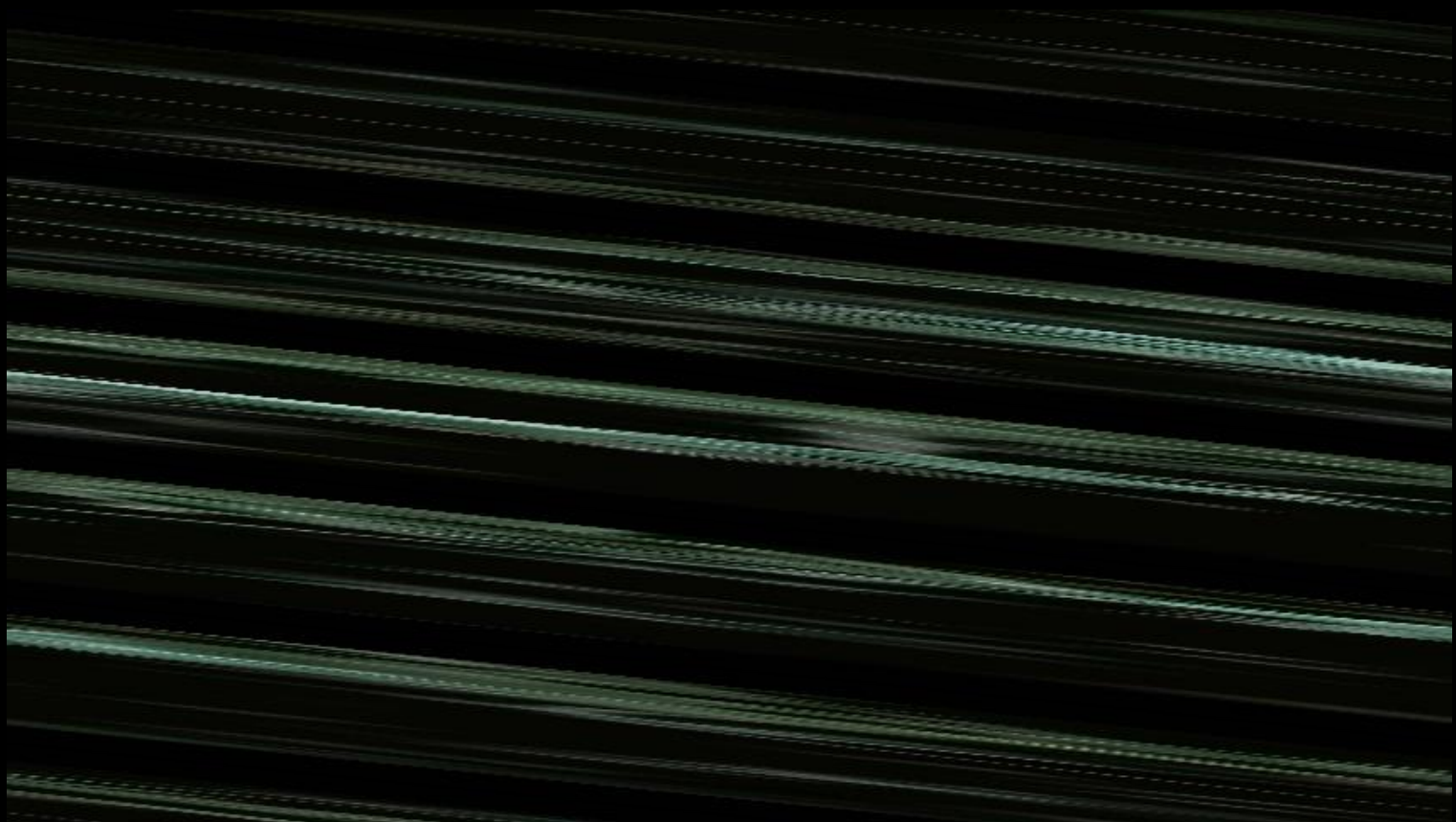
Controlled direction growth

Our arms and fingers grow in certain directions and not haphazardly.



Medium of transmission in animals

Electrical impulses



Limitations of electrical impulse

- a) Electrical impulses will reach only those cells that are connected by nervous tissue. Not each and every cell in the animal body.
- b) Cells cannot continually create and transmit electrical impulses.

Cells cannot continually create and transmit electrical impulses.

Once an electrical impulse is generated in a cell and transmitted, the cell will take some time to reset its mechanisms before it can generate and transmit a new impulse.

Chemical communication between the cells

Stimulated cells release a chemical compound, this compound would diffuse all around the original cell. If other cells around are able to detect this compound using special molecules on their surfaces, then they would be able to recognize information and transmit it.

Advantage of chemical communication

- a) Chemical communication can reach all cells of the body, regardless of nervous connections.
- b) It is steady and persistent.
- c) They act by diffusion to the area of action.

Plant hormones

Hormones are chemical compounds which help to coordinate growth, development and responses to the environment.

Functions of Plant hormones

- a) Auxins help in the growth of shoot.
- b) Gibberellins help in the growth of stem.
- c) Cytokinins promote cell division.
- d) Abscisic acid inhibits growth. It also help in wilting of leaves.

Chemical Coordination in animals

Chemical coordination

Chemical coordination in animals takes place through hormones. There are several endocrine glands which secrete various kinds of hormones. These hormones regulate different functions in the body. These hormones are poured into blood through which they reach the target tissue or organ to act. For example; insulin is a hormone which regulates the blood sugar level.

Hormones

Hormones are chemical messengers that regulate the biological processes in living organisms.

Characteristics of Hormones

1. Hormones are directly released into the blood.
2. They are released in very little quantity.
3. They act on specific tissues or organs.
4. They are generally slow in action.
5. They act away from the site of production.

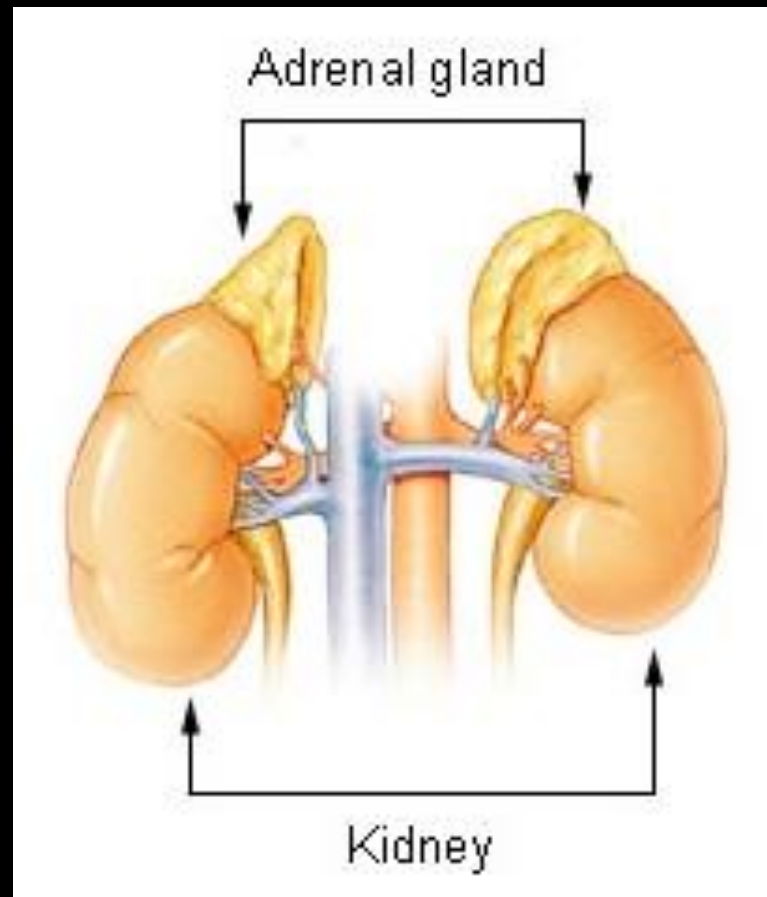
Target organs

Target organs are the specific tissues on which hormones act.

Adrenal gland

It is located above each kidney.

It secretes a hormone called adrenaline.



Adrenaline

- Adrenaline secreted acts on the heart.
- The heart beats faster, resulting in supply of more oxygen to our muscles.
- The blood to the digestive system and skin is reduced due to contraction of muscles around small arteries in these organs.
- This diverts the blood to our skeletal muscles.
- The breathing rate also increases because of the contractions of the diaphragm and the rib muscles.
- All these responses together enable the animal body to be ready to deal with the situation.

When a boy was followed by a stray dog, he got frightened and started running.

a) Name the hormone that prepared him to escape from the stray dog.

Adrenaline

b) Locate the position of the gland in our body which secretes this hormone.

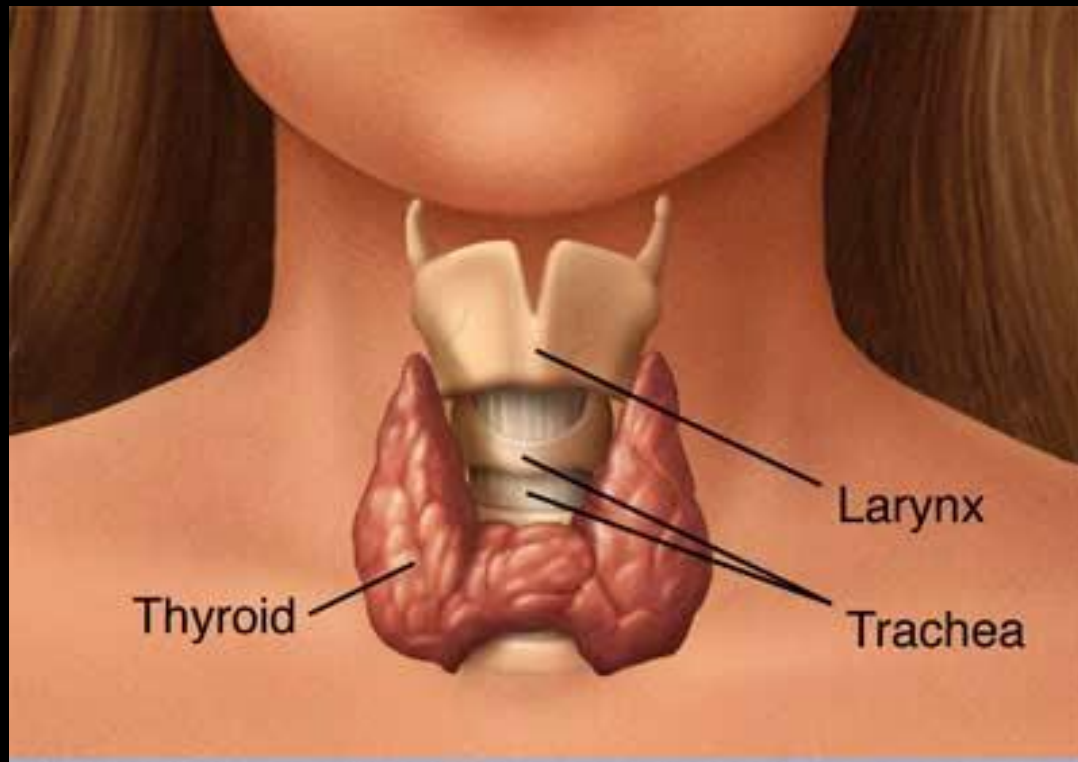
Adrenal gland is located on the upper part of each kidney.

c) Mention two effects of this hormone in human body.

The heart starts beating faster. More amount of oxygen is supplied to the muscles.

Thyroid Gland

- Thyroid gland is located in the neck region.
- It secretes a hormone called thyroxin.



Thyroxin

Thyroxin regulates carbohydrate, protein and fat metabolism in the body so as to provide the best balance for growth.

Deficiency of Thyroxin

Deficiency of thyroxin causes a disease called goitre.

It is caused due to deficiency of iodine in the diet.

Goitre

Symptom of goitre is swelling in the neck caused due to enlarged thyroid gland.



Why is Iodised salt made compulsory?

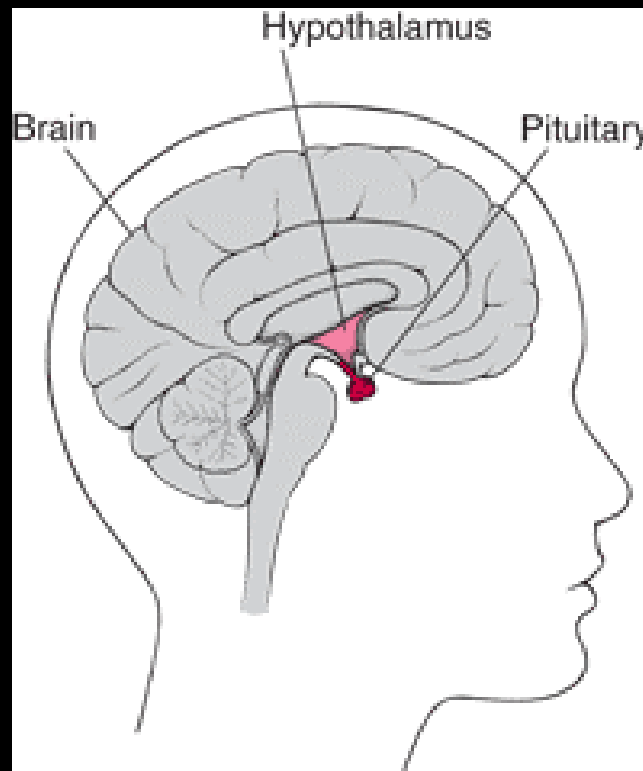
Iodine is necessary for the thyroid gland to make thyroxin hormone. Deficiency of iodine in our diet causes goitre. To reduce the occurrence of goitre, it is made mandatory to use iodised salt.



Pituitary gland

Pituitary gland is located at the base of the brain.

It produces the growth hormone.



Growth hormone

Growth hormone regulates growth and development of the body.

Puberty

Puberty is period (10 – 12 years of age) during which there are physical changes in boys and girls.

Dwarfism

Dwarfism is a condition caused due to deficiency of growth hormone in childhood.



Gigantism

Gigantism is a condition caused due to over secretion of growth hormone in childhood.



Testosterone

Testosterone is a hormone produced in males. It causes changes in the appearance during puberty.

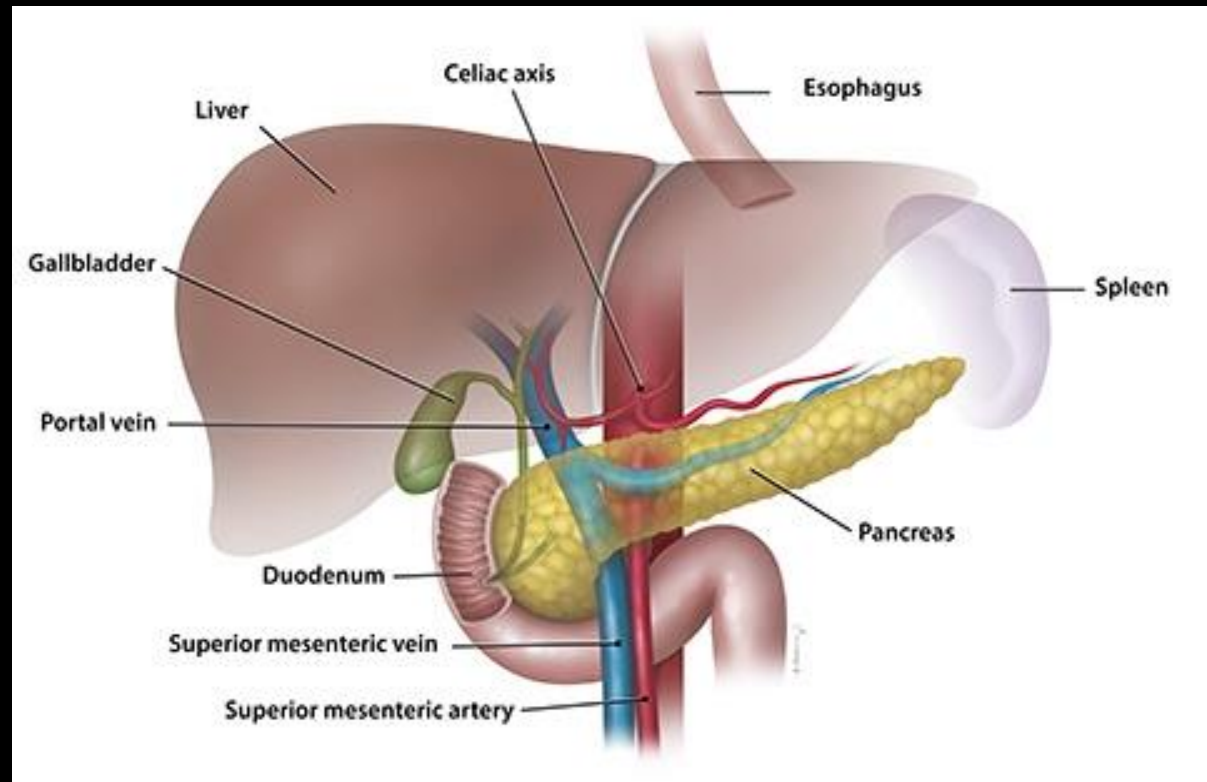
Oestrogen

Oestrogen is a hormone produced in females. It causes changes in the appearance during puberty.

Pancreas

Pancreas produces a hormone called insulin.

Insulin helps in regulating blood sugar levels.



How is the secretion of insulin regulated?

If the sugar levels in blood rise, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

Diabetes

Diabetes is a disease caused due to low secretion of insulin.

The sugar level in the blood rises causing many harmful effects.

Some cases of diabetes can be controlled by taking insulin injections.



Feedback mechanism

The feedback mechanism regulates the timing and amount of hormone to be secreted.

Name the disorder caused by the following situations:

a) Under secretion of growth hormone

Dwarfism

b) Over secretion of growth hormone

Extremely tall (giants)

c) Under secretion of insulin

Diabetes

d) Deficiency of iodine

Goitre

Name the hormone responsible for the following functions.

a) Regulating the blood sugar level

Insulin

b) Regulating the carbohydrates, proteins and fat metabolism in the body

Thyroxin

c) Changes at puberty in human females

Oestrogen

d) Regulating the growth and development of the body

Growth hormone

Name the gland and the hormone secreted by the gland, which are associated with the following

a) A girl has grown extremely tall

Pituitary gland, Growth hormone.

b) A woman has a swollen neck

Thyroid gland, Thyroxin

c) A gland present in female but not in males

ovary

d) A gland associated with kidneys

Adrenal gland

Comparison between nervous system mechanism and hormonal system mechanism

Nervous system mechanism	Hormonal system mechanism
1. The information is conveyed in the form of electric impulse.	1. The information is conveyed in the form of chemical messengers.
2. The axons and dendrites transmit the information through a coordinated effort.	2. The information is transmitted or transported through blood.
3. The flow of information is rapid and the response is quick.	3. The information travels slowly and the response is slow.
4. Its effects are short lived.	4. It has prolonged effects.

Comparison between movement in sensitive plants and movement in our legs

Movement in sensitive plants	Movement in our legs
1. The movement that takes place in a sensitive plant such as <i>Mimosa pudica</i> occurs in response to touch (stimulus).	1. Movement in our legs is an example of voluntary actions.
2. For this movement, the information is transmitted from cell to cell by electrochemical signals as plants do not have any specialized tissue for conduction of impulses.	2. The signal or messages for these actions are passed to the brain and hence are consciously controlled.
3. For this movement to occur, the plant cells change shape by changing the amount of water in them.	3. In animal muscle cells, some proteins are found which allow the movement to occur.

Given is an outline diagram of human body showing the position of endocrine glands.

a) Name the parts 1 – 4.

1 – Pituitary gland

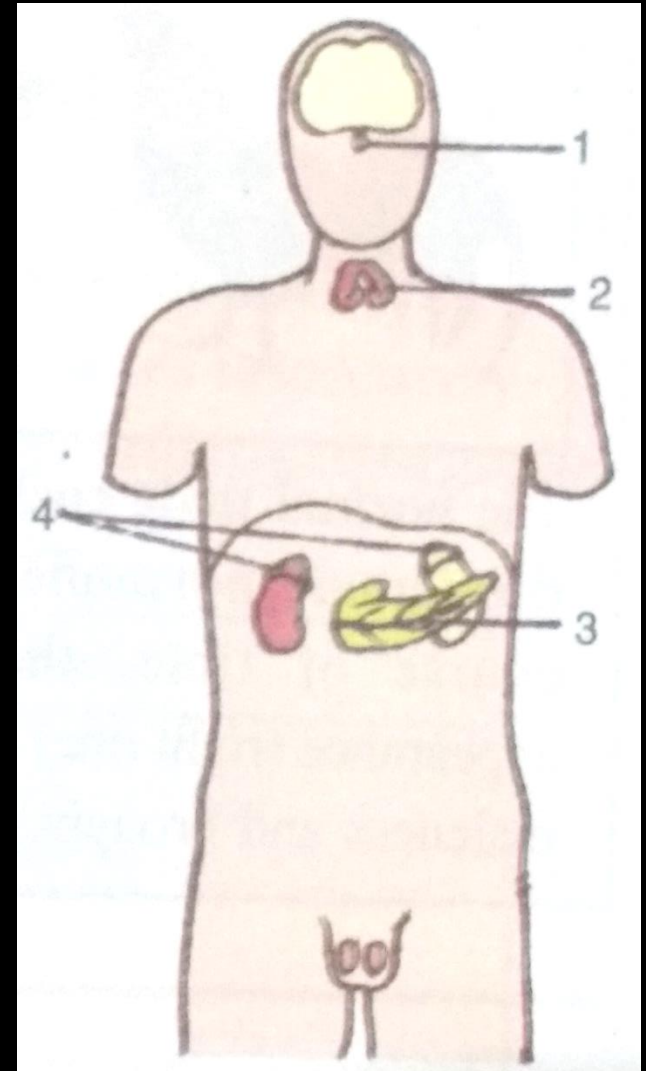
2 – Thyroid gland

3 – Pancreas

4 – Adrenal gland

b) Name the nutrient which is essential for the normal working of part 2.

Iodine



Given alongside is the outline of the human body showing important glands.

a) Name the glands marked 1 – 4

1 – Pituitary gland

2 – Thyroid gland

3 – Pancreas

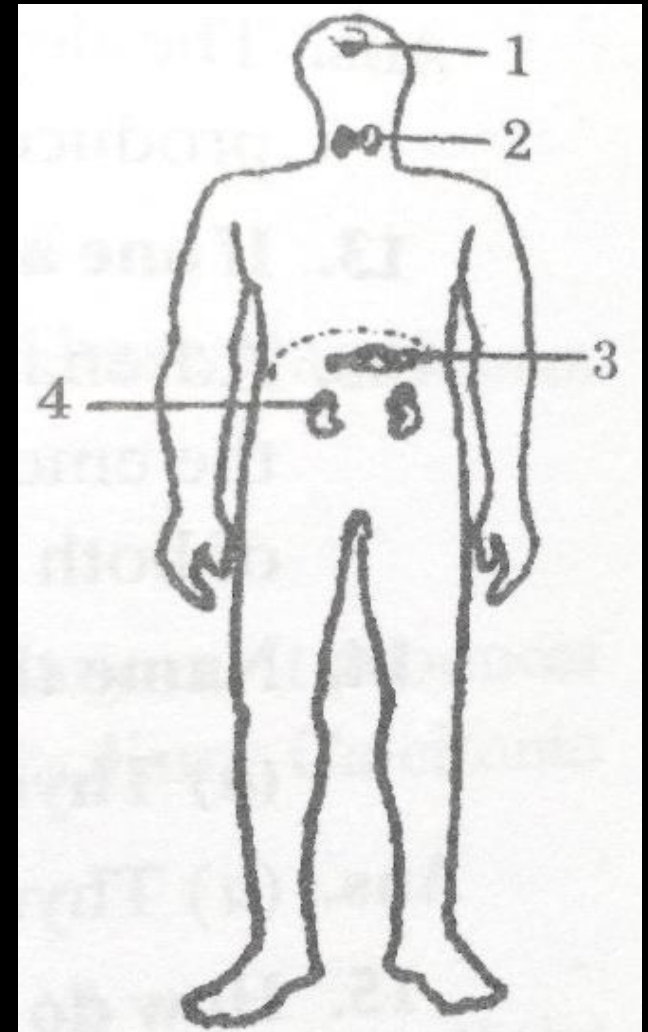
4 – Adrenal gland

b) Give one important function of part 2

Thyroxin regulates carbohydrate, protein and fat metabolism in the body so as to provide the best balance for growth.

c) Name the gland that secretes the fight or flight hormone.

Adrenal gland



Exercise (MCQ)

1. Which of the following is a plant hormone?

- (a) Insulin
- (b) Thyroxin
- (c) Oestrogen
- (d) Cytokinin

2. The gap between two neurons is called a

- (a) dendrite.
- (b) synapse.
- (c) axon.
- (d) impulse.

3. The brain is responsible for

- (a) thinking.
- (b) regulating the heart beat.
- (c) balancing the body.
- (d) all of the above.

END