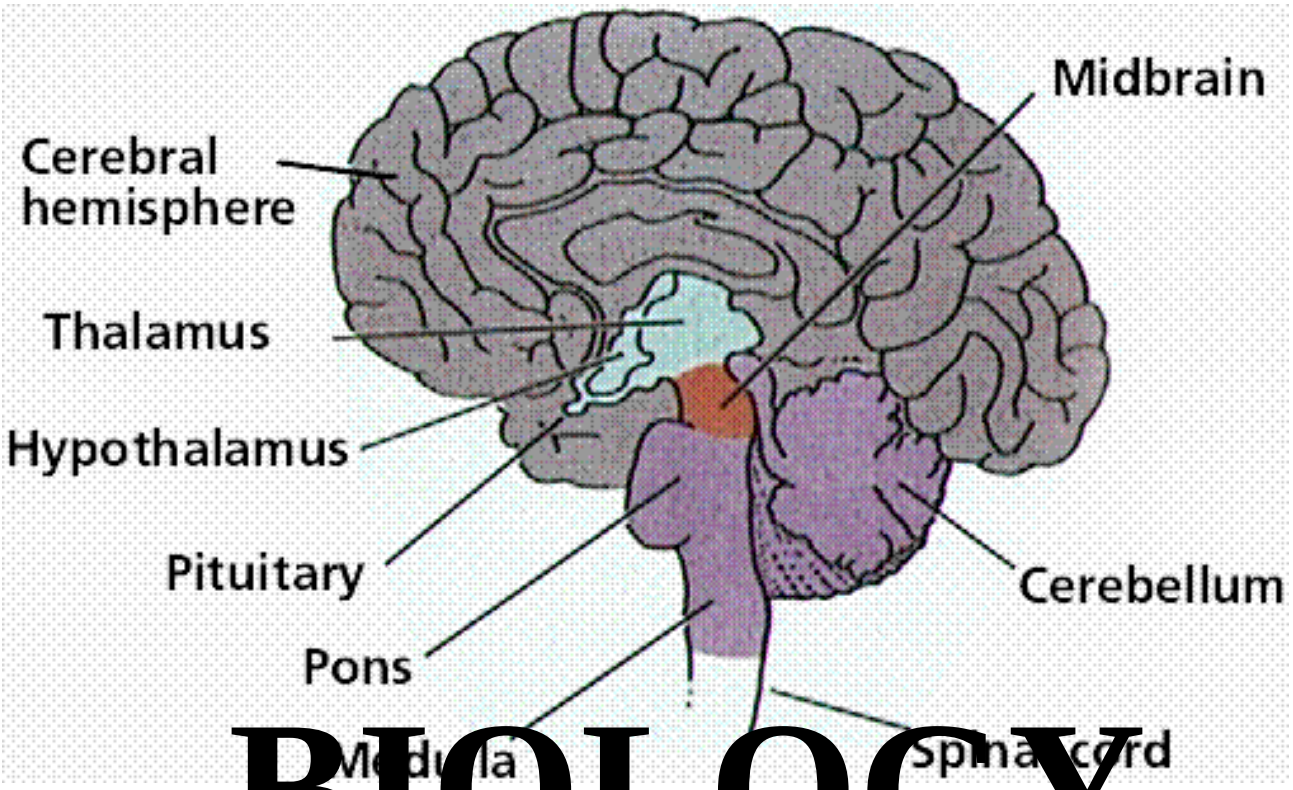


BIOLOGY

FOR

GENERAL SECONDARY CERTIFICATE

Unit (I)
Chapter (5)
Sensitivity (Irritability) in Livings

Sensitivity (Irritability) in Livings

Sensitivity is one of the functions done by a living organism to maintain its life. Sensitivity in animals is more obvious than that in plants.

Importance of sensitivity:

1. Sensitivity is essential for adjustment:

The surrounding environment is full of various natural factors and forces:
Sounds may be low or high.
Light differs in its intensity.
The atmospheric temperature may be very high or very low.
We receive such different stimuli through special sense organs such as ears, eyes, skin…. Then we perceive them, and respond to them in an appropriate way. Thus, in noisy conditions we move away, in bright light we close our eyes, at high temperatures we sweat to cool the body, and in low temperatures we shiver, which generates enough heat energy to keep our body temperature constant.
Sensitivity also includes the response to the internal stimuli. In the case of hunger, the response is to eat. We drink as a response to thirst.
Sensitivity starts with the reception of the external or the internal stimuli, the perception of them, and ends with the appropriate response in order to adjust the body to its environment. Sensitivity exists in all livings from unicellular to Man.

2. Sensitivity is essential for coordination:

Each of the various body systems is specialized for a certain function. In Man, the digestive system is specialized for digestion, the circulatory system for circulation, the respiratory system for respiration and so on. Each system does not perform its function separately. They are very closely linked and dependent of each other. Any change in the function of one system affects the others.
During muscular exercises:
- The muscles need more food and Oxygen.
- The breathing rate increases.
- The heart beats faster.
- A great volume of oxygenated blood is sent to the muscles.
- The skin is activated to excrete more sweat, to get rid of the excess heat and wastes.
There should be a type of coordination between the different body organs and systems, so each organ serves the conditions of the other organs, and adjust itself accordingly. Different body organs and systems work as one unit. This is achieved by a network of widely spread nerves in the body, and the different nerve centres.

So, its obvious that the importance of sensitivity is the production of coordination between the different body organs and systems, and between the body and its environment.

Sensitivity in plants

1) Response to touch and darkness:

If you touch a Mimosa leaflet, its petiole soon droops as if it has wilted. Other neighboring petioles soon follow, till the effect is seen in all leaflets.

In the day time, the leaflets are held in a horizontal position. At night, the leaflets hang downwards and fold their upper surfaces (undergoing sleep movement)

Explanation of the movement:

These movements can be explained according to cell turgidity. As Mimosa leaves are compound, and pinnate, each has a primary rachis which carries at its end four secondary rachises. Each secondary rachis carries two rows of leaflets. At the base of each primary and secondary rachis, and also at the base of each leaflets, there is a swollen structure called a pulvinus.

When the leaflet is touched or at night, the primary rachis hangs downwards, the secondary ones become depressed and so the upper surfaces of the opposing leaflets become folded together. The pulvini act as joints in these movements, where the lower surfaces shrink when being touched, as the cell walls of the lower half of each pulvinus are more sensitive. This leads to water diffusing to the neighboring tissues and hence the leaflet drop. When the stimulus is removed, the cells regain their turgidity and the leaflets open once more.

2) Tropism:

The growth of roots and stems depends on many factors such as light, humidity, and gravity, when these factors are exerted on the sides of the stem or roots in an unequal form, curvature results. This curvature is called tropism.

Types of tropism:

A. Positive and negative phototropism:

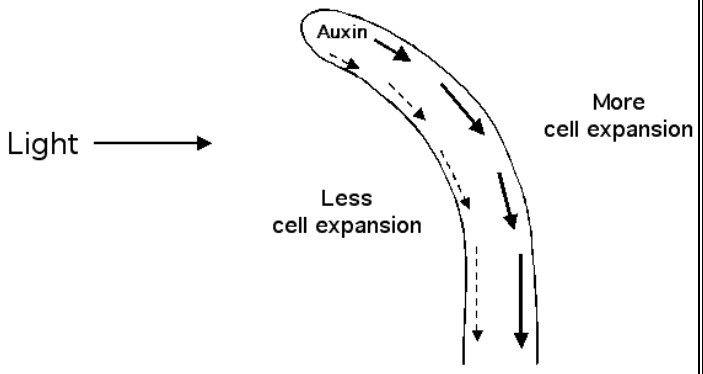
Experiment:

1. Place a straight seedling on a cork disc floating on the surface of a beaker half-filled with water.

2. Put the beaker in a light-proof box with a circular hole at one of its sides, to admit light.

3. Leave it for few days.

A coleoptile tip growing toward the light



Observation:

The stem inclines towards the source of light, while the roots incline away from it.

Conclusion:

Tropism is due to the unequal growth rates at the two sides in both the root and the stem. The side of the stem away from light grows more rapidly, while in case of the roots the opposite occurs.

Explanation of phototropism:

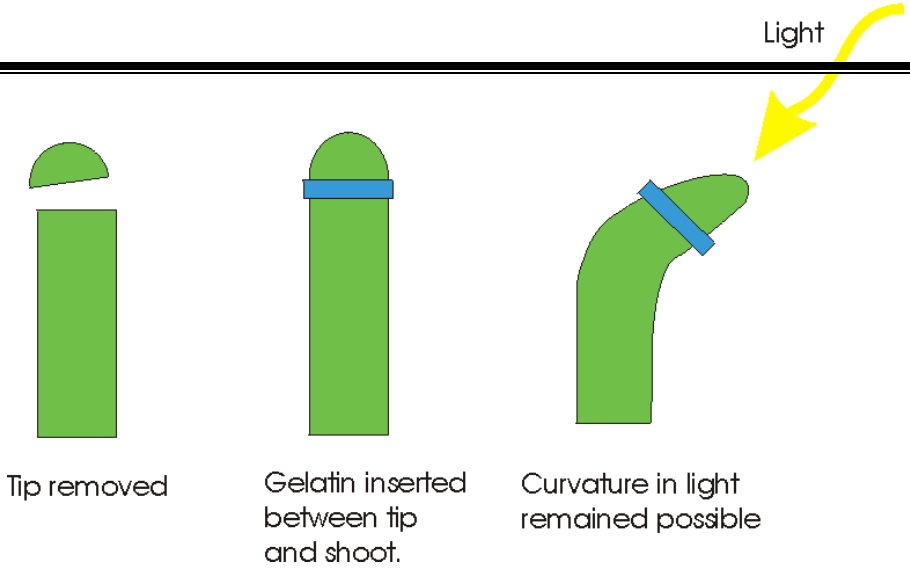
Boysen Jensen found that:

1. Oat (Avena) coleoptile lose its ability to bend towards light, if the tip is cut off (1-2 mm of the tip).

2. This ability is restored if the decapitated tip is returned or fixed again to the tip with gelatin.

3. If the tip is separated from the remaining coleoptile with mica sheet, there will be no curvature.

The indicates that the tip of the coleoptile synthesizes chemical substances, that diffuse through gelatin, and affect the growth. It can not pass through mica sheet. These chemicals are termed Auxins, the main one is known to be Indole-acetic acid (IAA). Curvature towards light is the result of the unequal growth of the two sides which is due to the unequal concentration of auxins on the two sides of the coleoptile.



Went experiment to prove the validity of Boysen Jensen explanation:

1. He exposed an Oat coleoptile to unidirectional illumination.
2. He cuts off the tip and placed it on two Agar blocks separated by a metallic sheet.
3. He measured the concentration of auxins in each block.

Observation:

He found that a great amount of auxins accumulated in the Agar block next to the side of the tip away from light.

Conclusion:

Auxins move from the side facing light to the far (darkened) side.
Went found that these blocks of Agar will produce curvature if they are placed on decapitated coleoptiles which are not subjected to light. Auxins move away from light to the non-illuminated side. This leads to elongation of cells on that side thus curvature towards light occurs. The stem is known to be positively phototropic.

The difference in the behavior of the root and stem towards unidirectional illumination:

Accumulation of auxins in the dark side of the root produces an opposite effect, elongation is inhibited in the dark side, while the illuminated side continues to grow. The root curvature tends away from light, and the root is known to be negatively phototropic. The concentration of auxins required for the elongation of root cells is

less than that required for the elongation of stem cells. So, the increase in auxins concentration will inhibit cell-elongation in roots, whereas it activates cell-elongation in the stem.

B. Geotropism:

Geotropism is the response of plant parts to the external stimulus of gravity, where they move away or towards the stimulus. The root grows vertically downwards, while the stem grows upwards.

It was believed that roots grow downwards in order to avoid light and seek nutrients, but this is incorrect.

Experiment:

Hang a potted plant upside for a time.

Observation:

The root grows downwards away from the soil, and towards gravity, while the shoot grows away from gravity.

Conclusion:

Growth of the root downwards is a positive response to gravity, while the growth of the stem upwards is a negative response to gravity.

Experiment:

1. Germinate a number of seeds in a soil moistened with water.

Observation:

1. The plumules grow vertically upwards, while the radicles grow downwards.

Experiment:

2. Place one seedling on its side so that the radicle and the plumule are horizontal.

3. Leave it for several days.

Observation:

2. The plumule grows upwards and the radicle grow downwards.

Conclusion:

The stems are negatively geotropic, while the roots are positively geotropic. Curvature is due to the variation in growth rates at the two sides of the plant organ, which is due to the unequal distribution of auxins.

Herman's experiment:

Herman's experiment showed that:

1. The total amount of auxins in the tips of Oat coleoptiles does not change by altering the position from the vertical to the horizontal.

2. There is a great variation in auxins distribution:

a. In the vertical position: Equal amounts of auxins move into the two halves from the tip.

b. In the horizontal position: More auxins diffuse into the lower half.

This variation in auxins distribution leads to unequal growth rates of the two sides of the Oat coleoptile.

Conclusion:

In the normal vertical position:

Auxins are equally distributed in the tips of both root and stem. As a result, the stem grows vertically upwards, while the root grows downwards.

In the horizontal position:

Auxins accumulate in the lower side of both the root and the stem:

In the stem: Auxins activate the cells of the lower which elongate more than those of the upper side. So, the tip of the stem curves upwards against gravity.

In the root: Auxins inhibit the elongation of the cells of the lower side, so the cells of the upper side elongate more. So, the root bends downwards.

The increase in auxins concentration –to a certain extend- inhibits the elongation of the root cells, while it activates those of the stem.

C. Hydrotropism:

Experiment:

1. Germinate a number of seeds in two glass troughs containing equal quantities of dry soil.

2. Spray water regularly in the first trough, but only at the sides in the second trough.

3. Leave the two troughs for several days.

Observation:

Roots in the first trough grow straight down, while roots in the second trough grow towards the water at the sides of the trough.

Conclusion:

In the first trough (A):

The roots grow vertically due to the equal distribution of water in the soil around the roots.

In the second trough (B):

Curvature of roots is due to the presence of water at the sides and its absence in the middle. Auxins accumulate in the side of the root facing water, and inhibits the elongation of cells of that side, while the cells of the far side continue their normal growth which leads to curvature of the root towards water.

The root is known to be positively hydrotropic.

Nervous & Hormonal Coordination

The nervous and the endocrine glands systems control all the body activities in Man. The two systems together organize the functions of different body organs and control the relation between Man and his environment. The hypothalamus which is a part of the brain is considered as a link between the nervous system and the endocrine glands system:

The function of the nervous system:

The function of the nervous system is to receive information from different sense organs, and sending electro-chemical signals to different body organs in the form of nerve impulses. Accordingly, the nervous system controls activities and reflexes as muscles contraction and relaxation, and glands secretions.

The function of the endocrine glands system:

The function of the endocrine glands system is the control of the metabolic processes through the secretion of chemical substances called hormones which are released to the blood to reach their target organ.

The main difference between the two systems is in the rapidity of actions and responses. The responses in case of the nervous system are very rapid, while the responses in case of the endocrine glands system are slow, but last for prolonged period.

The Nervous System and Sensation in Man

In addition to the control of all functions of Human's body systems, the nervous system receives information in the form of external and internal stimuli through receptor systems, and then gives the proper responses. It keeps the Human body in a continuous direct communication with his external and internal environments. This helps, with the endocrine glands system, to keep the internal conditions of the body in an ideal, constant, and balanced state (Homeostasis). The nervous system is highly developed in vertebrates, especially in Man.

The nervous system is divided into:

1. The central nervous system:

That includes the brain and the spinal cord.

2. The peripheral nervous system:

That includes the cranial nerves and the spinal nerves.

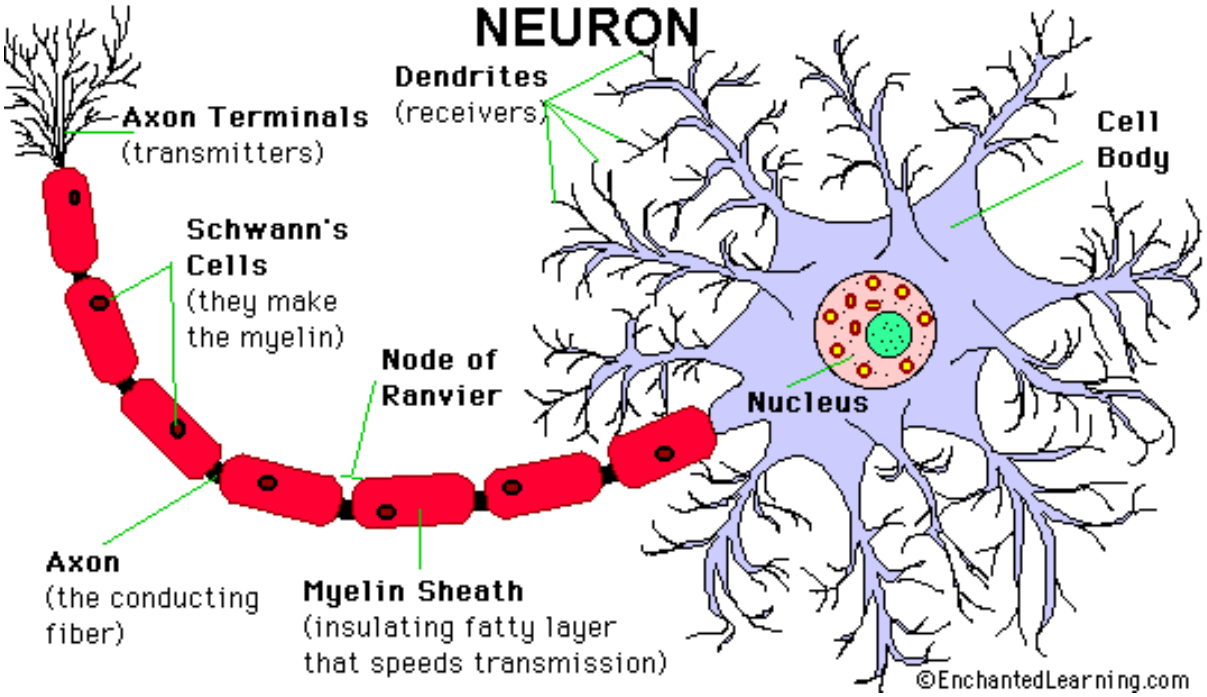
3. Autonomic nervous system:

That controls the involuntary muscles and the glands. This system is sub-divided into:
a. Sympathetic nervous system: The nerve fibers of this system originate from the thoracic and lumbar region (segments) of the spinal cord.

b. Parasympathetic nervous system: The nerve fibers of this system originate from the brain and the sacral region of the spinal cord.

The nerve cell (neuron):

The nerve cell is the unit of structure of the nervous system. Its small in size and cannot be recognized by the naked eye. It consists of:



1. The cell body:

It contains rounded nucleus surrounded by cytoplasm (neuroplasm). The neuroplasm contains neurofilaments and Nissl granules (which are unique for nerve cells). Nissl granules are considered as a stored food for the cell. The neuroplasm contains all other cell's organelles as mitochondria, and Golgi bodies, except the centrioles (That is why neurons cannot divide)

2. Cell processes:

a. Dendrites:

Dendrites are short processes which increase the surface area available to receive nerve impulses and through which most nerve impulses enter to the cell, while some of which enter to the cell through the cell body.

b. Axon:

It is a long cytoplasmic extension of the cell (may reach more than a meter in length) and usually known as the nerve fiber. In some nerve cells, the axon is surrounded by a sheath of lipid called myelin sheath secreted by special cells called Schawnn's cells. The outer cover of the axon (nerve fiber) is the neurolemma. The myelin sheath is not continuous around the axon but interrupted at certain points called nodes of Raniver. The conduction rate of verve impulses in myelinated axons (covered with myelin sheath) is much more rapid than in non-myelinated nerve fibers (axons) because the myelin sheath is an insulator.

Normally, the nerve impulse is propagated and conducted through the nerve cell in one direction only, from the dendrite to the nerve cell body to the axon, then to another next neuron (nerve cell) through a synapse. The axon ends in a group of branches called terminal arborizations.

Types of nerve cells:

According to the function, nerve cells are classified into three types:

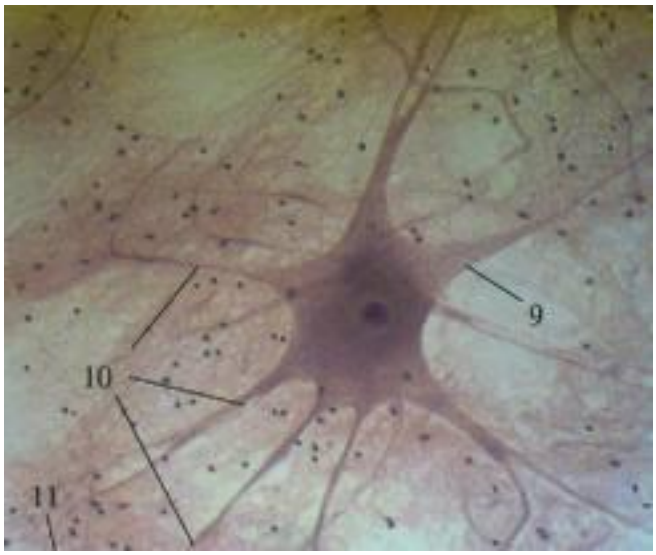
1. Sensory neurons: **Convey (transmit) impulses from receptors to the central nervous system.**

2. Motor neurons: **Convey impulses from the central nervous system to the effectors organs as muscles and glands.**

3. Connector (intermediate) neurons: **Relay impulses from sensory to motor neurons.**

Neuroglia:

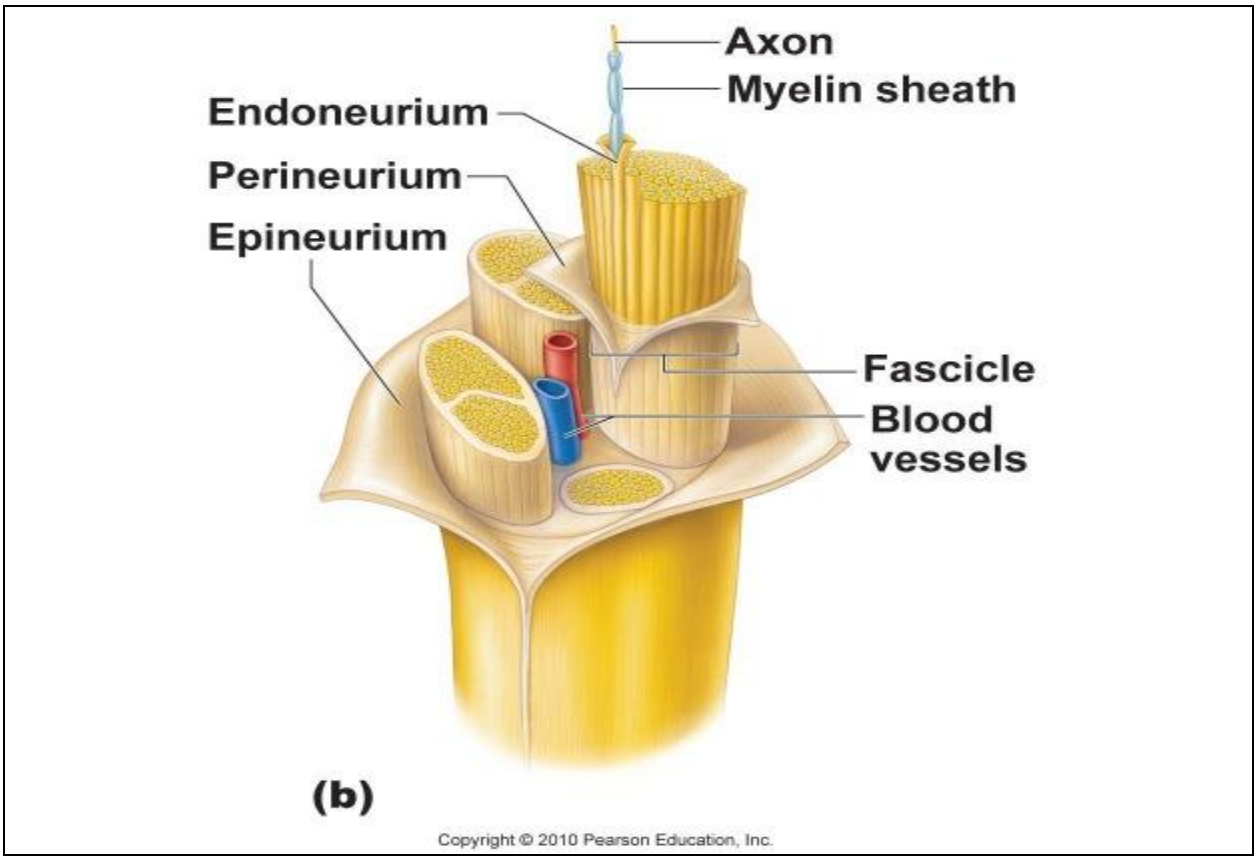
Another type of cells in the nervous system, have the ability to divide and perform the following functions:



1. They act as a connective tissue to support neurons.
2. They act as insulators between neurons.
3. Nutrition of the neurons.
4. Have a role in repair of injured parts of some neurons.

The structure of the nerve:

The nerve consists of a group of nerve bundles, each of which is surrounded by a connective tissue sheath. The whole nerve is surrounded by another connective tissue called epineurim which contains blood vessels. Each nerve bundle is formed of a group of nerve fibres (axons) and connected by supporting neuroglia cells (glial cells)



The nerve impulse:

The nerve impulse is the message transmitted through the nerves from sense organs (receptors) to the central nervous system, and from the latter to the effectors (responding) organs. It is an electrical phenomenon with a chemical nature (electro-chemical phenomenon). To understand the nature of the nerve impulse, we should study the nerve cells (neurons) during 4 different conditions:

http://faculty.irsc.edu/faculty/jschwartz/AP1%20Ch11.htm

1. The nerve cell at rest:

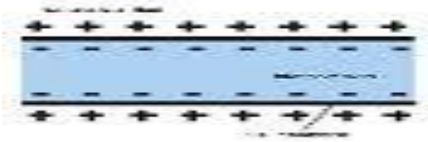
At rest, there is a difference in distribution and concentration of some ions outside and inside the nerve cell, as follows:

a. The concentration of positive Sodium ions (Na+) outside the cell is 10 up to 15 times higher than inside.

b. The concentration of positive Potassium ions (K+) inside the cell is 30 times higher than outside.

c. The concentration of negative ions as Chloride (Cl-) and protein ions are higher inside the cell.

This unequal distribution of ions results in the presence of an electrical potential difference between outside and inside the cell surface that equals – 70 millivolt (mV). The membrane of the nerve cell during this resting condition is said to be polarized.



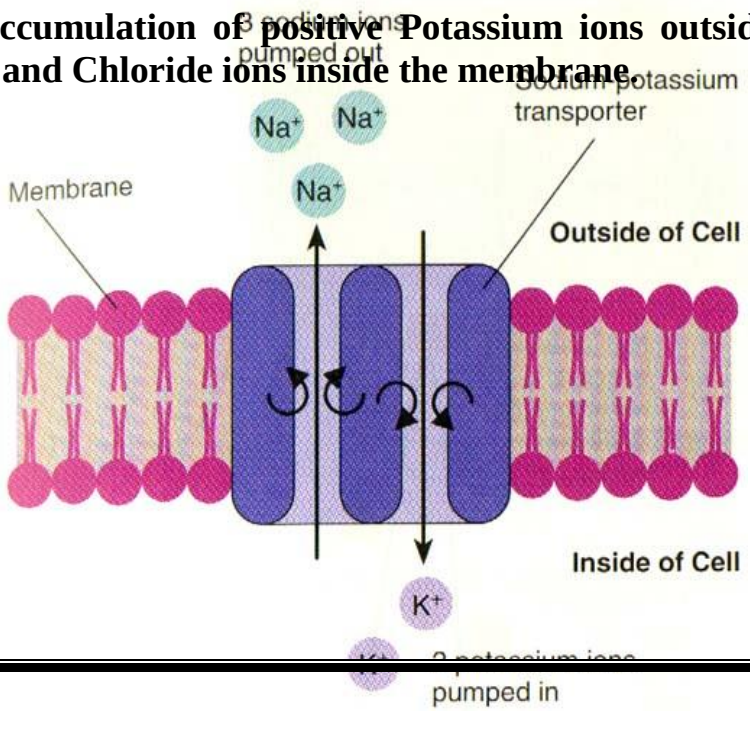
This state of polarization is a result of:

1. The selective permeability of the membrane (at rest), as the membrane of the nerve cell is 40 times permeable for Potassium ions (K+) (which diffuse from the inside to the outside of the membrane) than for Sodium ions (Na+) (which diffuse from outside to the inside of the membrane). This results in the accumulation of excess positive charges on the outer surface of the membrane.

2. Accumulation of high molecular weight protein ions in addition to Chloride ions which are negatively charged on the inner side of the membrane.

3. Sodium-Potassium pump (that pumps Sodium ions actively outside the membrane, and pumps Potassium ions actively inside the membrane) which plays a role in maintaining this ionic distribution.

Therefore, at rest there is an accumulation of positive Potassium ions outside the membrane, and negative protein and Chloride ions inside the membrane.



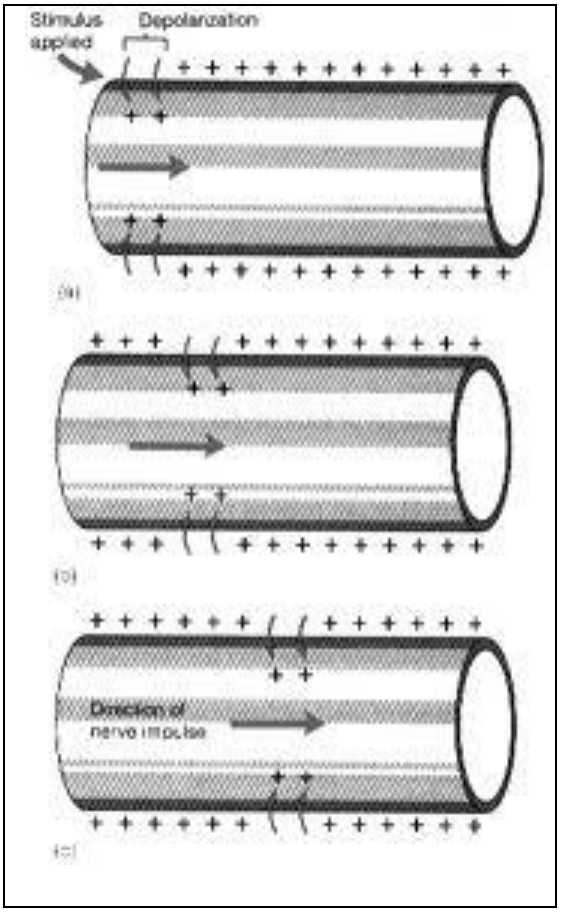
2. Changes in the nerve cell on stimulation:

The nerve cell is stimulated only when the stimulus is sufficient (strong enough). There are changes in permeability of the membrane in which:

a. The inflow of the positively charged Sodium ions exceeds the outflow of the positively charged Potassium ions through special channels in the membrane leading to accumulation of excess positive charges inside the membrane, i.e. reverse of the original polarity and the membrane potential becomes +40 mV. This new state is called depolarization.

3. Propagation of nerve impulse through the nerve fibres:

The depolarized (stimulated) point acts as a stimulus for the neighbouring points which when stimulated undergo the same previously mentioned changes, and the process is repeated along the nerve fiber.



4. How the nerve cell returns to its original state:

1. After the end of depolarization, the membrane becomes again permeable to Potassium ions and impermeable to Sodium ions.

2. Continuous out flow of Potassium ions leads again to accumulation of excess positive ions outside the membrane and the membrane is said to be repolarized, i.e. returns to the resting state again (-70 mV). The response of the nerve cell to the stimulus is called action potential (110 mV) which includes a state of depolarization followed by repolarization.

The nerve impulse is the propagation of the action potential along the nerve cell (fiber)

3. Refractory period: from 0.001 up to 0.003 second following the stimulation, the nerve cell will not respond to any stimulus whatever its strength. This period is called the refractory period. During this period, the membrane of the nerve cell regains its physiological properties to be ready to respond to new stimulus and to transmit another nerve impulse.

Properties of the nerve impulse:

1. The speed of propagation of the nerve impulse along a nerve fibre depends on its diameter:

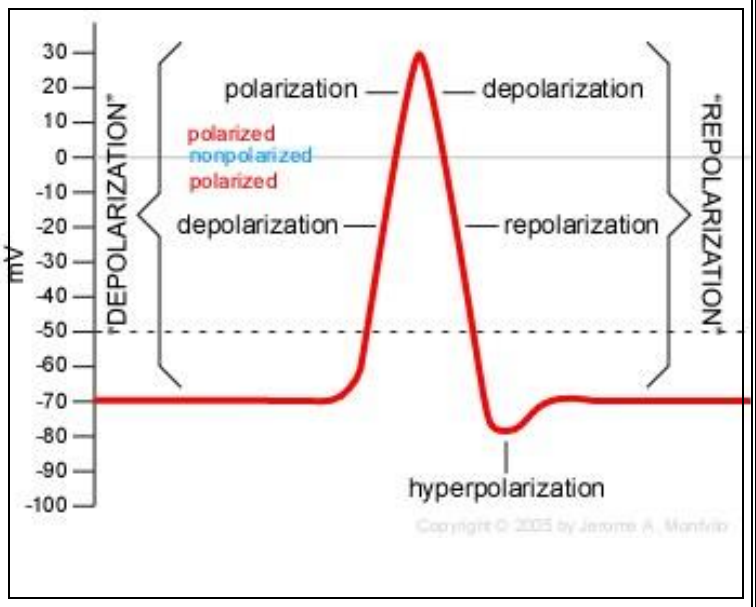
- It reaches 140 meters/second in thick (myelinated) nerve fibres.

- It reaches 12 meters/second in thin (non-myelinated) nerve fibres.

2. Stimulation of the nerve (and also muscles) obeys the all or none law, which means that the nerve responds maximumly or does not respond at all; the sufficient stimulus produces a maximum response (generation of a nerve impulse), after which, the response does not increase whatever the stimulus strength increases. Weak stimuli are insufficient to produce an action potential (nerve impulse).

The synapse:

The synapse is site between the terminal branches (arborizations) of the axon of one neuron and the dendrites of the next neuron.



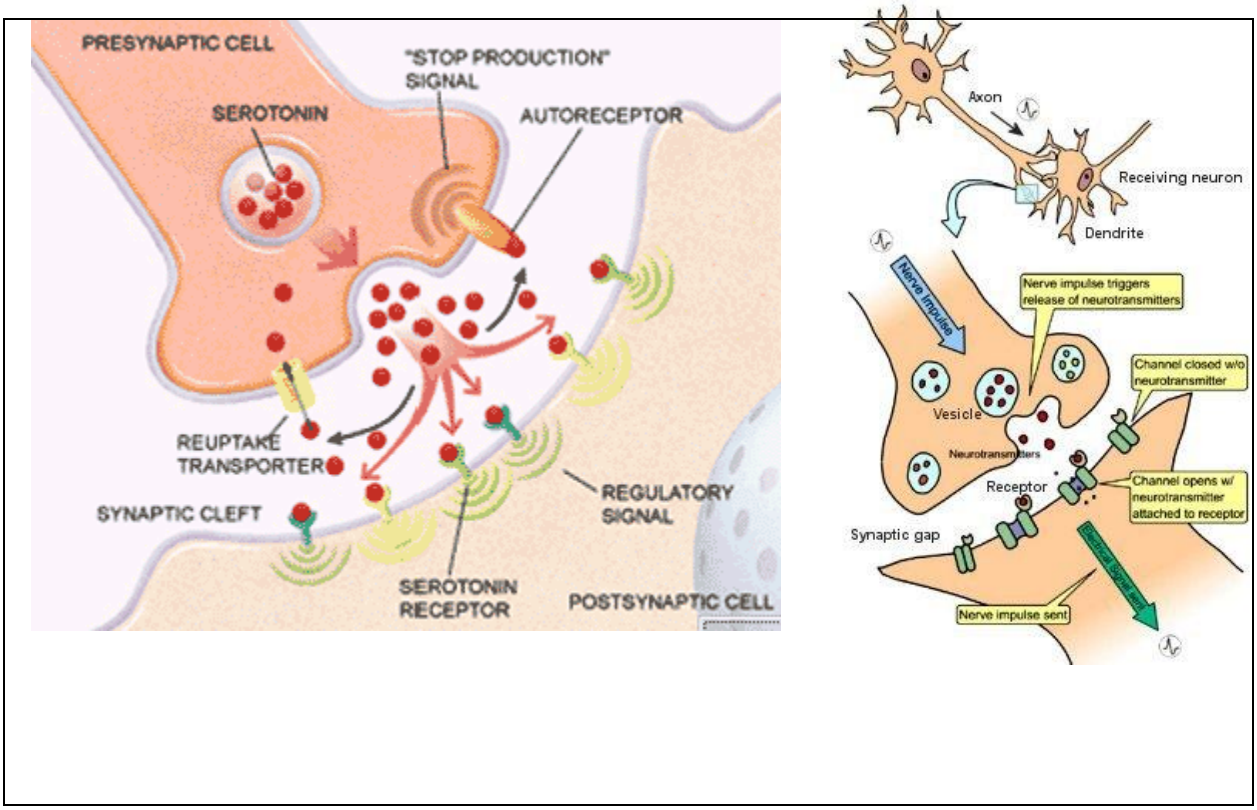
Types of synapses:

1. Synapse between two neurons.

2. Synapse between a neuron and a muscle fibre.

3. Synapse between a neuron and gland cells.

The structure of the synapse:



The terminal branches of the axon end with swellings called buttons which are very close to the dendrites of the next neuron. In between, there is a very narrow space called the synaptic cleft. This cleft separates a presynaptic membrane (axon) from a postsynaptic membrane (dendrite). The synaptic button contains small vesicles (sacs) called synaptic vesicles, filled with chemical transmitters as Acetylcholine and Noradrenalin which play an important role in synaptic transmission of the nerve impulse from one neuron to the next.

Mechanism of transmitting a nerve impulse across a synapse:

1. Arrival of a nerve impulse to the buttons leads to entrance of Calcium ions by the action of a Calcium pump in the cell membrane. The inflow of Calcium ions leads to rupture of the synaptic vesicles and the release of the chemical transmitters.
2. The chemical transmitters cross the synaptic cleft and reach the membrane of the dendrites of the next neuron.
3. Binding of the chemical transmitters to special receptors on the membrane of the dendrites leads to stimulation of these points and changes the permeability of the membrane to Sodium and Potassium ions. These results in depolarization and the production of an action potential (nerve impulse) as mentioned before. This nerve impulse is propagated through the body, then the axon of the neuron, then to a next synapse, and so on.
4. Acetylcholine (chemical transmitter) is destroyed (after performing its function) under the effect of an enzyme called cholinesterase to terminate its action. Then, the postsynaptic membrane (dendrite) returns to the resting state again.

The Central Nervous System (C.N.S)

A) The brain:

The brain constitutes the major part of the central nervous system, with a weight that ranges from 350 grams at birth, and reaches 1400 grams in adults. The brain occupies a bony space called the brain case or the cranium (a part of the skull).
The brain is surrounded by three membranes called the meningies which are responsible for the protection and nutrition of the brain cells. These membranes are:
1. The dura mater: The membrane which lines the skull.
2. The pia mater: The membrane which is in direct contact and adheres to the brain.
3. The arachnoid: The membrane which is in between the other two membranes and contains a transparent fluid to protect the brain from mechanical trauma.

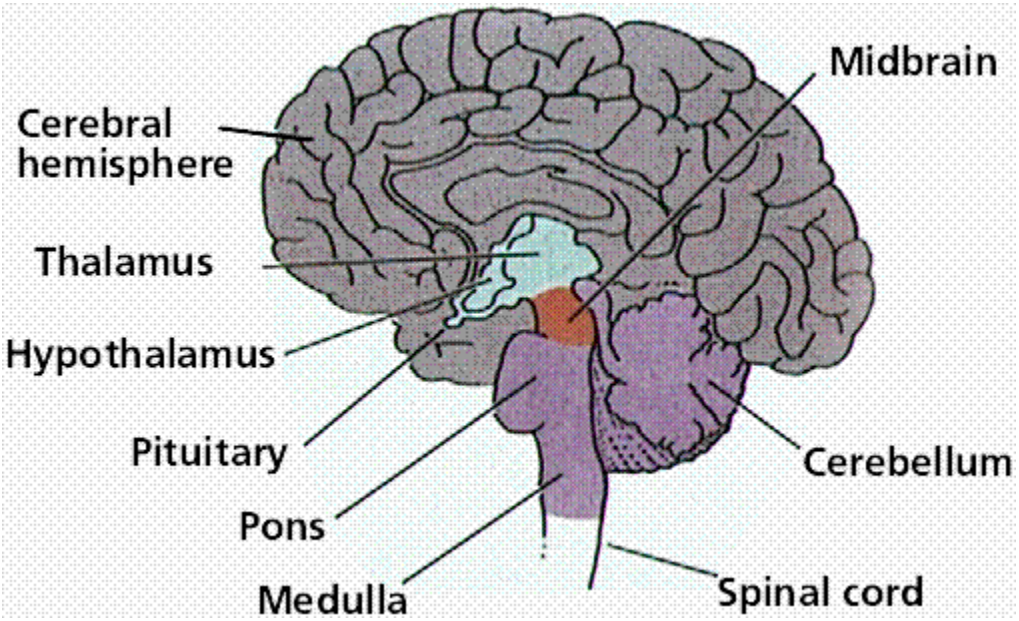
The brain consists of three main parts:

1. Forebrain: **It includes the two cerebral hemispheres (the brain cortex), thalamus, and hypothalamus.**

2. Midbrain.

3. Hindbrain: **It includes the cerebellum, pons Varolii, and medulla oblongata.**

12 pairs of cranial nerves originate from the brain.



The structure and the function of each part of the brain:

1. Forebrain:

a. Two cerebral hemispheres (the cerebral cortex):

Two big lobes separated by a big fissure and attached to each other through a big bundle of nerve fibres. Each lobe is called a cerebral hemisphere. The cortex of each lobe (the cerebral cortex) is characterized by the presence of depressions of different depths called fissures and grooves, and in between there are folds.

Each cerebral hemisphere is divided into many lobes. These lobes are:

1. Frontal lobe. **2. Parietal lobe.**

3. Temporal lobe. **4. Occipital lobe.**

In addition, there is a 5th. Lobe covered by the frontal and parietal lobes.

The functions of the cerebral cortex:

a. The frontal lobe contains centers of voluntary movements (motor centers), center of memory and speech.

b. The parietal lobe controls many sensory functions and contains centers of sensation of heat, cold, pressure, and touch (somatic sensations from the skin)

c. The occipital lobe contains centers of vision.

d. The temporal lobe contains centers of smell and also centers of speech.

b. Thalamus:

Thalamus is an important center for coordination of different sensations (except the smell).

c. Hypothalamus:

Hypothalamus controls different reflexes and contains centers of hunger, satiety, thirst, and body temperature regulation, in addition to center of sleep.

2. Midbrain:

The smallest part of the brain, and represents a connection between the forebrain and the hindbrain, and contains centers of equilibrium and centers related to hearing and vision. In addition, it regulates many reflexes as those related to hearing.

3. Hindbrain:

It consists of:

a. Cerebellum:

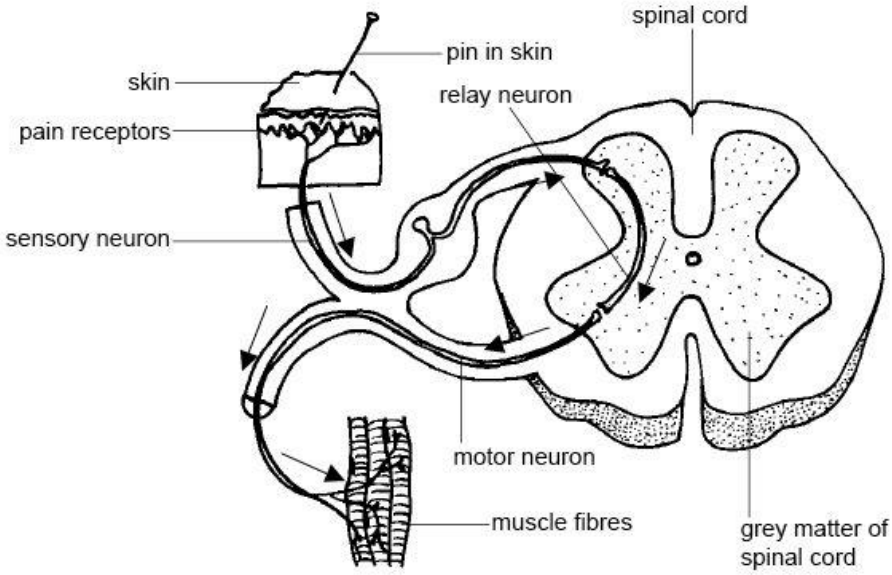
That is situated in the posterior region and consists of three lobes. The main function is to keep balance and equilibrium of the body in association with the inner ear and muscles.

b. Pons Varolii and medulla oblongata:

That performs the following functions:

1. Transmission of nerve impulses between the spinal cord and different brain regions.

2. The medulla oblongata contains vital centers as those of respiration, swallowing, vomiting, cough, sneezing, and blood vessels.



B) The spinal cord:

The spinal cord exists inside a canal in the vertebral column called the neural canal. It extends from the medulla oblongata in the form of a cylindrical cord about 45 cm long. The spinal cord is hollow containing a central canal and covered by meningies as those surrounding the brain (dura mater, pia mater, and arachnoid). Along the midline there are two fissures (dorsal, and ventral) which divide the spinal cord incompletely into two halves. The spinal cord consists of 2 layers; outer white matter formed of nerve fibers and inner grey matter formed of nerve cells with their dendrites and neuroglia. Gray matter is H-shaped with two dorsal horns and two ventral horns.

Functions of the spinal cord:

The grey matter is the main center of reflex action as it contains thousands of reflex arcs. The white matter transmits impulses from different parts to the brain and vice versa.

Spinal nerves:

There are 31 pairs of spinal nerves that originate as successive pairs from both sides of the spinal cord as follows:

1. **Eight pairs of cervical nerves.**
2. **Twelve pairs of thoracic nerves.**
3. **Five pairs of lumbar nerves.**
4. **Five pairs of sacral nerves.**
5. **One pair of coccigeal nerves.**

Each spinal nerve originates from the spinal cord by two roots (dorsal, and ventral). The dorsal root carries sensory nerve fibers that transmit impulses from the receptors to the spinal cord and then to the brain. The ventral root carries motor nerve fibers that transmit impulses to the responding organs (effectors) as muscles and glands.

Peripheral Nervous System

This system consists of a network of nerves distributed all over the body connecting the central nervous system to all parts of the body. These nerves are of two types:

1) Cranial nerves:

12 pairs connected to the brain:

a. Some cranial nerves are purely sensory containing sensory fibres only and carry impulses from receptors to the brain.

b. Others are purely motor containing motor fibres only and carry impulses from the brain to the effecter organs.

c. Some cranial nerves are mixed with both motor and sensory fibres.

2) Spinal nerves:

31 pairs connected to the spinal cord and these are mixed nerves with both sensory and motor fibres.

The reflex action (reflex arc):

The reflex action is the unit of nervous activity. The majority of the nervous functions can be analyzed to a group of reflex actions at different levels.

The reflex action consists of at least two nerve cells (neurons), one sensory (afferent) and the other is motor (efferent).

The majority of reflex actions consist of 5 elements:

1. Receptor (sense organ)
2. Afferent (sensory) neuron.
3. Connector (intermediate) neuron.
4. Efferent (motor) neuron.
5. Effector (responding) organ.

Reflex actions are of two types:

a. Voluntary (somatic) reflex:

In which effector organ is a voluntary (skeletal) muscle.

b. Involuntary (autonomic) reflex:

In which the effector organ is an involuntary muscle, a gland or the heart muscle.

Autonomic Nervous System

This system regulates the different involuntary activities as contraction of cardiac muscle and smooth (involuntary) muscles in addition to secretion of glands.

The autonomic nervous system includes two divisions:

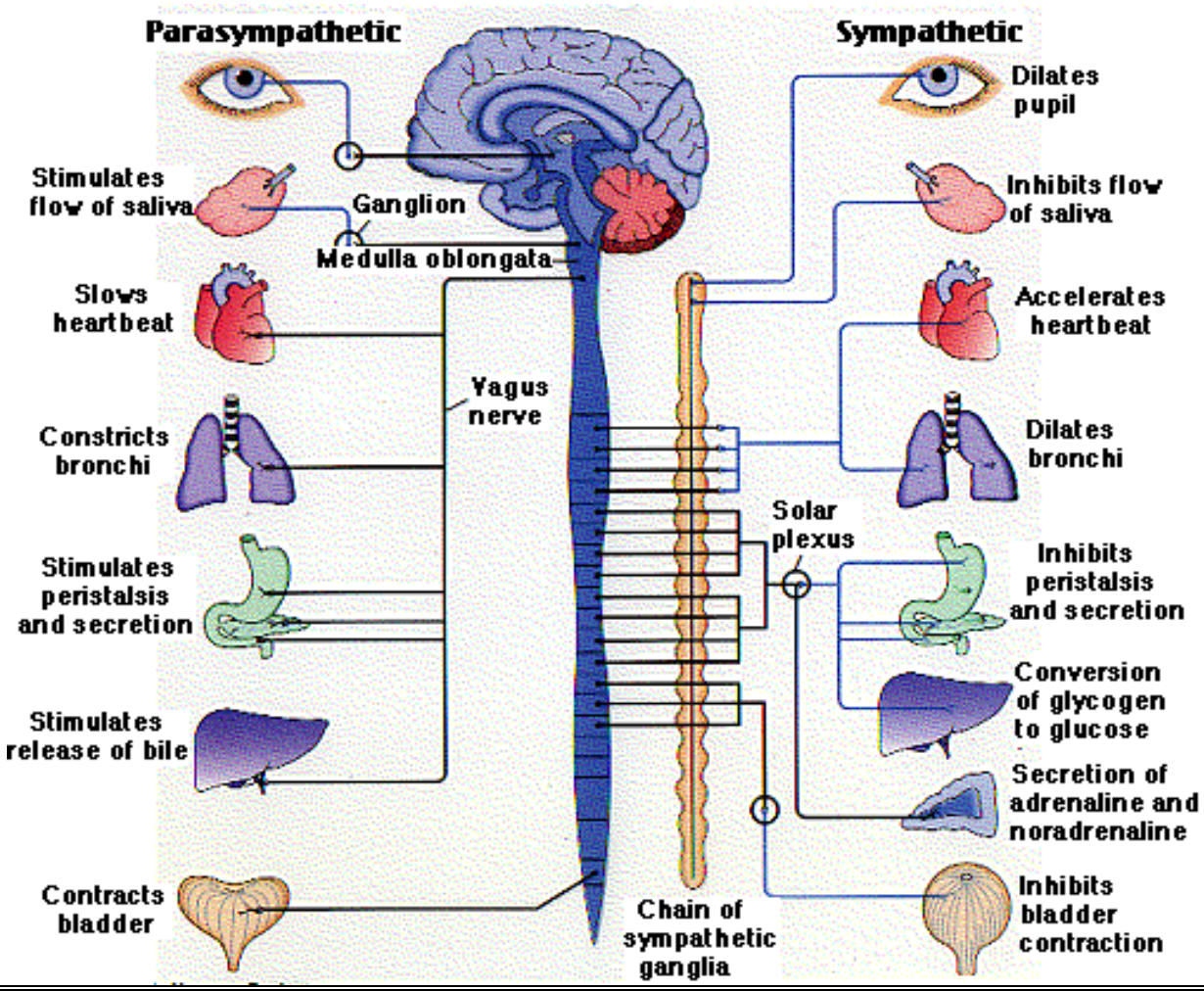
1) Sympathetic nervous system:

The nerve fibres of this system originate form the thoracic and lumbar regions of the spinal cord. This system is important as an emergency system which enables the body to confront emergency situations.

2) Parasympathetic nervous system:

The nerve fibers of this system arise from the brain (stem) and the sacral region of the spinal cord. Most of the internal parts of the body receive nerve fibres related to both sympathetic and parasympathetic systems and in most cases the effort of one system antagonize the effect of the other.

The following table summarizes the effects of the sympathetic and parasympathetic system on some parts of the body:



Effector organ	Effect of Sympathetic system	Effect of Parasympathetic system
Heart	Increases heart beat rate and force of contraction.	Decreases heart beat rate and force of contraction.
Blood vessels	Vaso constriction of blood vessels of skin, viscera, salivary glands, brain, external genetalia and lungs.	Vaso relaxation of salivary glands and external genetalia.
Alimentary canal	Relaxation of the wall of stomach, intestine and colon.	Contraction of the wall of stomach, intestine and colon.
Respiratory system	Dilatation (relaxation) of bronchioles and decreases secretions.	Constriction (contraction) of bronchioles and increases secretions.
Urinary bladder	Relaxation of the wall.	Contraction of the wall.
Eyes	Dilatation of the eye pupils.	Constriction of the eye pupils.
Glands:		
1. Salivary	Stimulates small quantity of secretion.	Stimulates large quantity of secretion.
2. Gastric (of the stomach)	Inhibits secretion.	Stimulates secretion.
3. Liver	Break down of Glycogen and increases Glucose level in blood.	No Parasympathetic fibres.
4. Pancreas	Inhibits secretion of enzymes.	Stimulates secretion of enzymes.
5. Adrenal medulla	Stimulates the secretion of the adrenaline hormone (epinephrine) which increases blood pressure, increases heart beat rate, and increases the Glucose level in the blood.	No Parasympathetic fibres.

Effects of autonomic nervous system on some parts of the body

Revision VII

Sensitivity in Livings.

1. Give the scientific term that represents each of the following:

a. Two main functions for sensitivity in livings. (----------)
b. Two types of stimuli to which sensitivity systems can pick up and respond to. (----------)
c. The movement in which the leaflets of Mimosa hang downwards and fold their upper surfaces at night. (----------)
d. One of the main Auxins present in plants. (----------)
e. The response of plant parts to the external stimulus of gravity. (----------)
f. The response of plant parts to the external stimulus of light. (----------)
g. The response of plant parts to the external stimulus of humidity. (----------)
h. The two systems that organize the functions of different body organs and control the relation between Man and his environment. (----------)
i. The link between the nervous system and the endocrine glands system. (----------)
j. The structures that receive information in the form of external and internal stimuli. (----------)
k. The unit of structure of the nervous system. (----------)
l. The system that includes the brain and the spinal cord. (----------)
m. The system That includes the cranial nerves and the spinal nerves. (----------)
n. The system that controls the involuntary muscles and the glands. (----------)
o. The system that its nerve fibres originate from the thoracic and lumbar region (segments) of the spinal cord. (----------)
p. The system that its nerve fibres originate from the brain and the sacral region of the spinal cord. (----------)
q. The response of the nerve cell to the stimulus which includes a state of depolarization followed by repolarization. (----------)
r. The period during which, the membrane of the nerve cell regains its physiological properties to be ready to respond to new stimulus. (----------)

2. Give reasons for:

a. Leaflets of Mimosa plant hang downwards and fold their upper surfaces.
b. The plant stem is +ve phototropic.
c. The plant root is –ve phototropic.
d. The plant stem is –ve geotropic.
e. The plant root is +ve geotropic.
g. The plant root is +ve hydrotropic.
h. Neurons cannot divide.

i. Dendrites are very important structures in the nerve cells.
j. The conduction rate of nerve impulses through myelinated axons is rapid.
k. The nerve cell membrane is said to be polarized at rest.
l. Polarization of the nerve cell membrane at rest.
m. The speed of propagation of the nerve impulse along a nerve fibre depends on its diameter.
n. Stimulation of the nerve obeys the all or none law.

3. Draw a labeled diagram to represent:

a. The structure of Mimosa leaf.
b. The structure of the nerve cell in Man.
c. The structure of a synapse.
d. The structure of the nerve.

4. What do you know about:

a. Tropism.
b. Phototropism in plants.
c. Geotropism in plants.
d. Hydrotropism in plants.
e. Sleep movement in Mimosa.
f. The sympathetic nervous system.
g. The parasympathetic nervous system.
h. The structure of the synapse.
i. The neuroglia.
j. Polarization of the nerve fibre membrane at rest.
k. The structure of the nerve.
l. Refractory period.
m. The nerve impulse.
n. The action potential.
O. The reflex action (reflex arc) , its elements, and its two types.

5. Describe the experiment, and draw the apparatus used to represent:

a. The occurrence of phototropism.
b. The occurrence of geotropism.
c. The occurrence of hydrotropism.
d. Went experiment to prove the validity of Boyson Jensen explanation about phototropism.
f. Herman's experiment to explain geotropism, and its results.

6. Compare between:

a. The behavior of the stem and that of the root towards unidirectional illumination.
b. Action of high concentrations of Auxins in plant cells in both the root and the stem.
c. Horizontally growing coleoptile, and vertically growing one in terms of Auxins distribution, and the direction of growth in each.
d. Myelinated nerve fibres, and non-myelinated nerve fibres.
e. The sensory neurons, the motor neurons, and the connector neurons.
f. The sensory nerves, the motor nerves, and the mixed nerves.
g. The three meningies.
h. Sympathetic nervous system and parasympathetic nervous system.
i. Exterceptors and Interceptors.

7. Explain the movement of Mimosa leaflets as a response to touch or at darkness.

8. Describe in details the structure of Mimosa leaf with drawing a labeled diagram.

9. How did Boyson Jensen explain the curvature of Avena coleoptile towards unidirectional illumination.

10. Mention the main functions of the nervous system and the endocrine glands system. How does each perform its role? and describe the main differences between the two in performing these functions.

11. Mention the site, the structure, and the importance of each of the following structures:

a. The pulvini.
b. The hypothalamus.
c. Neuroplasm.
d. Nissl granules.
e. Dendrites.
f. Neurolemma.
g. Nodes of Raniver.
h. Terminal arborizations.
i. Neuroglia.
j. Epineurim
k. The meningies

12. Describe the physiological state of the nerve cells membrane during:

a. Rest.
b. On being stimulated.
c. Propagation of nerve impulse through it.
d. Repolarization.

13. Mention the types of synapses, and describe the mechanism of transmitting a nerve impulse across a synapse.

14. Describe the structure and the function of each of the following parts of the brain:

a. Two cerebral hemispheres.
b. Thalamus.
c. Hypothalamus.
d. Midbrain.
e. Cerebellum.
f. Cerebellum.
g. The spinal cord.
h. Spinal nerves.

15. Describe the structure and the function of the autonomic nervous system.

16. Describe the different types of sensory receptors according to the type of stimuli or the energy to which the receptor is sensitive.