



SSC

Stenographer Grade C&D

STAFF SELECTION COMMISSION (SSC)

Volume - 2

Science



Index

S.No.	Chapter	P.No.
1.	Chemistry <ul style="list-style-type: none">• States of Matter• Solids• Liquids• Gas• Cause of different physical states of matters• Other states of matter• Atomic Structure• Electron• Protons• Neutrons• Properties of electrons, protons, and neutrons• Distribution of Electrons in Distinct Shells• Valency• Atomic Number (Z)• Mass Number (A)• Isotopes• Isobars• Metals, Non-metals and Metalloids• Metallurgical Principles and methods• Steps in Metallurgical Process• Principles of Metallurgy• Important ores and alloys• Acids, Bases and Salts• Acids• Bases• Strength of Acid and Bases• Universal Indicator• Salts• Equations of Acids, Bases and Salts:• Concept of pH and Buffers• Buffers• Important Drugs (Synthetic and Natural)• Antacids• Antihistamines• Neurologically Active Drugs: Tranquilizers• Antioxidants and Preservatives• Insecticides• Pesticides• Fungicides	1

	<ul style="list-style-type: none"> • Herbicides • Fertilizers • Binders and Sweeteners • Carbon and its compounds • Radioactivity - concepts and applications 	
2.	Physics <ul style="list-style-type: none"> • Gravitation • Human eye and Defects • Heat • Magnetism • Sound • Electro-Magnetic Waves • Nuclear fission and Fusion 	33
3.	Biology <ul style="list-style-type: none"> • Excretory System • Respiratory System • Circulatory System • Digestive systems in Human beings • Blood groups • Composition and Functions of blood • Hormones • Genetics and Lifestyle Diseases • Human diseases- Communicable and Non-communicable • Endemic, Epidemic, Pandemic their Diagnosis and Control • Immunisation and Vaccination • Drugs and Alcohol abuse • Plant parts and their functions • Plant nutrition • Plant growth regulators • Sexual and asexual reproduction in plants 	47

3

Chapter

Biology

The Cell

- **Simplest and most basic unit** of life.
- **Discovered:** Robert Hooke (1665)
- All living things made up of cells- **structural, functional, and biological unit of life.**
- Has the **ability to duplicate itself** on its own.
- aka "**building blocks of life.**"

Cell Structure and its components

Cell Organelles

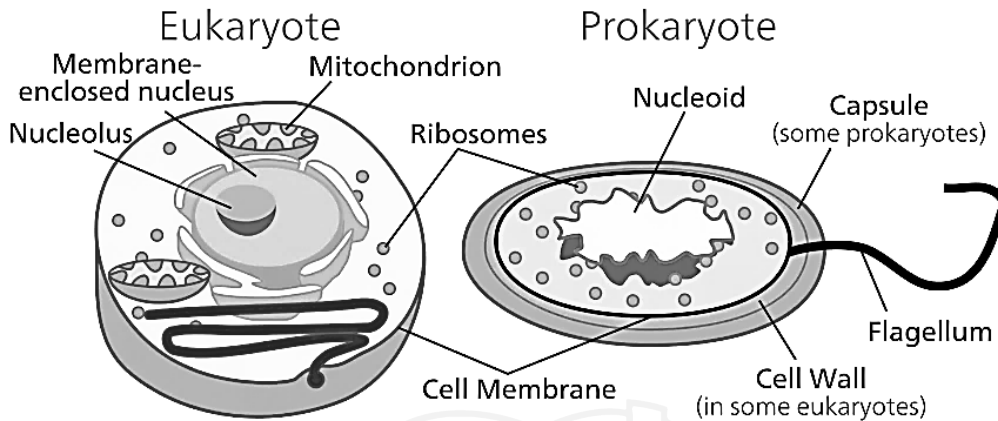
- Present within a cell & **perform certain specific functions to carry out life's processes.**

Plasma / Cell Membrane	<ul style="list-style-type: none">• Outermost covering of the cell• Separates contents of cell from its external environment.• A selectively permeable membrane as it allows entry and exit of some materials in and out of the cell.
Cell Wall	<ul style="list-style-type: none">• ONLY in plants• Outside the plasma membrane.• Mainly composed of cellulose.<ul style="list-style-type: none">○ Cellulose: A complex substance - provides structural strength to plants.
Cytoplasm	<ul style="list-style-type: none">• Jelly-like substance present between cell membrane & nucleus.• Fluid content inside plasma membrane.• Contains many specialised cell organelles (mitochondria, golgi bodies, ribosomes, etc)
Nucleus	<ul style="list-style-type: none">• Contains chromosomes that contain information for inheritance of features from parents to next generation in form of DNA• Plays a central role in cellular reproduction.• Nuclear membrane- a double-layered covering on nucleus.<ul style="list-style-type: none">○ Allows transfer of material from inside nucleus to its outside, i.e., to cytoplasm.
Nucleolus	<ul style="list-style-type: none">• Ribosome synthesis site regulating cellular activity and reproduction.
Gene	<ul style="list-style-type: none">• Unit of inheritance in living organisms.
Protoplasm	<ul style="list-style-type: none">• Entire content of a living cell [cytoplasm + nucleus].• aka living substance of the cell.
Chromosomes	<ul style="list-style-type: none">• Rod-shaped structures• Visible only when the cell is about to divide.• Contain information for inheritance of features from parents to next generation in the form of DNA (deoxyribo nucleic acid)• Composed of DNA and Protein.
DNA molecules	<ul style="list-style-type: none">• Contains information necessary for constructing and organising cells.• Functional segments of DNA - genes.

Vacuoles	<ul style="list-style-type: none"> ● Empty structure in cytoplasm ● Act as storage sacs for solid or liquid contents. ● Common in plant cells. ● Smaller in animal cells. ● Substances stored- amino acids, sugars, various organic acids and some proteins.
Endoplasmic Reticulum	<ul style="list-style-type: none"> ● A large network of membrane-bound tubes and sheets. ● 2 types : 1. Rough endoplasmic reticulum [RER] <ul style="list-style-type: none"> ○ Has ribosomes attached to its surface. ○ Ribosomes - sites of protein manufacture. 2. Smooth endoplasmic reticulum <ul style="list-style-type: none"> ○ Helps in the manufacture of fat molecules, or lipids, important for cell function. ○ Some of these proteins and lipids help in building the cell membrane k/a membrane biogenesis. ● Serve as channels for transport of materials between various regions of cytoplasm or between the cytoplasm and the nucleus. ● Also functions as a cytoplasmic framework providing a surface for some biochemical activities of cells.
Golgi Apparatus/ Complex	<ul style="list-style-type: none"> ● A system of membrane-bound vesicles arranged parallel to each other in stacks called cisterns. ● Packages and dispatches material synthesised near ER to various targets inside and outside the cell. ● Stores, modifies and packages products in vesicles. ● Involved in the formation of lysosomes. <ul style="list-style-type: none"> ○ Membrane-bound sacs filled with digestive enzymes. ○ Kind of waste disposal system of the cell. ○ Help to keep the cell clean by digesting any foreign material as well as worn-out cell organelles.
Mitochondria	<ul style="list-style-type: none"> ● Aka powerhouse of the cell. ● Energy required for various chemical activities is released by mitochondria in the form of ATP (Adenosine Triphosphate) molecules. ● 2 membranes: <ul style="list-style-type: none"> ○ Outer membrane- porous ○ Inner membrane - deeply folded. <ul style="list-style-type: none"> ■ Folds create a large surface area for ATP-generating chemical reactions.
ATP	<ul style="list-style-type: none"> ● aka energy currency of the cell. ● Body uses energy stored in ATP for making new chemical compounds and for mechanical work.
Ribosomes	<ul style="list-style-type: none"> ● Site of protein synthesis. ● Polyribosomes or Polysomes: Several ribosomes may attach to a single mRNA and form a chain. ● Prokaryotes- ribosomes are associated with the plasma membrane of the cell.
Cilia and Flagella	<ul style="list-style-type: none"> ● Hair-like outgrowths of the cell membrane. ● Cilia - small structures which work like oars, causing the movement of either the cell or the surrounding fluid. ● Flagella - comparatively longer and responsible for cell movement.

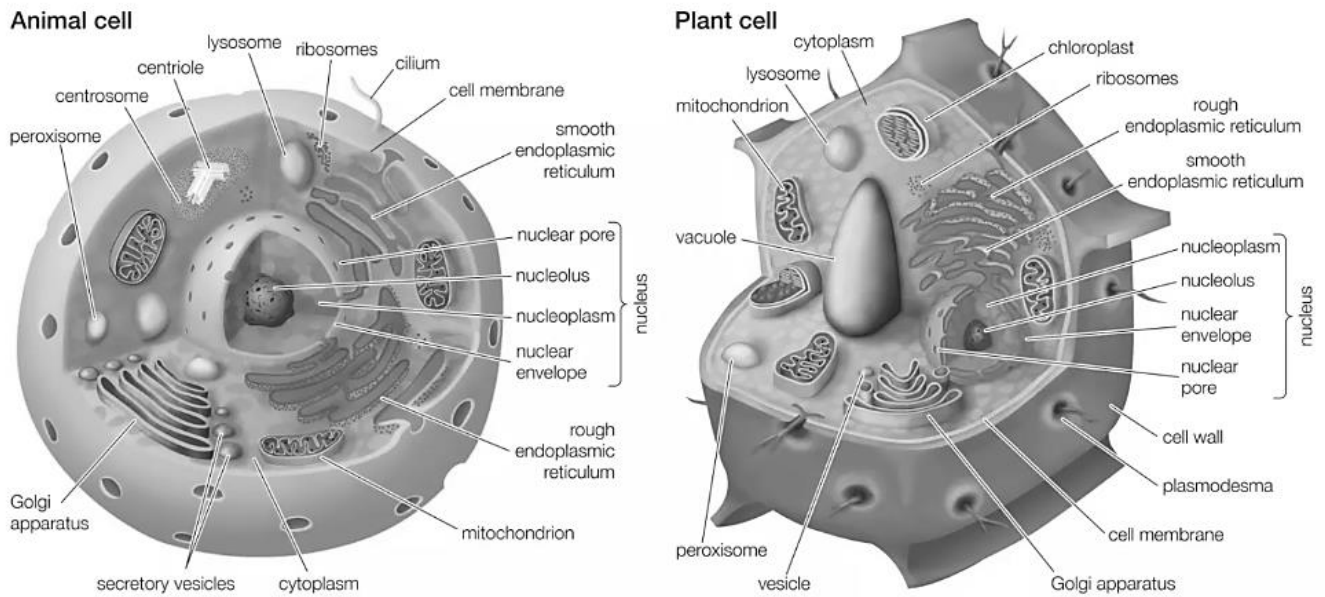
	<ul style="list-style-type: none"> ● Prokaryotic bacteria have flagella but structurally different from eukaryotic flagella.
Centrosome and Centrioles	<ul style="list-style-type: none"> ● Centrosome- an organelle usually containing 2 cylindrical structures called centrioles. ● Surrounded by amorphous pericentriolar materials. ● Both the centrioles in a centrosome lie perpendicular to each other

Types of Cells



Prokaryotic Cell	Eukaryotic Cell
● Primitive/undeveloped nucleus.	● Has true or developed nucleus
● Size - 0.2 - 2.0 micrometers	● Size- 10- 100 micrometers.
● Simpler in structure	● More complex
● Organelles not membrane-bound	● Organelles membrane bound & specific in function.
● DNA arranged in circular shape	● DNA linear in shape
● Cytoplasm present, but lacks in most cell organelles.	● Consists of both cytoplasm and organelles
● Cell wall present. ● Made of mucopeptide or peptidoglycan	● Usually, absence of cell wall here. ● Made of cellulose
● Cell division - binary fission, transduction, conjugation, and transformation	● Cell division - mitosis
● Mitochondria absent	● Mitochondria present.
● Endoplasmic reticulum not present.	● Endoplasmic reticulum present.
● Ribosome present	● Ribosome present
● Plasmids commonly found. ○ A small, circular, double-stranded DNA molecule distinct from a cell's chromosomal DNA. ○ Naturally exist in bacterial cells.	● Plasmids very rarely found
● Only asexual reproduction.	● Both sexual and asexual reproduction.
● Have a single origin of replication	● Have multiple origins of replication
● Only 1 chromosome.	● Many chromosomes present
● Eg. Bacteria and Archaea.	● Eg. Plant and animal cells.

Plant and Animal Cells



	Animal Cell	Plant Cell
Nucleus	Present	Present
Cilia	Present	Very rare
Shape	Round (irregular shape)	Rectangular (fixed shape)
Chloroplast	NO chloroplasts	Chloroplasts present
Cytoplasm	Present	Present
Endoplasmic Reticulum	Present	Present
Ribosomes	Present	Present
Mitochondria	Present	Present
Vacuole	One or more small vacuoles (much smaller than plant cells).	One large central vacuole taking up 90% of cell volume.

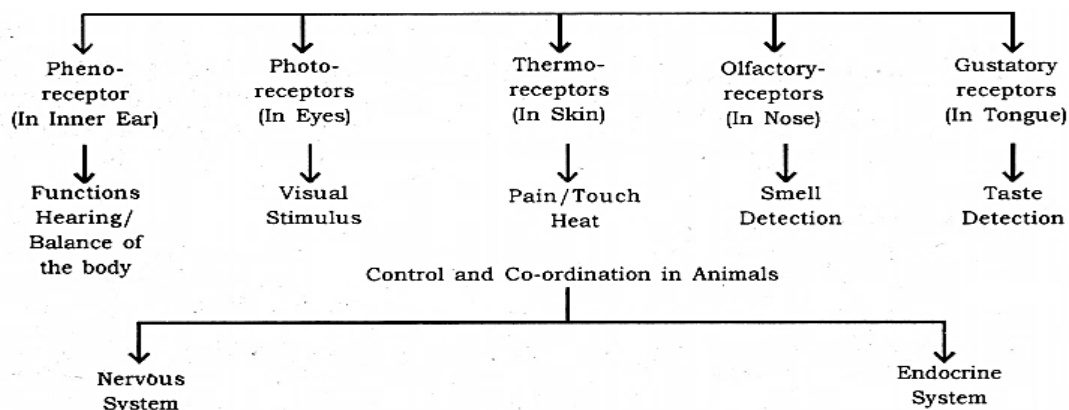
Control and Coordination

In animals

Nervous system and hormonal system are responsible for control and coordination.

Receptors:

- Specialized tips of nerve fibres that collect information to be conducted by nerves.
- In the sense organs of the animals.



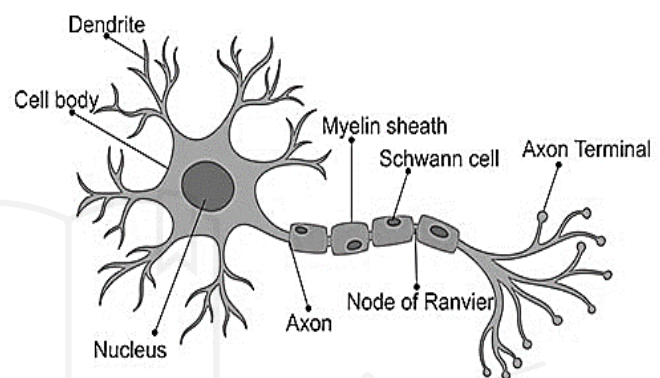
- **Types:**

1. **Nervous System**

- A **highly complex regulatory system** in animals.
- **Coordinates actions & transmits sensory information and signals** to/from the different parts of body.
- **Neuron - structural and functional unit** of entire system.
- **Functions:**
 - **Receives information** from the **environment**.
 - Receive the information from the **various body parts**.
 - **Act accordingly** through muscles and glands.
- **Movement- ability** of an organism **to move a particular body part**.
- **Locomotion - ability** of an organism **to move its whole body** from one place to another.

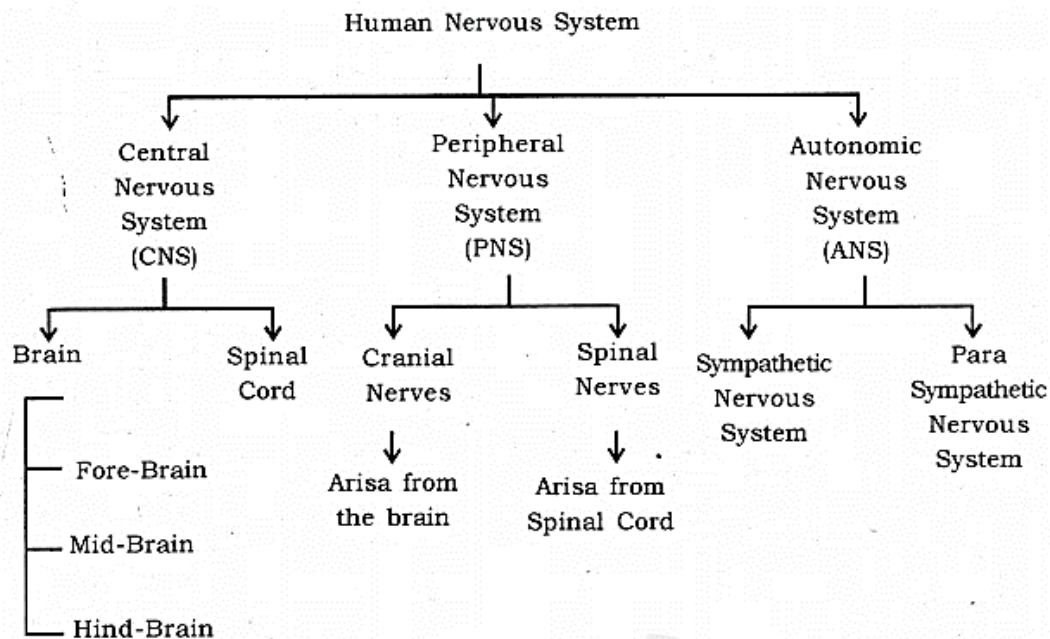
Neuron

- **Structural and functional unit of the nervous system**
- **Coordinates and controls the complex actions** in animals.
- **Specialized cells** responsible for **transmission of nerve impulses**.
- **3 parts-**



1. **Axon-**
 - **Tail of the neuron**.
 - **Ends in fine hair-like structures k/a axon terminals** which rely on nerve impulses
 - **Axons - myelinated or unmyelinated**.
 - **Impulse transmission** is faster in **myelinated neurons**.
 2. **Cyton/soma/cell body-**
 - **Star-shaped** having various **hair-like structures k/a dendrites** which **receive the nerve impulses**
 3. **Myelin Sheath-**
 - An **insulating sheath** on **axon**.
 - **Insulates axon against nerve impulse** from its **surroundings**.
 - **Dendrites receive the impulse** from other neurons.
 - **Cyton or Soma cells process the impulse- transmitted** to the **Axon**. Gets transmitted either to other neurons or to muscles for taking necessary action.
- **Types :**
 1. **Sensory neurons-** Receive the signals from a sense organ
 2. **Motor neurons-** Send the signals to a gland or muscle
 3. **Relay or association neuron-** Relay signals between a motor neuron and sensory neuron.
 - **Synapse**
 - A **microscopic gap** between **two adjacent neurons**.
 - A **point contact between terminal branches** of **axon** of one neuron and with the dendrite of another neuron.
 - **Convert electric signals** into **chemicals** that can cross over gap between axon and dendrite.
 - **Chemical message** is **passed to next neuron** and **converted back** to the **electrical signal** for **interpretation**.
 - **Neuromuscular Junction:**
 - **Point where a muscle fibre comes in contact with a motor neuron** carrying nerve impulse from the control nervous system.

Human nervous system



1. Central Nervous System:

- Brain + spinal cord.
- Brain controls all the functions in the human body.
- Spinal cord works as relay channel for signals between brain and peripheral nervous system.

Human Brain

- A highly complex organ mainly composed of nervous tissue.
- Tissues highly folded to accommodate a large surface area in less space.
- Covered by a 3-layered system of membranes k/a meninges.
- Cerebrospinal fluid filled between meninges cushions the brain against mechanical shocks.
- 3 parts:

1. Fore-brain:

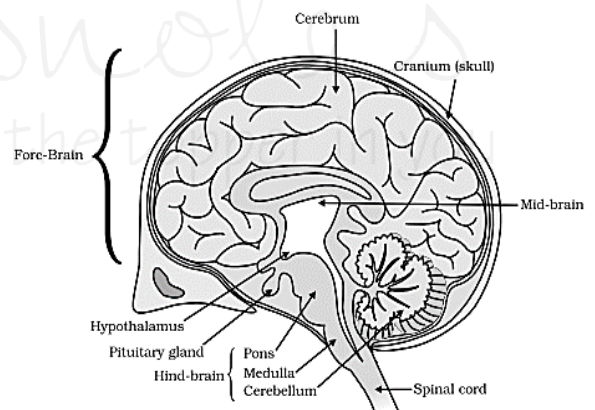
- Composed of the cerebrum.
- Cerebrum- Largest part in human brains.
- Divided into 2 hemispheres k/a cerebral hemispheres.
- Functions:
 - Controls voluntary motor actions.
 - Site of sensory perceptions, like tactile and auditory perceptions.
 - Site of learning and memory.

2. Mid-brain:

- Composed of the hypothalamus.
- Hypothalamus- lies at the base of the cerebrum.
- Controls sleep and wake cycle (circadian rhythm) of the body.
- Controls the urges for eating and drinking.

3. Hind-brain:

- Composed of cerebellum, pons, medulla, oblongata.
- Cerebellum- lies below cerebrum and at back of whole structure.
 - Coordinates the motor functions.
 - Eg. riding a bicycle, ensures perfect coordination between pedalling and steering control.
 - Controls posture and balance.
 - Controls the precision of voluntary action.



- **Medulla: Forms brain stem**, along with the pons.
 - **Lies at the base of brain** and **continues** into **spinal cord**.
 - **Controls various involuntary functions**, like hear beat respiration, etc.
 - **Controls involuntary actions**.
 - **Eg:** Blood pressure, salivation, vomiting.
- **Pons:**
 - **Relays impulses** between **lower cerebellum** and **spinal cord**
 - **Regulates respiration**.

Spinal cord:

2. **Controls reflex actions** and conducts messages between different parts of body and brain.

3. **Reflex Action:**

4. **Sudden and involuntary response** to **stimuli**.

5. **Helps organisms to quickly adapt** to an **adverse circumstance** that could cause bodily harm or even death.

6. **Eg.** Pulling our hands away immediately after touching a hot or cold object.

7. **Reflex Arc:**

8. **Path** through which nerves signals, **involved** in a **reflex action**, travel.

Receptor → **Sensory neuron** → **Relay neuron** → **Motor neuron** → **Effector** (muscle)

9. **Peripheral Nervous System:**

- **Cranial nerves + spinal nerves.**
- **12 pairs of cranial nerves** coming out of brain and go to the organs in the head region.
- **31 pairs of spinal nerves** coming out of spinal cord and go to the organs which are below the head region.

10. **Autonomous Nervous System:**

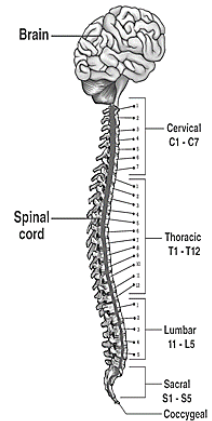
- **Composed of a chain of nerve ganglion** which **runs along spinal cord**.
- **Controls all the involuntary actions** in the **human body**.
 - **2 parts :**

A. Sympathetic Nervous System:

 - **Increases activity** of an **organ** as required.
 - **Eg.** during running, there is an increased demand for oxygen by the body - fulfilled by an increased breathing rate and increased heart rate.

B. Parasympathetic Nervous System:

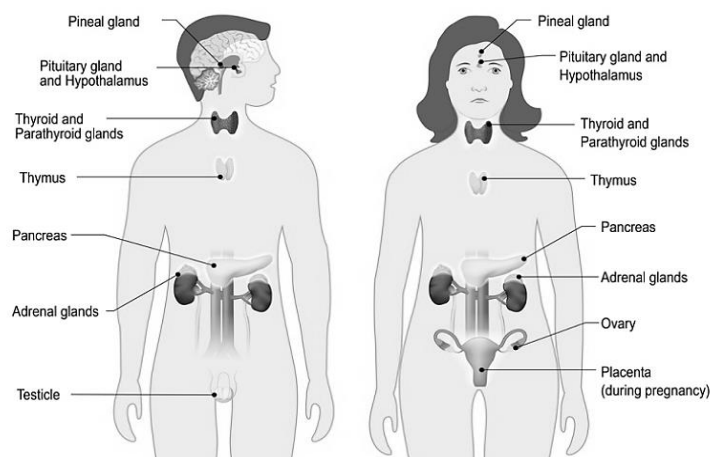
 - **Decreases the activity** of an organ and thus has a calming effect.
 - **Eg.** during sleep, breathing rate slows down and so does the heart rate.
 - Helps in the **conservation of energy**.



2. **Endocrine System**

- **Made up of interconnected glands** that create **hormones**.
- Almost **every cell, organ, and function in our body is influenced by the endocrine system**.
- **Aids** - regulation of mood, growth and development, tissue function, metabolism, and sexual and reproductive functions.
- Also k/a **ductless system** as the endocrine glands **secrete** their **hormones** directly into **bloodstream**.

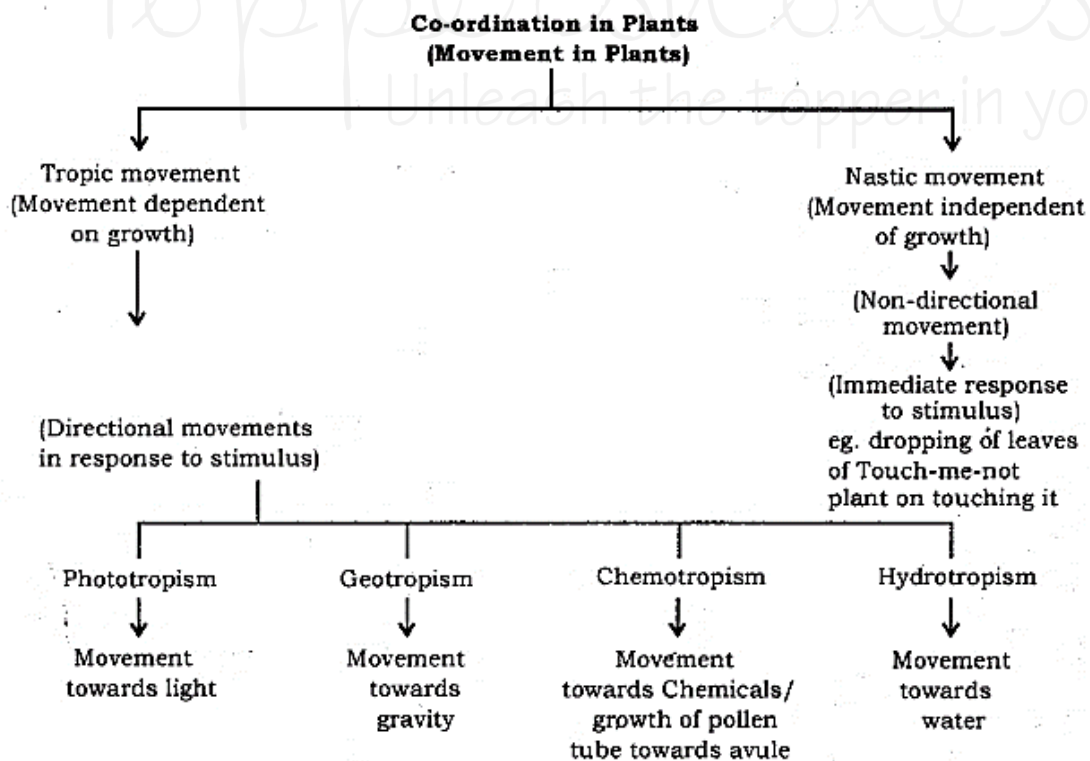
ENDOCRINE SYSTEM



Hormones released by endocrine glands

Endocrine Gland	Location	Hormones Produced	Functions
Pituitary gland (aka master gland)	Base of brain	<ul style="list-style-type: none"> • Growth hormone (GH). • Thyroid stimulating hormone (TSH). • Follicle stimulating hormone (FSH) 	<ul style="list-style-type: none"> • GH stimulates growth. • TSH stimulates the functioning of thyroid gland. • FSH stimulates follicles during ovulation.
Thyroid Gland	Neck	<ul style="list-style-type: none"> • Thyroxine 	<ul style="list-style-type: none"> • Controls general metabolism and growth in the body.
Adrenal gland	Above kidneys	<ul style="list-style-type: none"> • Adrenalin 	<ul style="list-style-type: none"> • Prepares the body for emergency situations and hence is also called 'Fight and flight' hormone.
Pancreas	Near stomach	<ul style="list-style-type: none"> • Insulin 	<ul style="list-style-type: none"> • Controls blood sugar level
Testis (male)	In Scrotum	<ul style="list-style-type: none"> • Testosterone 	<ul style="list-style-type: none"> • Sperm production, development of secondary sexual characters during puberty.
Ovary (female)	Near uterus	<ul style="list-style-type: none"> • Oestrogen • Progesterone 	<ul style="list-style-type: none"> • Egg production, development of secondary sexual characters during puberty.

In Plants



- Plants do **not** have a nervous system.
- Use **chemical** means for control and co-ordination.
 - **Responsible for various kinds of movements in plants.**
- **Types of movements:**

1. Tropic Movement:

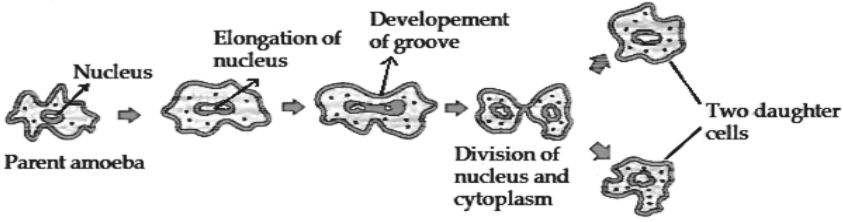
- Movements in a **particular direction** in relation to **stimulus**.
- **Occur** as a **result of growth** of a plant part in a particular direction.
- **4 types** of tropic movements.
 - A. Geotropic movement:**
 - **Growth in a plant part in response to the gravity.**
 - **Eg. Roots** - positive geotropic movement.
 - **Stems** - negative geotropic movement.
 - B. Phototropic Movement:**
 - **Growth in a plant part in response to light.**
 - **Eg. Stems** - positive phototropic movement,
 - **Roots** - negative phototropic movement.
 - C. Hydrotropic Movement:**
 - **Growth in a plant part in response to water.**
 - **Eg. Roots** - positive hydrotropic movement.
 - D. Thigmotropism Movement:**
 - **Growth in a plant part in response to touch.**
 - **Eg. tendrils of climbers.**

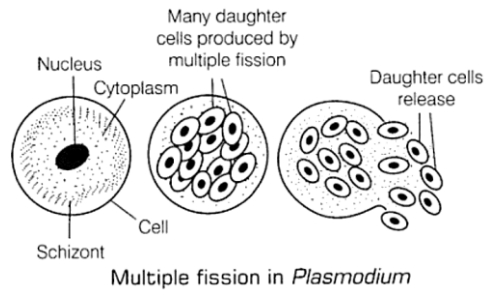
2. Nastic Movement:

- **Do not depend** on **direction of stimulus**.
- **Eg,** when someone touches the leaves of touch-me-not plant, the leaves droop - independent of direction from which the leaves are touched.

Reproductive System

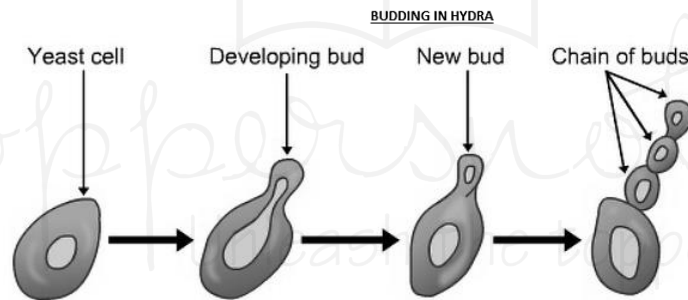
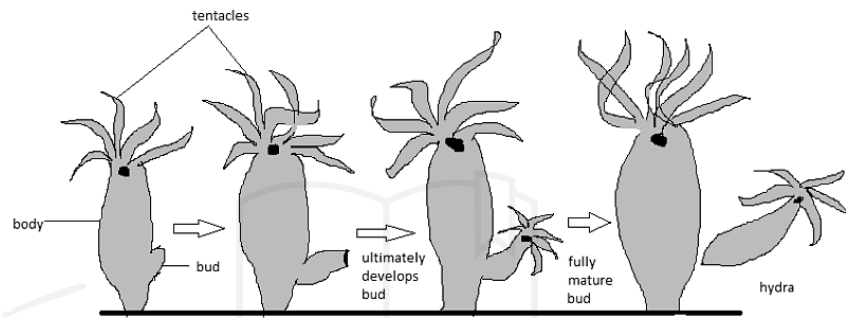
- A **biological process** by which an **organism produces an offspring** (biologically similar to the organism).
- Ensures the continuity of species, generation after generation.
- **Main feature of life on earth.**
- **2 types :**
 - 1. Asexual Reproduction**
 - Involves **only one parent**.
 - **No formation** and fusion of **gametes**.
 - **Young offsprings almost identical** to each other & parent.
 - **Occurs** during **favourable environmental conditions** and when there is an abundance of food.
 - **Faster** method of **reproduction**.
- **Types:**

<p>Binary Fission:</p>	<ul style="list-style-type: none"> ● In bacteria, protozoa. ● Process: Withdrawing of pseudopodia (false cavity) → Nuclear division → cytoplasmic division → 2 daughter cells formed  <p style="text-align: center;">Binary fission in Amoeba</p> <ul style="list-style-type: none"> ● Cytokinesis: Division of cytoplasm. ● Karyokinesis: Division of Nucleus.
<p>Multiple Fission</p>	<ul style="list-style-type: none"> ● A single parent cell is divided into many daughter cells. ● Most common form of reproduction in protists and in some parasitic species.



Budding

- A genetically identical new organism grows attached to body of parent and separates later on.
- A bud develops as an outgrowth due to repeated cell division at one specific site.
- Grows randomly.
- No specific order or direction they follow.
- Eg. in hydra and yeast



Regeneration

- Ability of organisms to develop their lost parts.
- Some organisms show have high regenerative capacity
- Eg. Planaria.
- Carried out by specialized cells which redivide to form a mass of cells from which different cells undergo changes to become different cell types and tissues.
- Occur in an organized sequence k/a development.

