SHORT QUESTIONS

1. Identify the two types of coordination in living organisms.

Ans. Types of Coordination:

There are two types of coordination in organisms:

i. Nervous coordination brought about by nervous system and

ii. Chemical coordination about by endocrine system

2. Differentiate between the modes of nervous and chemical coordination's.

Ans. Nervous coordination works through the nervous system of organisms - the network of neurons and such.

Chemical coordination is hormonal control, and it works through the release of hormones into the blood to flow to target receptor cells.

Animals have both the nervous and chemical coordination systems in their bodies while plants and other organisms have only chemical coordination.

3. What are the main components of coordination?

Ans. Components of Coordination:

A coordinated action has five components

Stimulus - Receptor Coordinator - Effector – Response

4. Define reflex action and reflex arc.

Ans. Reflex action:

The involuntary and immediate response to a stimulus is called reflex action A reflex action, also known as a reflex, is an involuntary and nearly instantaneous movement in response to a stimulus.

Reflex arc:

The nerve pathway over which the nerve impulses travel in a reflex action. A reflex arc is a neural pathway that controls an action reflex.

There are two types of reflex arc:

a. Autonomic reflex arc (affecting inner organs)

b. Somatic reflex arc (affecting muscles)

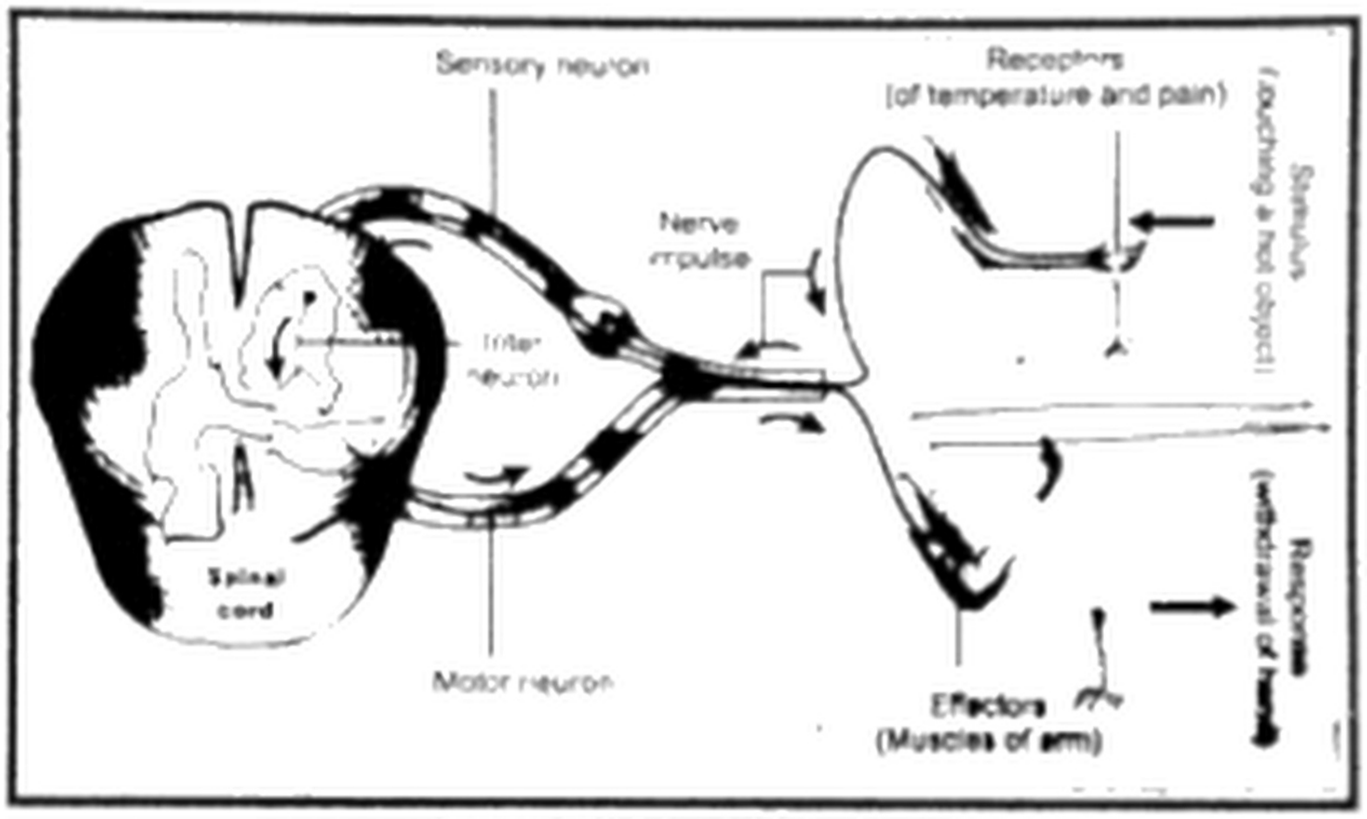
5. Trace the path of a nerve impulse in case of a reflex action.

Ans. Path of a nerve impulse:

When central nervous system sends impulses to muscles and glands two types of actions (responses) result

1. The higher centres of brain control the conscious action or voluntary actions

2. When impulses are not passed to the higher centres of bran results in responses which are not under conscious control Such responses are called involuntary actions Sometimes the involuntary response ... CNS is very quick Such a response is called reflex action the pathway followed by the nerve impulses for production a reflex action is called reflex arc.



Reflex arc in a reflex action

6. Describe the pupil reflex in dim and bright light.

Ans. There is round hole in the eye, called pupil, in the centre of iris. After striking the cornea, light passes through the pupil. The size of pupil is adjusted by the muscles of iris

Pupil reflex in bright light:

Pupil constricts in bright light when the circular muscles of iris contract similarly

Pupil reflex in dim light:

Pupil dilates in dim light when the radial muscles of iris contract.

7. How would you associate the role of vitamin A with vision and effects of its deficiency on retina?

Ans. Rods contain a pigment called rhodopsin. When light falls on rhodopsin, it breaks for generating a nerve impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Body synthesizes rhodopsin from

vitamin A and that is why the deficiency of vitamin A causes poor night vision. This problem is called night blindness.

8. Define the terms; hormone and endocrine system.

Ans. Hormone:

A substance that is secreted by an endocrine gland directly into blood and that produces a specific effect on a particular tissue is called hormone Blood carries the hormones to target organs or tissues, upon which they act.

Endocrine System:

The bodily system that consists of the endocrine glands that release their secretions (hormones) into the bloodstream to reach and act on target cells of Specific organs.

The activities such as growth, reproduction, maintenance of glucose concentration in blood, reabsorption of water in kidneys etc. need to be regulated Endocrine system performs this job This system uses chemicals to communicate with its effectors. These chemicals are known as hormones.

UNDERSTANDING THE CONCEPT

1. **Explain what can happen if there is no coordination in the activities of organisms.**

Ans. The tissues and organs in the bodies of multicellular organisms do not work independently of each other They work together performing their many tasks as the needs of the whole body. This means that these activities are coordinated Coordination also enables the organism to respond to happenings in the world around it

Explanation:

When we are writing something, our hands and fingers work in collaboration with our muscles, eyes, thoughts etc. and then very intricate movements result

Example:

One familiar example of coordination is the way in which muscles work together during movement. When a boy runs to catch a ball, he uses hundreds of muscles to move his arms, legs and back. His nervous system uses information from his sense organs and coordinates these muscles

Due to this coordination, the muscles contract in the correct sequence, power and length of time. But that is not all. Such activities involve many other kids of coordination. For example; breathing and heartbeat rates are increased blood pressure is adjusted, and extra heat is removed fast from the body

Note:

Life activities are controlled and coordinated i.e. body works as one unit, in which its different organs and systems cooperate and work in harmony with each other.

2. Explain the location and function of these parts of brain; cerebrum. cerebellum, pituitary gland, thalamus, hypothalamus, medulla oblongata.

Ans. Central Nervous System:

The central nervous system consists of brain and spinal cord

Brain:

In animals all life activities are under the control of brain. The structure of brain is suitable to perform this function Brain is situated inside a bony cranium (part of skull).

Meninges:

Inside cranium, brain is covered by three layers called meninges. Meninges protect brain and also provide nutrients and oxygen to brain tissue through their capillaries.

Cerebrospinal fluid (CSF):

The brain contains fluid-filled ventricles that are continuous with the central canal of spinal cord. Fluid within ventricles and central canal is called cerebrospinal fluid (CSF).

The Divisions of Brain:

There are three major regions in the brain of human and other vertebrates These are forebrain, midbrain and hindbrain. Important parts of each of these regions are described below.

Forebrain

Forebrain is the largest area of brain. It is most highly developed in humans Following are the important parts of this region

(i) Thalamus:

Thalamus lies just below cerebrum. It serves as a relay centre between various parts of brain and spinal cord. It also receives and modifies sensory impulses (except from nose) before they travel to cerebrum Thalamus is also involved in pain perception and consciousness (sleep and awakening)

(ii) Hypothalamus:

Hypothalamus lies above midbrain and just below thalamus in humans, it is roughly the size of an almond. One of the most important functions of hypothalamus is to link nervous system and endocrine system. It controls the secretions of pituitary gland. It also controls feelings such as rage, pain, pleasure and sorrow

(iii) Cerebrum:

Cerebrum is the largest part of forebrain. It controls skeletal muscles thinking, intelligence and emotions. It is divided into two cerebral hemispheres.

Olfactory bulbs:

The anterior parts of cerebral hemispheres are called olfactory bulbs which receive impulses from olfactory nerves and create the sensation of smell

The upper layer of cerebral hemispheres i.e, cerebral cortex consists of grey matter. The grey matter of nervous system consists of cell bodies and no myelinated axons beneath this layer is present the white matter. The white matter of nervous system consists of myelinated axons

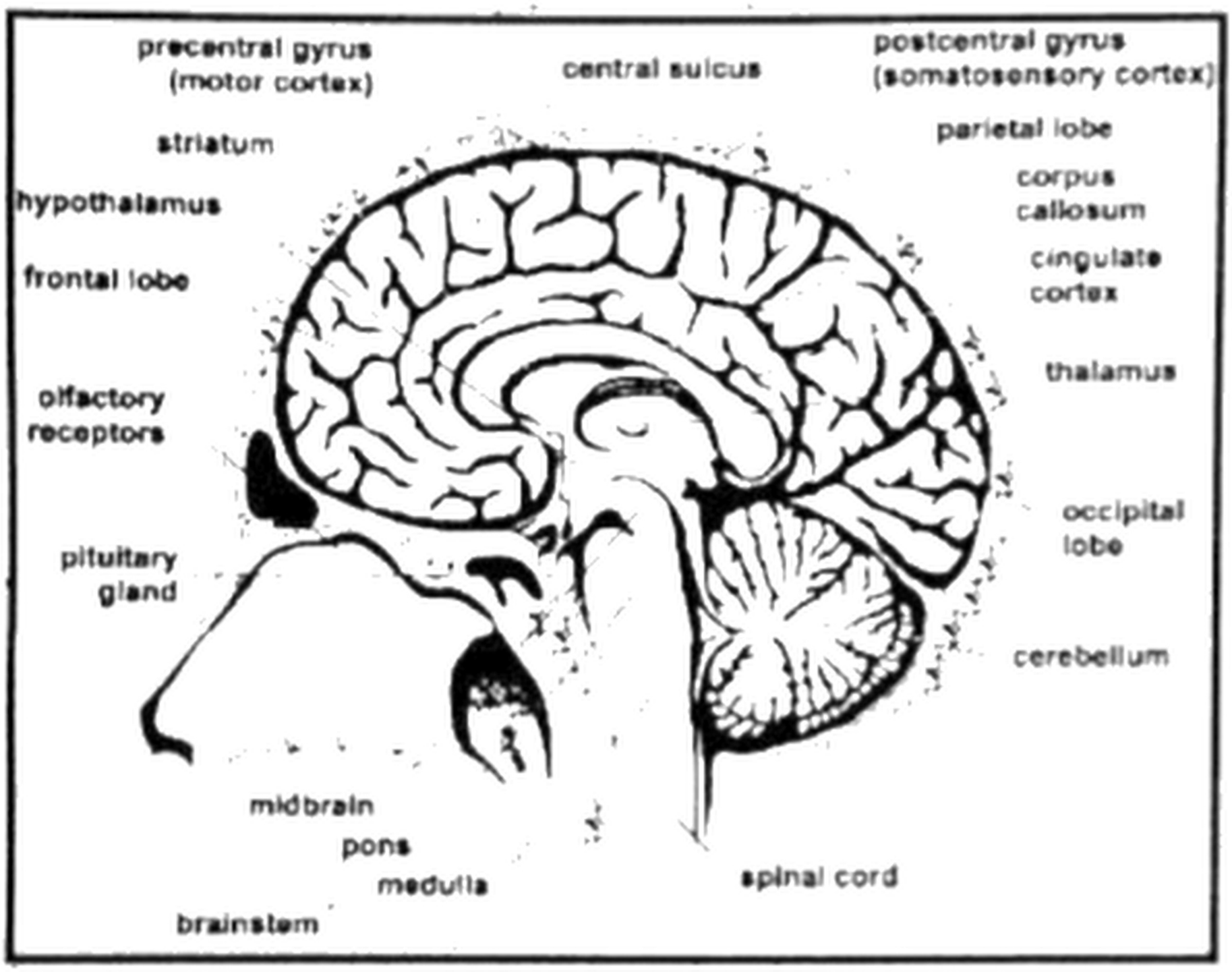
Lobes of cerebral cortex:

Cerebral cortex has a large surface area and is folded in order to fit in skull It is divided into four lobes Lobe

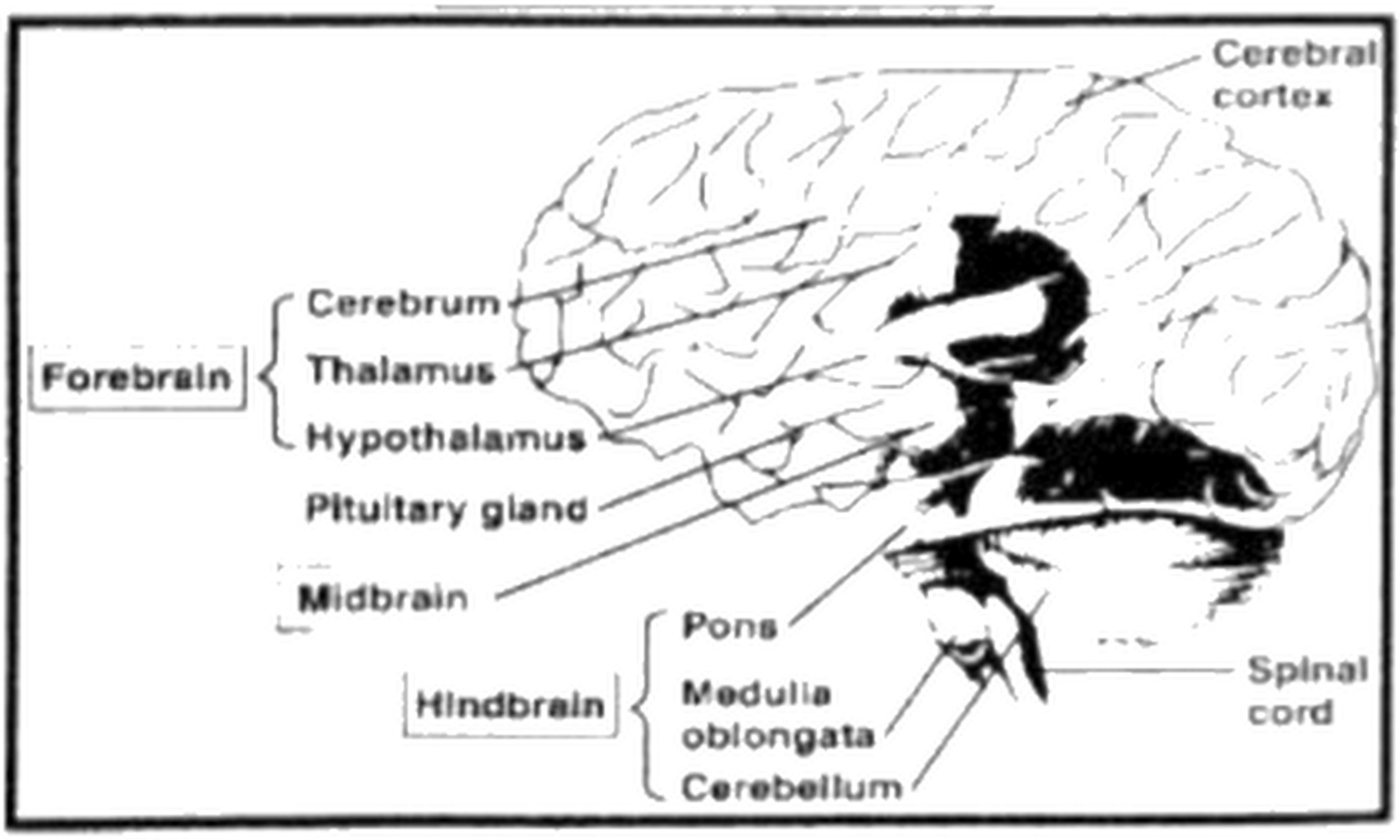
Lobe	Function
Frontal	Controls motor functions, permits conscious control of skeletal muscles and Coordinates movements involved in speech
Parietal	Contains sensory areas that receive impulses from skin
Occipital	Receives and analyzes visual information
Temporal	Concerned with hearing and smells

Midbrain:

Midbrain lies between hindbrain and forebrain and connects the two it receives sensory information and sends it to the appropriate par of forebrain. Midbrain also controls some auditory reflexes and postures.



Structure of human brain



Structure of human brain

Hindbrain:

Hindbrain consists of three major parts

(1) Medulla oblongata:

Medulla oblongata lies on the top of spinal cord it controls breathing, heart, rate and blood pressure. It also controls may reflex such as vomiting coughing, sneezing etc. Information that passes between spinal cord and the rest of brain pass through medulla

(ii) Cerebellum:

Cerebellum is behind medulla It coordinates muscle movements

(iii) Pons:

Pons is present on top of medulla. It assists medulla in controlling breathing It also serves as a connection between cerebellum and spinal cord.

Spinal Cord:

The spinal cord is in fact a tubular bundle of nerves It starts from brain stem and extends to lower back Like brain, spinal cord is also covered by meninges. The vertebral column surrounds and protects spinal cord.

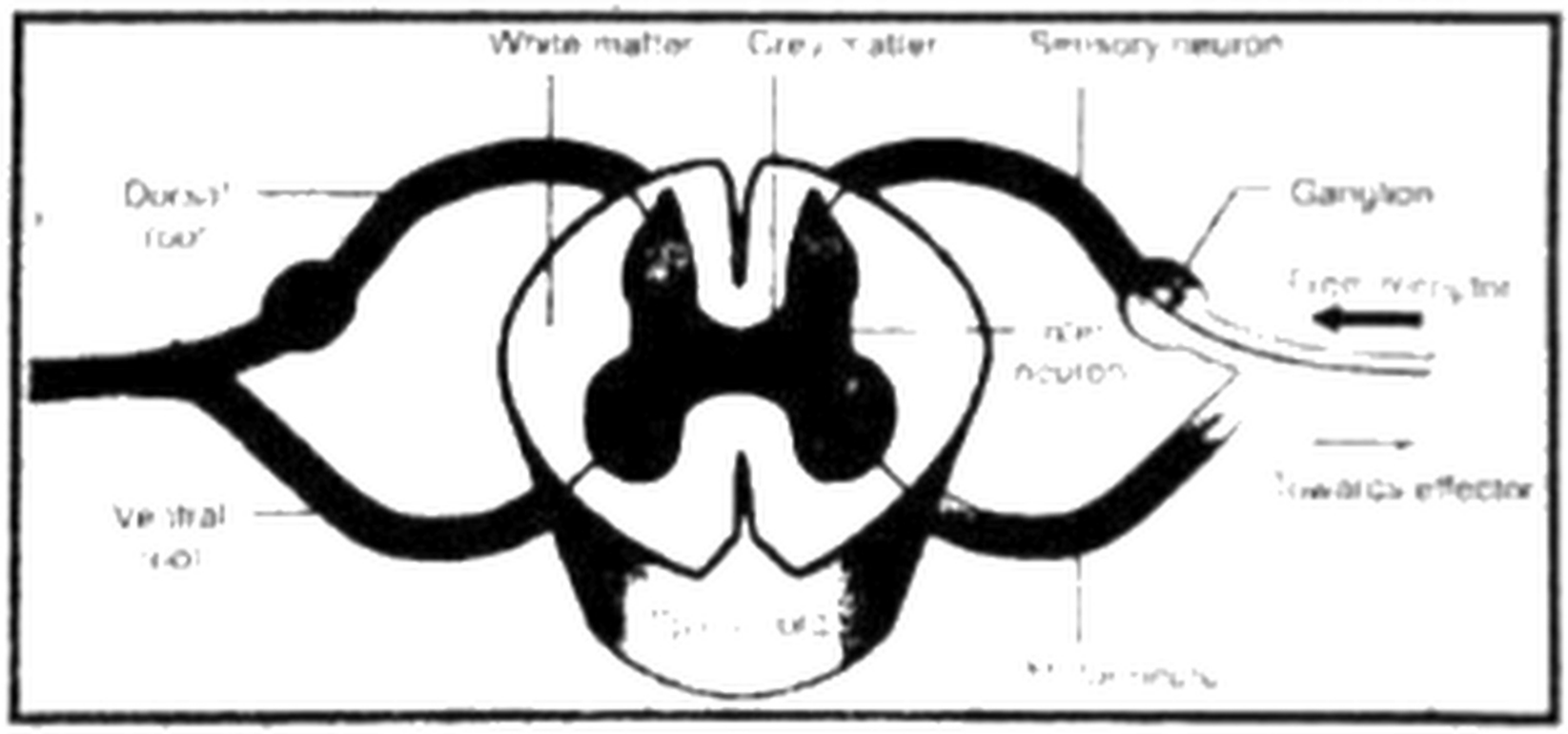
The outer region of spinal cord is made of white matter (containing myelinated axons) The central region is butterfly shaped that surrounds the central canal It is made of grey matter (containing neuron cell bodies)

Mixed nervous:

31 pairs of spinal nerves arise along spinal cord. These are "mixed" nerves because each contains laxons of both sensory and motor neurons. At the point where a spinal nerve arises from spinal cord, there are two roots of spinal nerve. Both roots unite and form one mixed spinal nerve.

- The dorsal root contains sensory axons and a ganglion where cell bodies are located

- The ventral root contains axons of moto neurons



Functions of spinal cord:

Spinal cord performs two main functions.

i. It serves as a link between body parts .....
ii. Spinal cord also acts as a coordinator, responsible for some simple reflexes

3. Define neuron and describe the structure of a general neuron.

Ans. Neuron or Nerve cell:

Nerve cell or neuron is the unit of the nervous system. The human nervous system consists of billions of neurons plus supporting (neuroglial) cells

Function of Neuron:

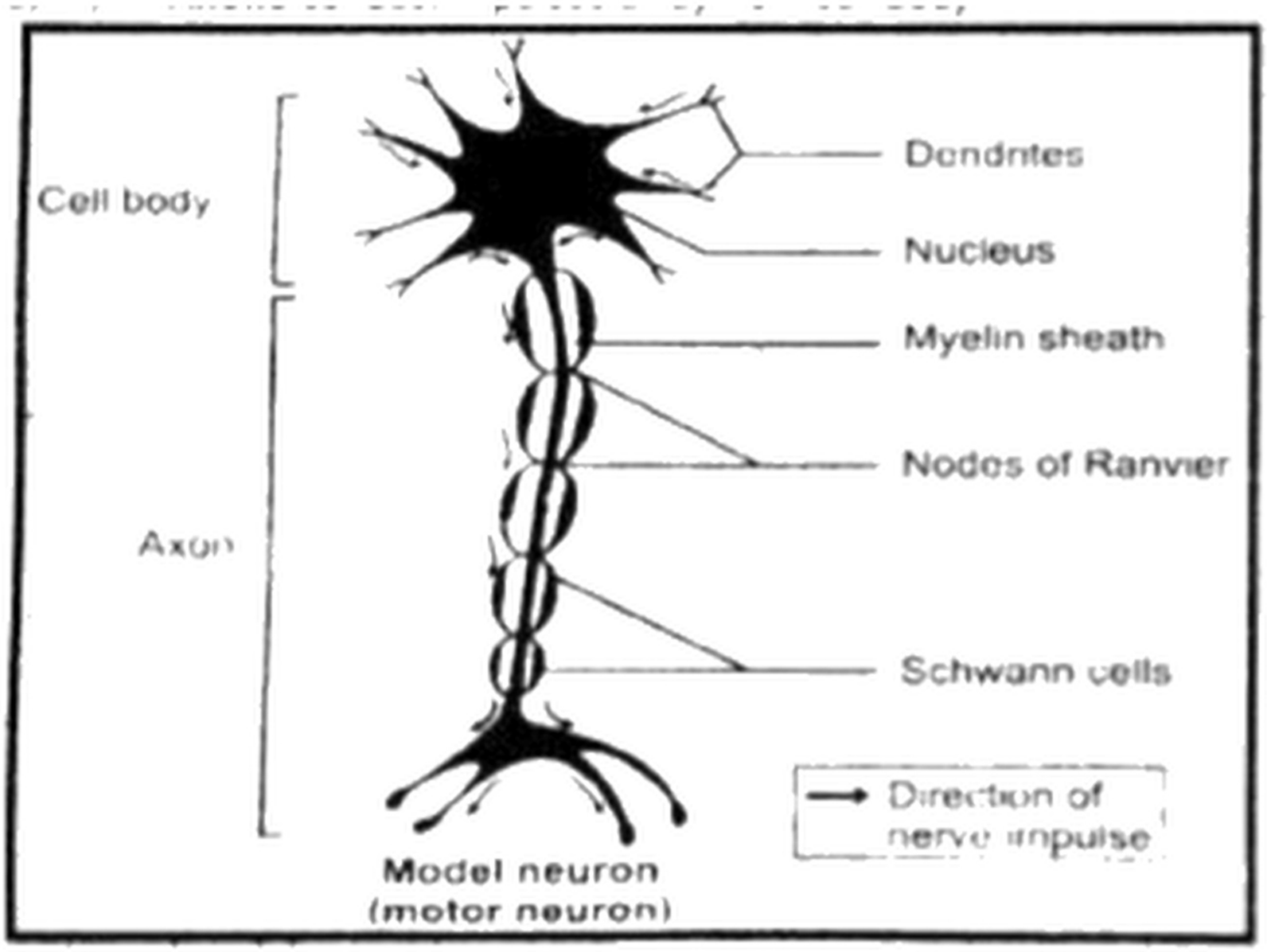
Neurons are specialized cells that are able to conduct nerve impulses from receptors to coordinators and from coordinators to effectors. In this way they communicate with each other and with other types of body cells

Structure of Neuron:

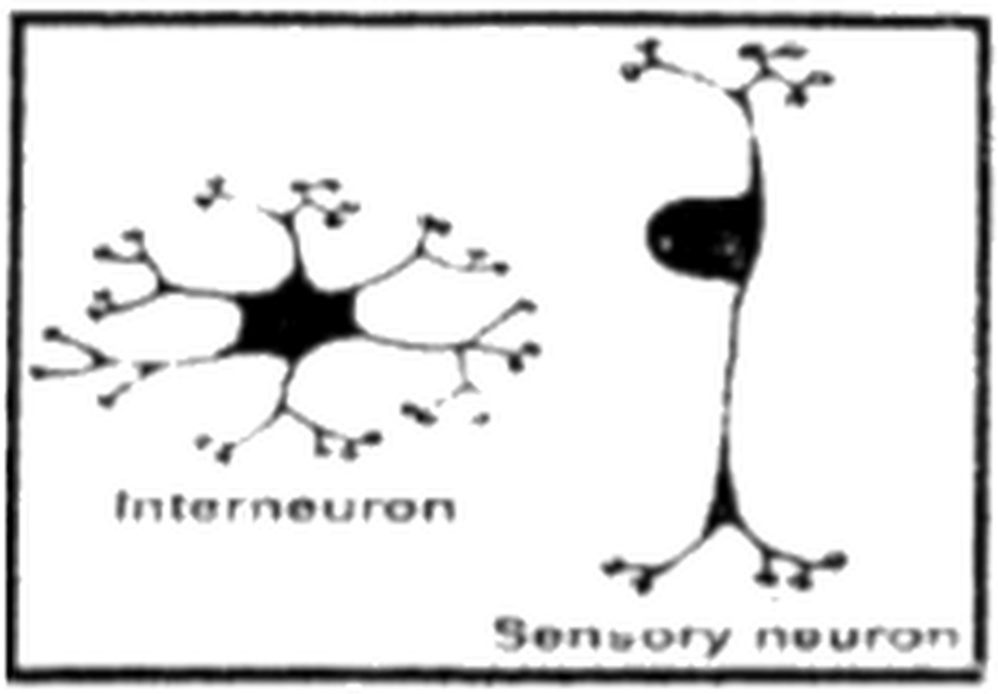
The nucleus and most of the cytoplasm of a neuron is located in its cell body. Different processes extend out from cell body these are called axons

Dendrites: Dendrites conduct impulses toward cell body

Axons: Axons conduct impulses away from cell body



Model Neuron (Motor Neuron)



Schwann cells:

Schwann cells are special neuroglial cells located at regular intervals along axons

Myelin sheath:

In some neurons, Schwann cells secrete a fatty layer called myelin sheath, over axons

Nodes of Ranvier:

Between the areas of myelin on an axon, there are non-myehnated points called the nodes of Ranvier. Myelin sheath is an insulator so the membrane coated with this sheath does not conduct nerve impulse.

Saltatory ("jumping') impulses:

A neuron, impulses "jump over the areas of myelin going from node to node Such impulses are called saltatory ("jumping') impulses. This increases the speed of nerve impulse.

Types of neuron:

On the basis of their functions, neurons are of three types

i. **Sensory neurons:**

Sensory neurons conduct sensory information (nerve impulse) from receptors towards the CNS Sensory neurons have one dendrite and one axon.

ii. **Interneurons:**

Interneurons form brain and spinal cord. They receive information, interpret them and stimulate motor neurons. They have many dendrites and axons

iii. **Motor neurons:**

Motor neurons carry information from interneurons to muscle or glands (effectors). They have many dendrites but only one axon

4. Describe the structure of human eye.

Ans. Eye:

Our eyes are located in small portions of skull known as the orbits or eye sockets. Eyelids wipe eyes and prevent dehydration. They spread tears on eyes, which contains substances for fighting bacterial infections. Eyelashes prevent fine particles from entering eye.

Structure of human eye:

The structure of eye can be divided into three main layers

i. Outer layer:

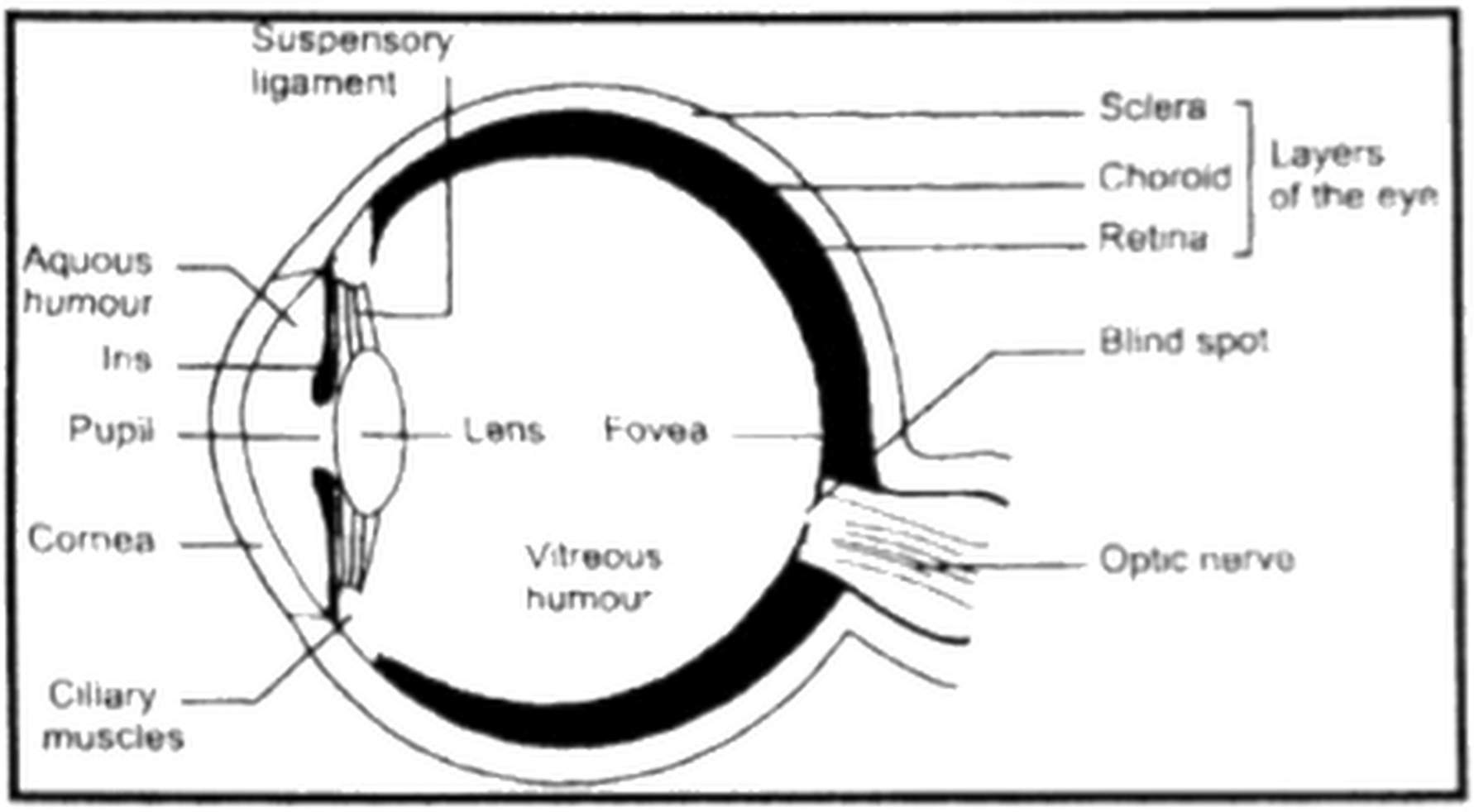
The outer layer of eyeball consists of sclera and cornea.

Sclera:

Sclera gives eye most of its white colour. It consists of dense connective tissue and protects the inner components of eye and maintains its shape. In the front, sclera forms the transparent cornea

Cornea:

Cornea admits light to the interior of eye and bends light rays so that they can be brought to a focus.



Structure of human eye

ii. Middle layer:

Choroid:

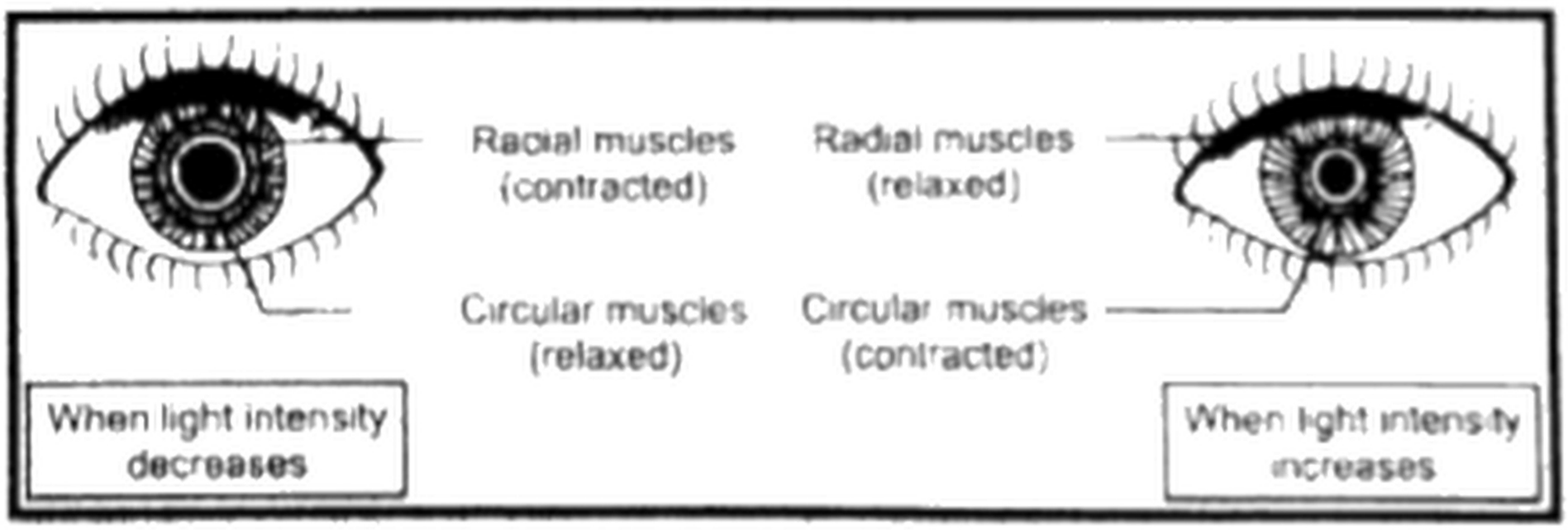
The middle layer is called choroid. It contains blood vessels and gives the inner eye a dark colour

Iris:

The dark colour prevents disruptive reflections within eye. Behind cornea, choroid bends to form a muscular ring, called iris.

Pupil:

There is round hole, called pupil, in the centre of iris. After striking the cornea, light passes through the pupil. The size of pupil is adjusted by the muscles of iris. Pupil constricts in bright light when the circular muscles of iris contract. Similarly, pupil dilates in dim light when the radial muscles of iris contract.



Contraction and dilation of pupil

Convex lens:

Behind iris, there is a convex lens, which focuses light on retina Lens is attached to ciliary muscles of eye via a ring of suspensory ligament. To clearly see an object far away, ciliary muscles are relaxed and lens becomes less convex When ciliary muscles contract, lens becomes more convex and rounder

iii. Inner layer:

Retina:

The inner layer is sensory is called as retina. It contains the photosensitive cells called rods and cones and associated neurons

Rods:

Rods are sensitive to dim light while cones are sensitive to bright light and so distinguish different colours. Retina has two points ide fovea and optic disc

Fovea:

Fovea is a dip in retina, directly opposite to lens and is densely packed with cone cells. It is largely responsible for colour vision and sharpness

Optic disc:

Optic disc is a point on retina where the optic nerve enters retina. There are no rods and cones at this point that is why it is also referred to as the blind spot

Chambers:

The iris divides the cavity of eye into two chambers. The anterior chamber is in front of iris i.e., between cornea and ins; whereas the posterior chambers between iris and retina

Aqueous humour:

The anterior chamber contains a clear fluid known as aqueous humour

Vitreous humour:

The posterior chamber contains a jelly-like fluid known as vitreous humour It helps maintain the shape of eye and suspends the delicate lens

Sensation of vision:

Light from objects enters eye and is refracted when it passes through cornea, aqueous humour, lens and vitreous humour. Lens also focuses light on retina. As a result, the image falls on retina. Rods and cones generate nerve impulses in the optic nerve. These impulses are carried to the brain, which makes the sensation of vision

Rhodopsin:

Rods contain a pigment called rhodopsin. When light falls on rhodopsin, it breaks for generating a nerve impulse. In the absence of light, the breakdown products are again converted into rhodopsin. Too much light being let in could damage the retina, too little light makes sight difficult.

5. **How would you describe the structure of the external, middle and inner ear of man?**

Ans. Ear:

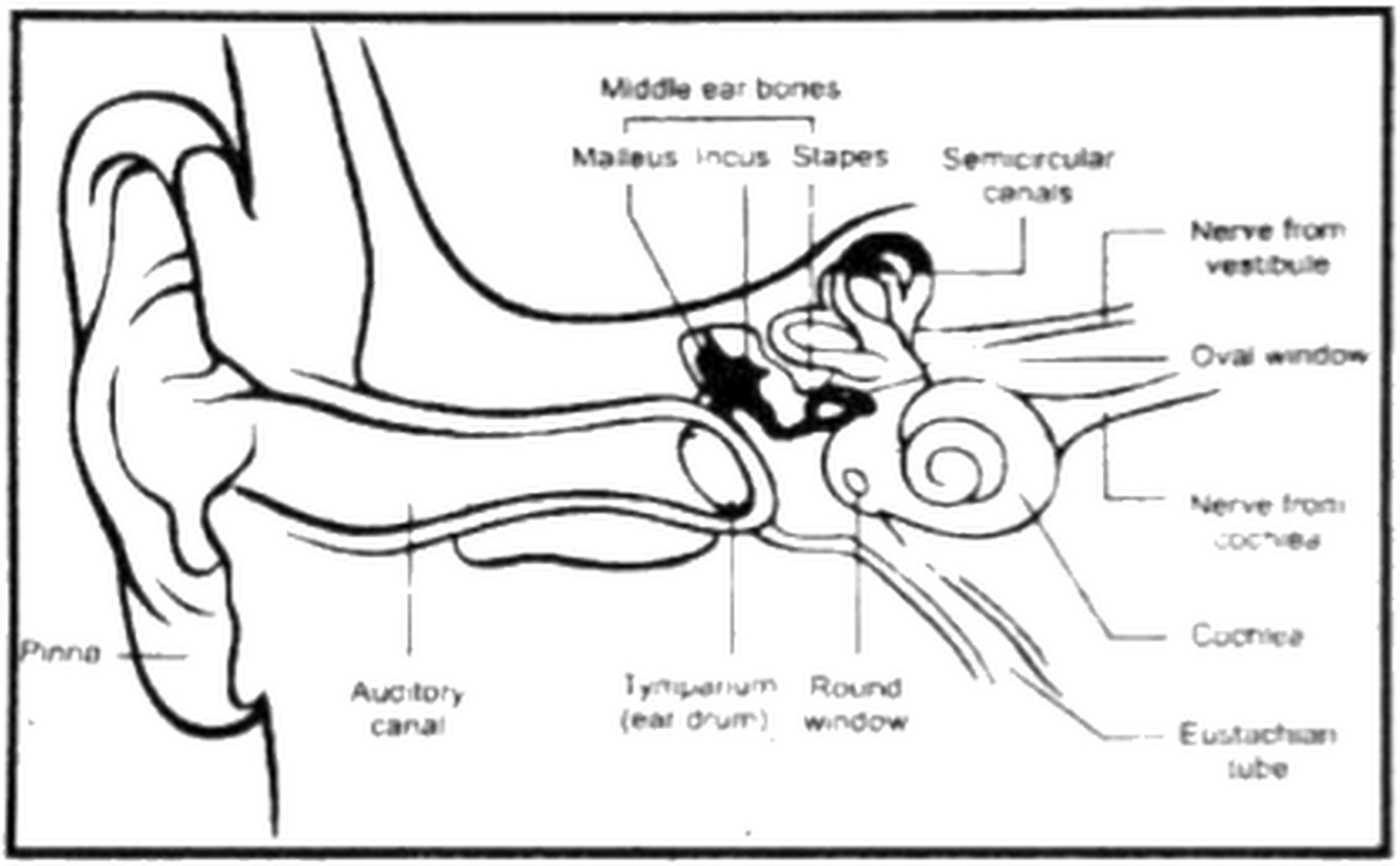
Our ear helps us in hearing and also to maintain the balance or equilibrium of our body

Structure of Ear:

Ear has three main parts i.e. external ear, middle ear, and internal ear

i. External Ear:

External ear consists of pinna, auditory canal and ear drum tympanum) Pinna is the broad external part, made of cartilage and covered with skin It helps to direct sound waves into auditory canal. There are special glands in the walls of auditory canal, which produce wax. The wax and the hairs in auditory canal protect ear from small insects, germs and dust. In additions to this, they help to maintain the temperature and dampness of auditory canal. Auditory canal ends in ear drum. This thin membrane separates external ear from middle ear.



Structure of human ear

ii. Middle Ear:

Middle ear is a chamber after external ear. Three small bones, called middle ear ossicles, are present in a chain in middle ear. These movable bones include malleus, incus and stapes. Malleus is attached with ear drum, then comes incus and finally stapes that is connected with a membrane called oval window. Oval window separates middle ear from inner ear Middle ear also communicates with the nasal cavity through Eustachian tube. This tube regulates the air pressure on both sides of ear drum.

iii. Inner Ear:

Inner ear consists of three parts i.e. vestibule, semicircular canals and cochlea Vestibule is present in the centre of inner ear. Three canals called semicircular canals are posterior to the vestibule. The cochlea is made of three ducts and wraps itself into a coiled tube.

Sound receptor cells are present within the middle duct of cochlea

Structure of inner ear

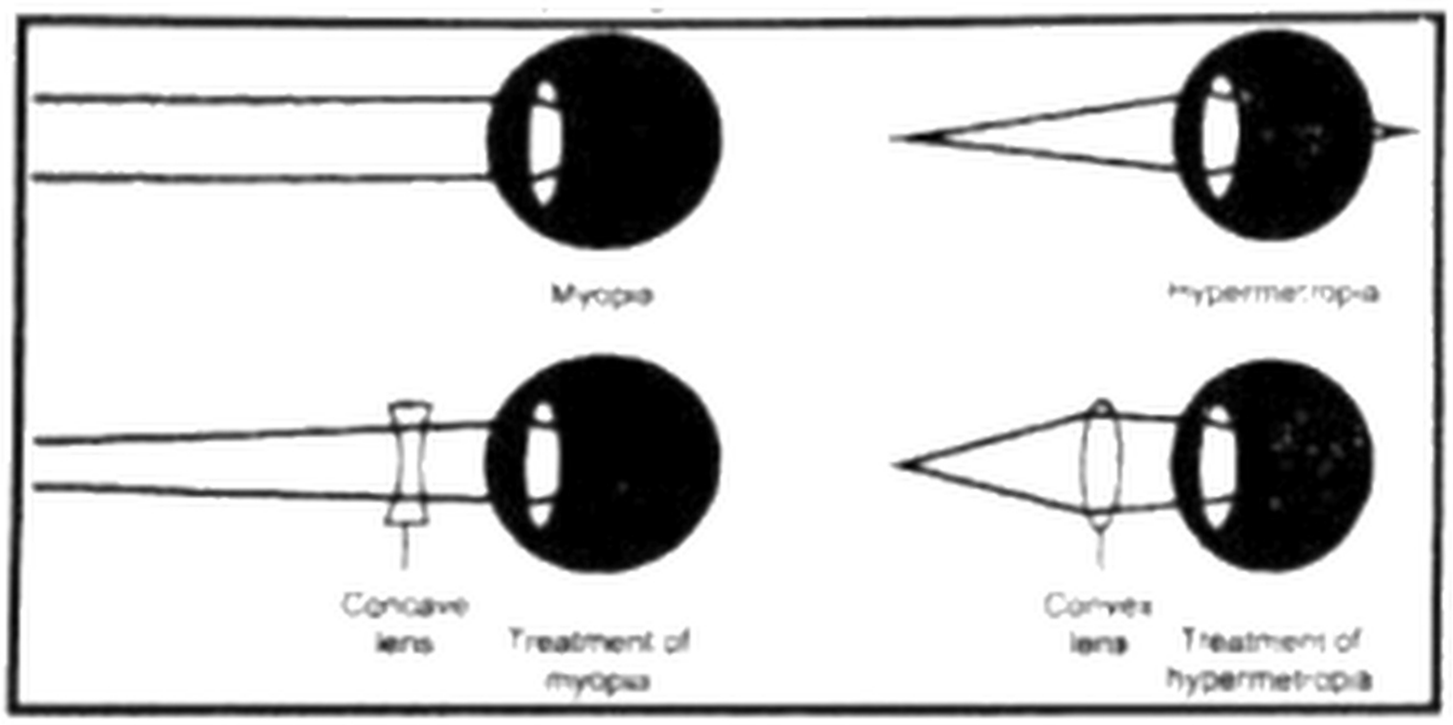
6. What are short sight and long sight problems and how these can be treated?

Ans. Disorders of the Eye:

The working of eye is affected by the changes in the shape of eyeball

Myopia (Short sight):

The elongation of eyeball results in myopia. Such persons are not able to see distant objects clearly. The image of a distant object is formed in front of retina This problem can be rectified by using concave lens.



Hypermetropia (Long sight):

It happens when eyeball shortens. Such persons are not able to see near objects clearly. The image is formed behind retina. Convex lens is used to rectify this problem.

7. Explain the role of ear in the maintenance of balance.

Ans. Ears maintain the Balance of Body:

Semicircular canals and vestibule help to maintain the balance of body Semicircular canals contain sensory nerves which can detect any movement of head. Vestibule can detect any changes in the posture of body. The neurons coming from these two receptors reach cerebellum through the auditory nerve.

8. Relate the contribution of Ibn-al-Haitham and Al-Ibn-Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases.

Ans. Contributions of Muslim Scientists:

Ali ibn Isa (950 - 1012):

Ali ibn Isa was a famous Arab scientist. He wrote three books on ophthalmology (study of the diseases and surgery of eyes). He described 130 eyes diseases and prescribed 143 drugs to treat these diseases.

Ibn al-Haytham (965 -1039):

Ibn al-Haytham an Arab scientist, made significant contributions to the principles of eye and vision. He is regarded as the father of optics (study of the behavior of light). His "Book of Optics" correctly explained and proved the modern theory of vision. He discussed the topics of medicine and eye surgery in his book. He made several improvements to eye surgery and accurately described the process of sight, the structure of eye, image formation in eye and visual system Ibn al-Haytham also described the principles of pinhole camera

Ibn al-Haytham's Book of Optics has been ranked alongside a book of Isaac Newton. It is one of the most influential books ever written in the history of physics

9. Outline the major glands of the endocrine system (pituitary, thyroid, pancreas, adrenal, gonads), with name of their hormones and their functions.

Ans. 1. Pituitary Gland:

It is a pea-shaped gland attached to the hypothalamus of brain. Many hormones (trophic hormones) of pituitary gland influence the secretions of other endocrine glands. However, some hormones of this gland act directly on various tissues of body. There are two lobes of pituitary gland i.e. anterior lobe and posterior lobe

a. Anterior Lobe:

It produces many hormones

Somatotropin:

One of its important hormones is somatotropin (growth hormone)

Function of Somatotropin:

It promotes the growth of body

Dwarfism:

If the production of this hormone is diminished during growing age, the rate of growth decreases. This condition is called dwarfism.

Gigantism:

If this hormone is excessively produced during growing age, it leads to gigantism (very tall and overweight)

Acromegaly:

If somatotropin is excessively produced after growing age, internal organs and body extremities alone grow large. This condition is known as acromegaly. Such persons will have large hands, feet and jawbones

Thyroid-stimulating-hormone (TSH):

Another important hormone secreted by the anterior lobe of pituitary gland is thyroid-stimulating-hormone (TSH).

Function of thyroid-stimulating-hormone (TSH):

It stimulates thyroid gland to secrete its hormones. The remaining hormones of anterior lobe influence reproductive organs and also control adrenal glands

b. Posterior Lobe:

Oxytocin and vasopressin:

The posterior lobe of pituitary gland stores and secretes two hormones i.e. Oxytocin and vasopressin (antidiuretic hormone ADH). These hormones are produced by hypothalamus (a part of brain)

Function of vasopressin:

Vasopressin increases the rate of reabsorption of water from nephrons. When we have low amount of water in body fluids, pituitary gland secretes vasopressin and so more reabsorption of water occurs from nephrons into blood in this way, body retains water and less amount of urine is produced

Diabetes Insipidus:

On the other hand, when body fluids have more than normal water, there is a decline in the secretion of this hormone

if pituitary gland does not secrete this hormone in the required amount, less water is reabsorbed from nephrons and there is excessive loss of water through urine. This condition is known as diabetes insipidus

Function of Oxytocin:

The hormone, oxytocin stimulates the contraction of uterus walls in mothers for child birth. Moreover, this hormone is necessary for the ejection of milk from breast.

2. Thyroid gland:

Thyroid gland is the largest endocrine gland in human body. It is present in neck region, below larynx.

Thyroxin:

Thyroid gland produces a hormone thyroxin, iodine is required for the production of this hormone

Goiter:

If a person lacks iodine in diet, thyroid gland cannot make its hormone. In this condition, thyroid gland enlarges. This disorder is called goiter.

Function of Thyroxin:

Thyroxin increases the breakdown of food (oxidation) and release of energy in body. It is also responsible for the growth of body

Hypothyroidism:

Hypothyroidism is caused by the under-production of thyroxin it is characterized by low energy production in body and slowing down of heart-beat

Hyperthyroidism:

Hyperthyroidism is caused by over production of thyroxin Its symptoms are increase in energy production, increased heart-beat, frequent sweating and shivering of hands

Calcitonin:

The thyroid gland produces another hormone called calcitonin I decreases the level of calcium ions in blood and promotes the absorption of calcium from blood into bones

3. Parathyroid glands:

These are four glands situated on the posterior side of thyroid gland. They produce a hormone known as parathormone.

Function of Parathormone:

It increases the level of calcium ions in the blood. When there is increased production of parathormone, more than normal calcium, consequently the bones become brittle if there is deficiency in the production ... blood calcium level falls. It leads to tetany which affects the function of muscle

4. Adrenal glands:

Two adrenal glands are situated above kidneys. Each adrenal gland consists of two parts. The outer part is cortex and the inner part is medulla

Epinephrine or adrenaline:

Adrenal medulla secretes a hormone called epinephrine or adrenaline in response to stress.

Function of Epinephrine or adrenaline:

It prepares our body to overcome emergency situations Therefore, adrenaline is also termed as emergency hormone

Corticosteroids:

The adrenal cortex secretes many hormones called corticosteroids which maintain the balance of salts and water in blood

5. Pancreas:

Pancreas has two, functions. The major part of pancreas is a ducted (exocrine) gland. This portion secretes digestive enzymes, through a duct into the small intestine.

Islets of Langerhans:

Some portions of pancreas serve as ductless (endocrine) gland. This portion contains groups of endocrine cells referred to as islets of Langerhans. These islets secrete two hormones i.e. insulin and glucagon.

Glucagon:

Glucagon influences the liver to release glucose in blood and so the blood glucose concentration rises.

Insulin:

Insulin influences the liver to take excess glucose from blood and so the blood glucose concentration fall.

Diabetes mellitus:

If a person's pancreas does not make normal quantity of insulin the blood glucose concentration rises and we say that the person has diabetes mellitus Persons with diabetes have loss of body weight, weakening of muscles and tiredness. The disease can be controlled by insulin administration formerly, insulin

extracted from animals was used for this purpose. But now human insulin produced from bacteria through genetic engineering is available

6. Gonads:

Testes (Singular, testis) and ovaries are the male and female reproductive organs i.e. gonads. In addition to producing gametes, gonads also secrete hormones called sex hormones

Testosterone:

Testes secrete hormones e.g. testosterone, which is responsible for the development of male secondary sex characters such as growth of hair on face and coarseness of voice etc.

Estrogen and progesterone:

Ovaries secrete estrogen and progesterone, which are responsible for the development of female secondary characters such as the development of breast etc.

10. Describe negative feedback with reference to insulin and glucagon.

Ans. Negative feedback of Insulin and Glucagon:

In negative feedback the output of a process decreases or inhibits the process. This mechanism works to return a condition towards its non-value.

Example:

When the blood glucose concentration rises, pancreas secretes insulin decreases the blood glucose concentration. Decline in the blood glucose concentration to a normal set-point inhibits the secretion of insulin. Similarly, when blood glucose concentration drops below normal, pancreas secretes glucagon it raises the blood glucose concentration. In this case, rise in the blood glucose concentration to a normal set-point inhibits the secretion of glucagon in

other words, the blood glucose concentration (output) controls the process i.e. the secretion of insulin and glucagon.

11. Explain how adrenaline may be involved in exercise and emergency conditions?

Ans. The outer part is cortex and the inner part is medulla. Adrenal medulla secretes a hormone called epinephrine or adrenaline in response to stress. It prepares our body to overcome emergency situations. Therefore, adrenaline is also termed as 'emergency hormone. The adrenal cortex secretes many hormones called corticosteroids which maintain the balance of salts and water in blood.

12. Enlist the important symptoms and treatments of paralysis and epilepsy.

Ans. Paralysis:

Paralysis is the complete loss of function by one or more muscle groups. It is most often caused by damage to the central nervous system (brain or spinal cord). The damage may be due to stroke (rupture in a blood vessel of brain or spinal cord) blood clotting in these blood vessels, or poison produced by polio viruses. Patient may have weak paralysis throughout his/her body or have paralysis in one side of body. There may also be paralysis in the lower extremities or in all four limbs.

Treatment:

The knowledge of the composition and functioning of nervous system has helped man in the diagnosis and treatment of nervous disorders including paralysis and epilepsy. Man has discovered the areas of brain that receive information from different sense organs and the areas that send messages to

different effectors Such knowledge helps a lot in identifying the malfunctioning areas of brain.

Epilepsy:

Epilepsy is a nervous disorder in which there is abnormal and excessive discharge of nerve impulses in brain. It causes unprovoked seizures in patient. A seizure of epilepsy is a temporary abnormal state of brain marked by convulsions In younger people, epilepsy may be due to genetic or developmental causes in people over age 40 years, brain tumours are more likely to cause epilepsy Head trauma and central nervous system infections may cause epilepsy at any age.

Treatment:

There is no known cure of epilepsy but medicines can control seizures Patients of epilepsy have to take medicines daily for the treatment as well as prevention of seizures. These are termed "anticonvulsant" or antiepileptic" drugs.

During a seizure attack, objects should never be placed in a patient's mouth as it can result in serious injury. It is possible that the patient will bite his/her own tongue.