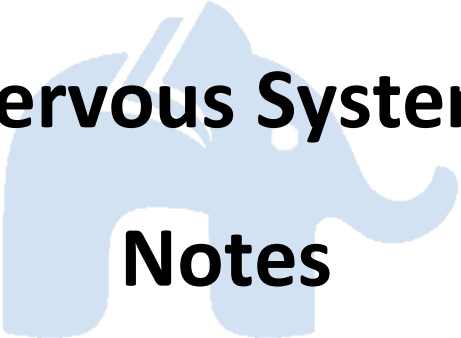


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BIOLOGY

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Nervous System Notes

Coordination

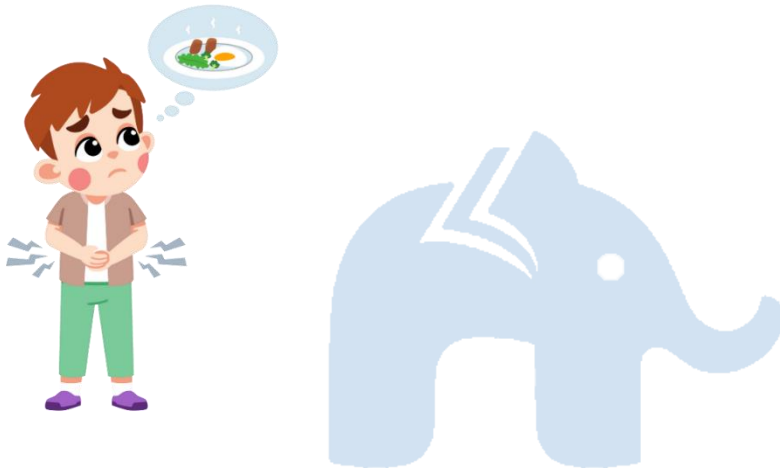
Interaction of life processes of a living being as per the needs of the body internally or externally is called coordination.

Types of Coordination

- Nervous Coordination
- Chemical Coordination

Nervous Coordination

- Coordination by nervous system (Brain, Spinal cord, nerves and sense organs)



- When you feel hungry, you eat food. This also involves a number of coordinated activities.

Chemical Coordination

- Brought about by hormones (Chemical Messengers)

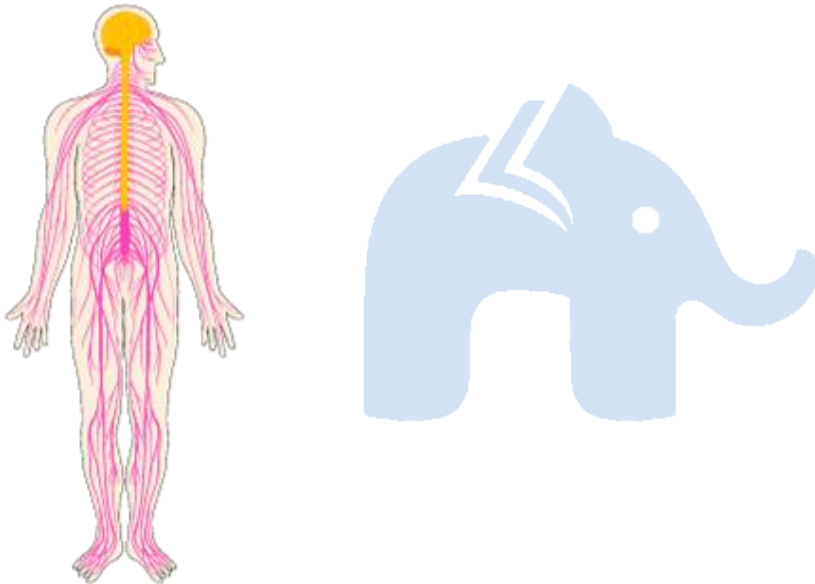


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- In an emergency situation, if you are suddenly attacked by a bull in the street, you will try to run away. This needs a certain chemical to be released into the blood to provide you an extra energy.

Functions of Nervous System

- Keep us informed about outside world
- Enable us to remember, think and reason
- Controls and harmonises all voluntary muscular activities
- Regulates involuntary activities



Neuron – Structural and Functional Unit of Nervous System

- Special cells called Nerve cells or Neurons

Main parts of Neurons:

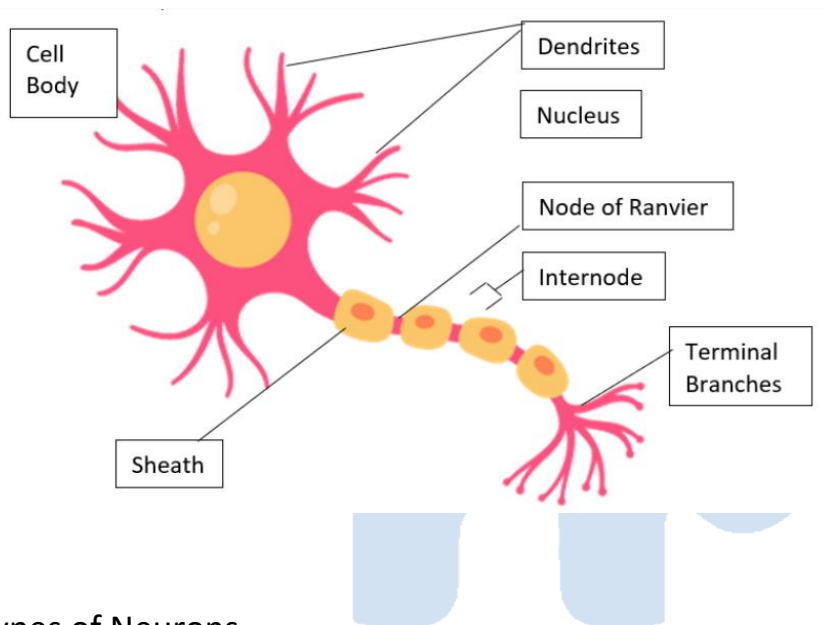
- Cyton
- Axon

1. Main cell body is called cyton, which gives out a large number of fine processes (dendrites).

- Cell body contains nucleus.

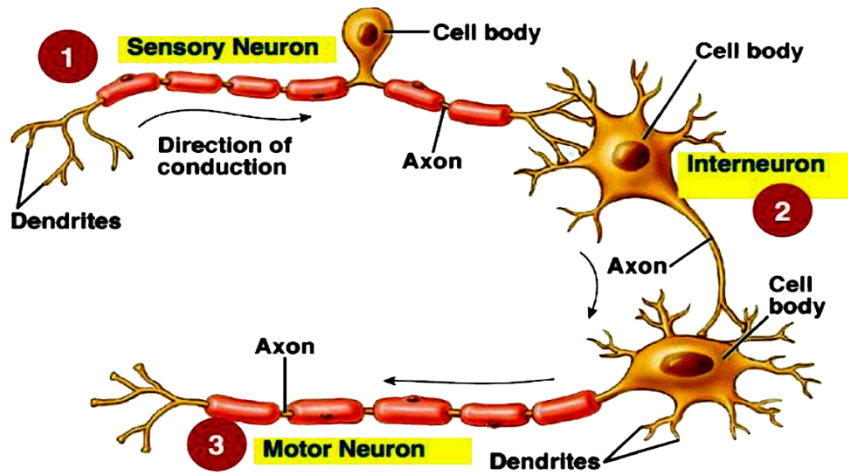
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- Dendrites are the cytoplasmic extensions of the cell body.
2. They receive messages from organs and transmit them through the cell body into axon which transmits the message.
 3. End of the axon terminates in a number of branches called terminal branches.
 4. Individual neurons make contact through these terminal processes.
 5. The space between the neurons is called as SYNAPSE.



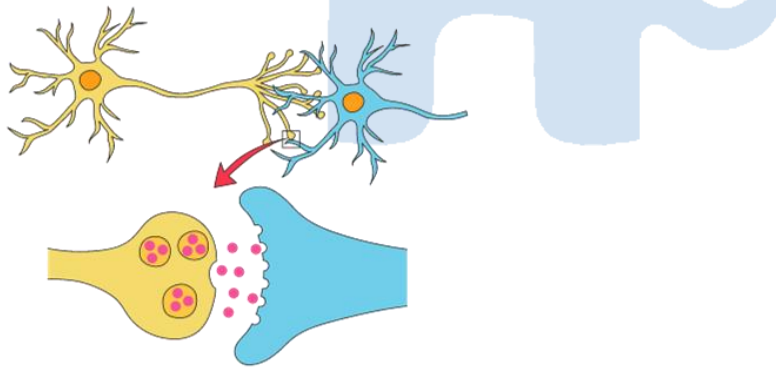
Types of Neurons

- Sensory Neurons – Carry impulse from the sensory cells or sense organs to the spinal cord or brain.
- Motor Neurons – Carry messages from the brain or spinal cord to the effector glands or muscles.
- Association Neurons – Lie in the spinal cord and transmit impulses from one neuron to another.



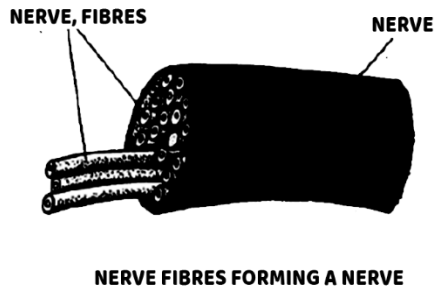
Synapse

- Terminal branches of the axon of one neuron lie very close to the dendrites of another neuron.
- *A synapse is a small junction used for communication between two neurons.*



Nerve

A nerve is formed of a bundle of axons (nerve fibres) enclosed in a tubular medullary sheath.



1. Sensory Nerve – Contains only sensory nerves e.g. optic nerve
2. Motor Nerve – Contains only motor neurons e.g. nerves of the muscles of the eyeball
3. Mixed Nerve – carries both sensory and motor nerves e.g. nerve which goes to the tongue.

Human Nervous System

1. Central Nervous System – Consists of brain and spinal cord. Brain lies within the skull, spinal cord lies within the vertebral column.
2. Peripheral Nervous System – Consists of nerves passing to and from the central nervous system, reaches to all parts of the body.
 - Somatic Nervous System
 - Autonomic Nervous System



Fig. Yellow colour indicates CNS, Pink indicates PNS.

Somatic Nervous System

- Connects the CNS to the organs, muscles and skin
- Carries motor and sensory information both to and from CNS

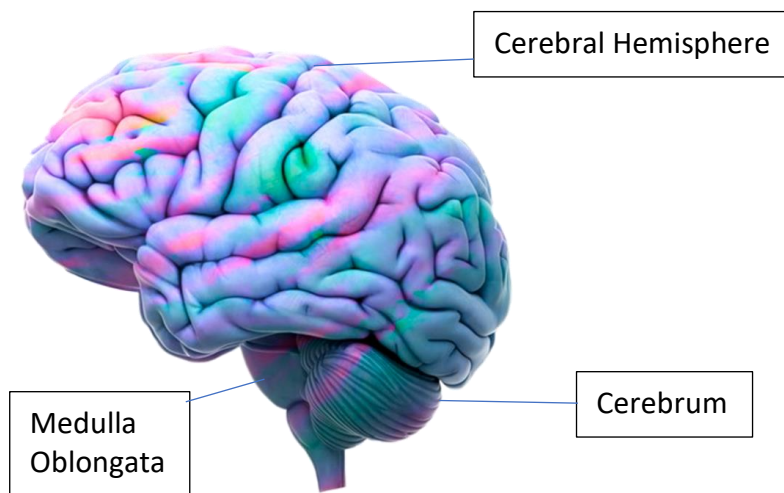
Autonomic Nervous System

- Acts largely unconsciously
- Controls involuntary bodily activities such as heart rate, dilation and constriction of blood vessels

Central Nervous System

Brain

- Most complex and important organs of our body
- An adult human brain weighs about 1.5 kg
- Contained in bony structure called SKULL /CRANIUM
- Enclosed in three protective membranes MENINGES, separated by CSF



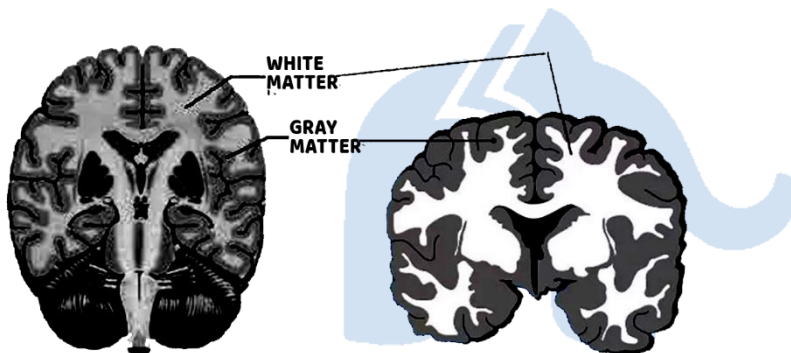
Three main parts:

1. Cerebrum

2. Cerebellum
3. Medulla Oblongata

1. Cerebrum

- Largest portion of brain
- 2 cerebral hemispheres of brain
- Outer surface of hemisphere is folded with ridges & grooves which increase the surface of brain so as to accommodate a large number of neurons.
- Outer (grey) matter – large number of 9 Billion neurons
- Inner (white) matter – mainly consists of axons



Functions:

- Seat of intelligence
- Consciousness
- Will power
- Controls voluntary activities

2. Cerebellum

Much smaller and is located under cerebrum

Functions:

- Balance of the body

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- Coordinate muscular activities
- Cerebellum get affected by alcohol.

3. Medulla Oblongata

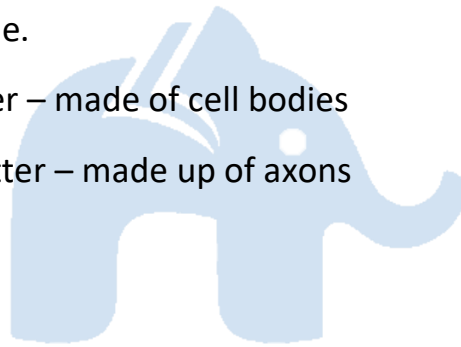
Lowest part of the brain and continues down spinal cord

Functions:

- Control activities of internal organs
- Beating of heart, breathing, peristalsis of alimentary canal

Spinal Cord

- Extends from medulla of the brain and runs down almost through whole length of backbone.
- Inner (grey) matter – made of cell bodies
- Outer (white) matter – made up of axons



Functions:

1. Control reflexes below the neck
2. Conduct messages from the skin and muscles of the brain
3. Conduct commands from brain to muscles of the trunk and limbs

Peripheral Nervous System

- Consists of nerves which connect the CNS to all parts of the body

Somatic nervous system

1. Cranial nerves (arising from brain)
2. Spinal nerves (arising from spinal cord)

Responsible for relaying sensations from body to CNS and sending commands from CNS to skeletal muscles.

Cranial Nerves

- Emerge from brain
- 12 pairs of cranial nerves
- Sensory nerves: olfactory, optic and auditory
- Motor nerves: ones going to eye muscles
- Mixed nerves: going to and coming from face and tongue

Spinal Nerves

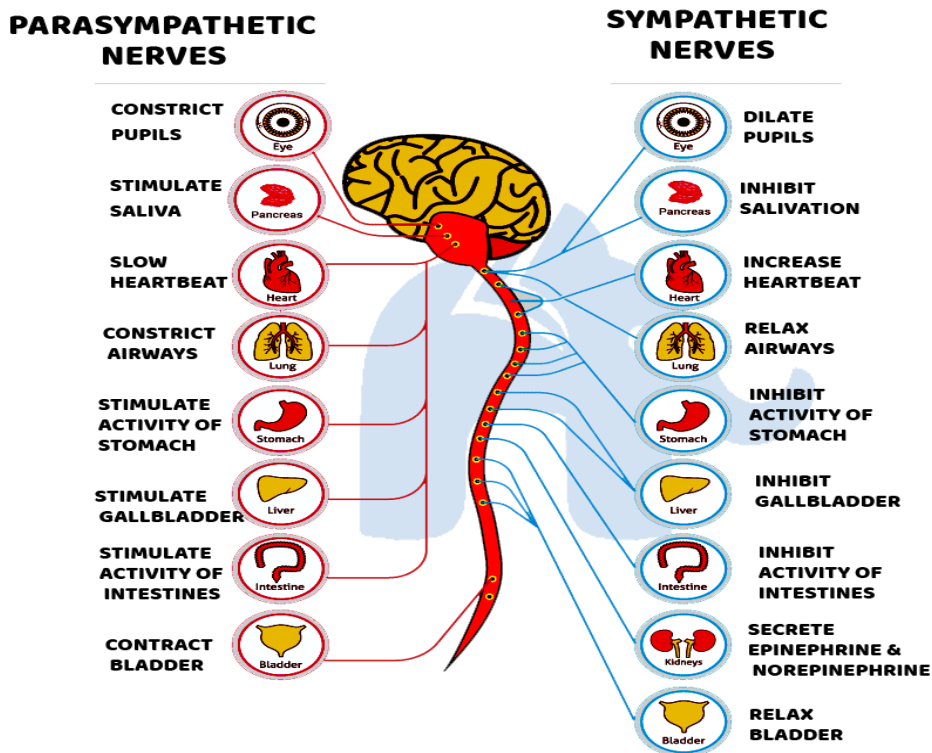
- Arise from spinal cord
- 31 pairs of spinal nerves
- *Typical spinal nerve is mixed nerve, consisting of*
- Sensory nerve
- Motor nerve

Autonomic nervous system

- Consists of chain of ganglia and nerves found on either side of spinal cord.
- System acts unconsciously
- Regulates the involuntary activities of our internal organs

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- Operates two systems
 1. Sympathetic system
 2. Parasympathetic system
- These two are antagonistic in their action.
- Example: SNS dilates the pupil of the eyes, constricts vessels of skin and accelerates heart rate.
- PNS is responsible for constriction of pupil of eyes, dilation of blood vessels and slowing of heart rate.



Nervous system acts in two ways:

1. Voluntary actions – occurs knowingly e.g. watching tv, picking up an apple
2. Involuntary actions – occurs unknowingly e.g. flushing of tears, instantaneous withdrawal of hand

Reflex Action

- *Peripheral nervous system and spinal cord together control certain actions where brain is not involved.*
- Like instantaneously removing hand while touching a hot plate, without thinking. Such actions are reflex actions.
- *Reflex action is a quick, immediate and automatic response to a stimulus without the involvement of the brain.*
- *Reflex arc is the shortest pathway of the nerve impulse from a receptor to the effector which makes a reflex action possible.*

Pathway of a Reflex arc

Stimulus → Receptor Organ → Sensory Nerve → Spinal Cord → Motor Nerve
→ Muscle Action

Types of Reflexes with Examples

- Natural (inborn) reflex
 - No previous experience or learning is required
 - E.g. blinking and watering of eyes, coughing, sneezing
 - Salivation when hungry provides functional efficiency.
- Conditioned (acquired) reflex
 - Develops from learning during lifetime learning or experiences
 - Watering of mouth at the sight of a favourite food.
 - Typing on the keyboard of computer

Terminology in Nervous system Functioning

- Stimulus: Any change in environment resulting in change in body activity

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- Response: Activity of body due to stimulus
- Impulse: wave of electrical disturbance that runs through nerves
- Receptors: Sense organs which receive stimulus
- Effector: Any muscle or gland where response occurs

