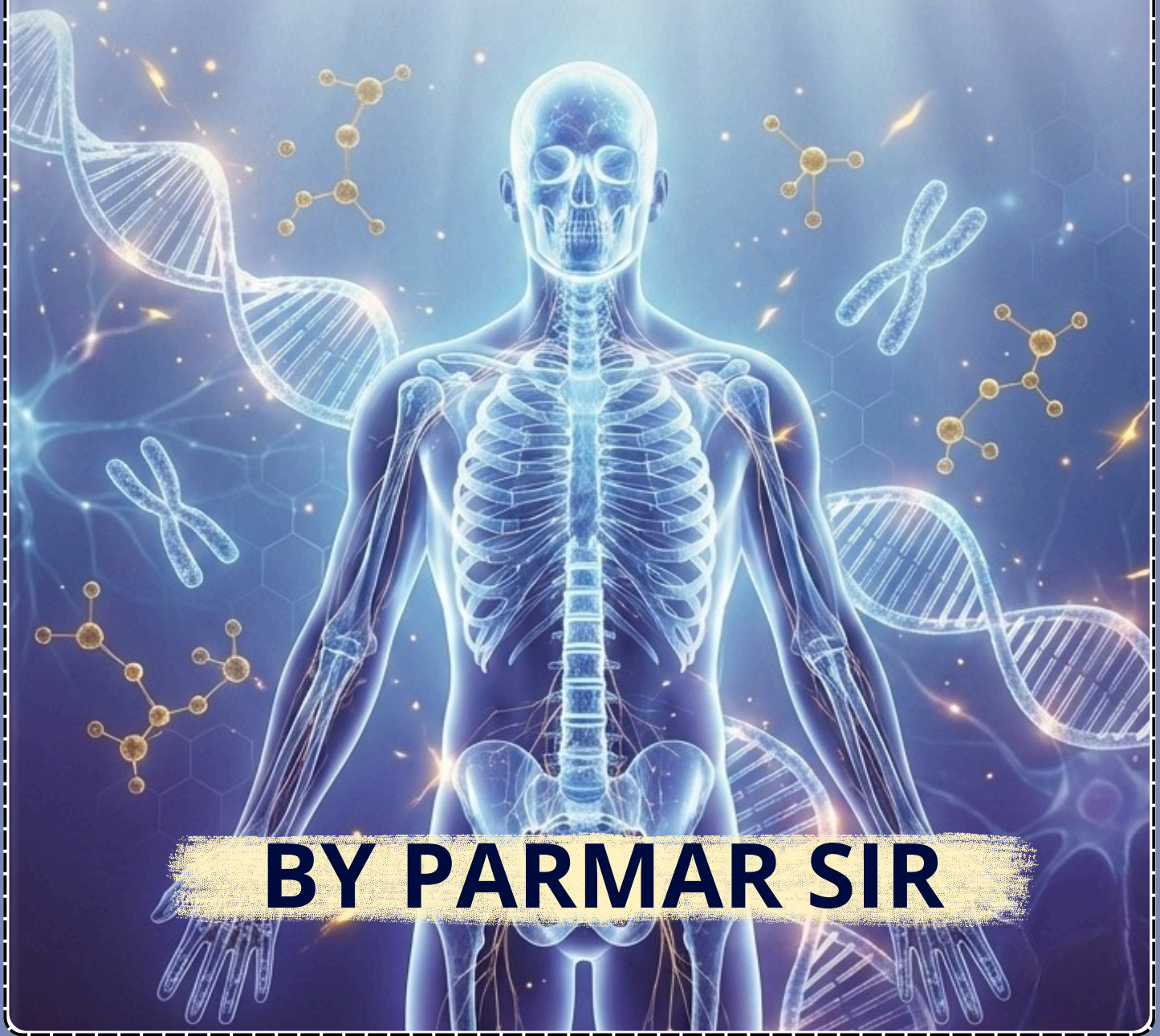
PARMAR SSC

GENETICS AND SKELETAL SYSTEM

Lecture - 13



BY PARMAR SIR

Heredity

- Heredity is the biological process through which traits or characteristics are passed from parents to offspring through genes.
- It is responsible for transmission of physical, behavioural, and physiological traits, such as eye colour, blood group, and certain genetic disorders.
- The basic unit of heredity is the gene, which is made up of DNA.

Types of Traits

1. **Acquired Traits:** Characteristics that develop in an organism during its lifetime as a result of environmental influences rather than genetics.
- **E.g.** Teaching, riding bike, etc.
2. **Inherited Traits:** Characteristics or quality that is passed down from parents to their offsprings through DNA.
- **E.g.** Eye colour, blood group, etc.

Variations

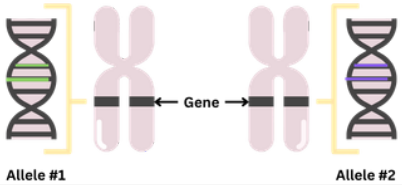
- It refers to the differences in traits or characteristics among individuals within a species.
- These differences can be caused by genetic variations or environmental factors that influence how genes are expressed.
- Variation is necessary for survivability. It is seen more in sexual organisms than asexual organisms (as only a single parent involved in asexual reproduction).

Genetic Traits

- A genetic trait is a characteristic or feature of an organism that is determined by genes and can be passed down from one generation to the next.
- Traits can be determined by genes, environmental factors or by a combination of both.
- Traits can be qualitative (such as eye color) or quantitative (such as height or blood pressure).

Alleles

- Alleles are alternate forms of genes, or DNA sequence, that occur at the same location on a chromosome.
- Alleles control the same trait, but they can produce different effects.



Types of Alleles

1. **Dominant Traits:** Trait that is expressed out when one or both alleles are dominant.
2. **Recessive Traits:** Trait that is expressed out when both the alleles are recessive.

Pea trait	Dominant trait	Recessive trait
Seed shape	Round	Wrinkled
Seed colour	Yellow	Green
Flower colour	Purple	White
Flower position	Axial	Terminal
Plant height	Tall	Short
Pod shape	Inflated	Constricted
Pod colour	Green	Yellow
Pod colour	Green	Yellow

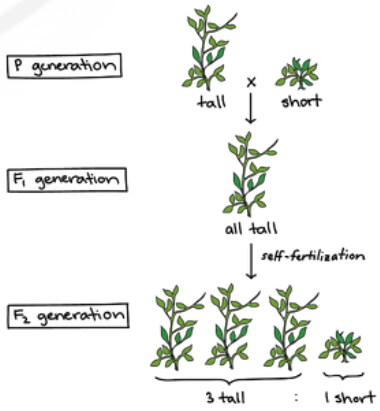
Gregor Mendel's Experiment

- Gregor Johan Mendel is known as "**Father of Genetics**". He conducted experiments of Inheritance traits in Pea Plant (Pisum sativum).

Reasons for Choosing a Pea Plant:

- It is easier to grow.
- It has short life cycle.
- It can be self-pollinated or cross-pollinated by hand.
- Different traits were easily observable. Many offsprings of pure pea plant can be easily obtained through self-pollination.

Gregor Mendel gave three laws of inheritance:



1. **1st Law (Law of Dominance)**

- It stated that when parents with contrasting traits are crossed, only the dominant trait will appear in the offsprings.

2. **2nd Law (Law of Segregation)**

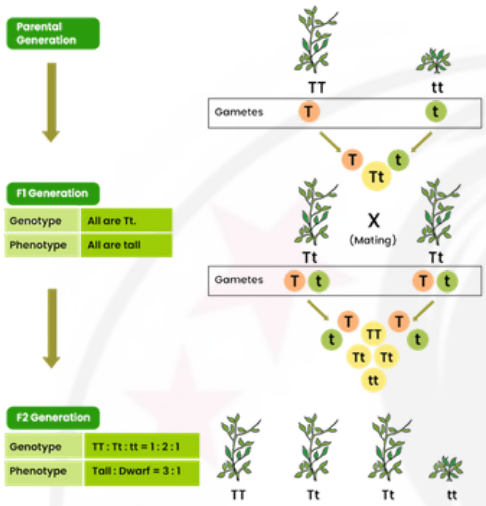
- It stated that during the formation of gametes, the pairs of gene variants, or alleles are separated from each other.
- Each gamete receives one allele.

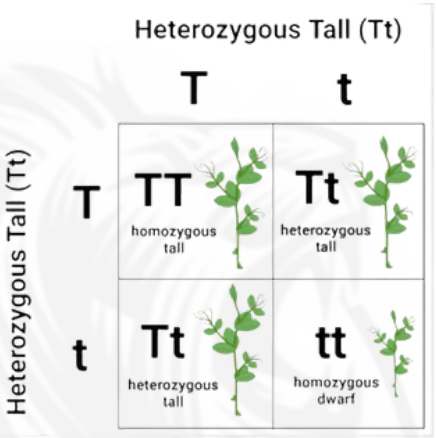
3. 3rd Law (Law of Independent Assortment)

- It stated that during gamete formation, alleles of two (or more) different genes get sorted into gametes independently of one another.

Monohybrid Cross

- A monohybrid cross is a genetic experiment that studies how a single trait is passed from parents to their offspring. It involves crossing two organisms that differ in one trait.
- **E.g.** A cross between a tall pea plant and a short (dwarf) pea plant.





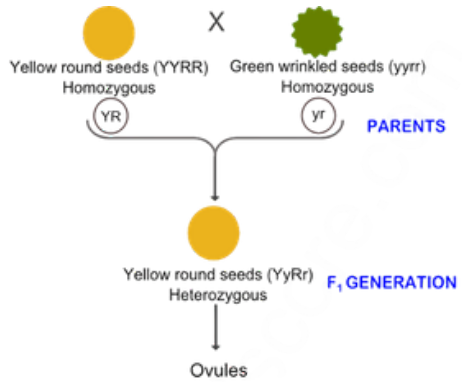
Phenotype :- Physical traits
Genotype :- Genetic makeup

Observation

- In the first generation, Mendel found that all the offspring shared one feature, which he called dominant trait (they were all tall), and did not display any recessive trait.
- When the first-generation plants were self-fertilized, the second generation showed the reappearance of the recessive trait in about 1 out of every 4 plants.
- This resulted in a 3:1 ratio, with three plants showing the dominant trait for every one showing the recessive trait.

Dihybrid Cross

- A dihybrid cross is a genetic cross involving two different traits, each with two contrasting alleles, where both parents are heterozygous for both traits.
- **E.g.** A cross between a seed shape (round vs. wrinkled) and seed color (yellow vs. green).





Dihybrid cross beween Yellow round & Green Wrinkled seed Pea plant

Observation

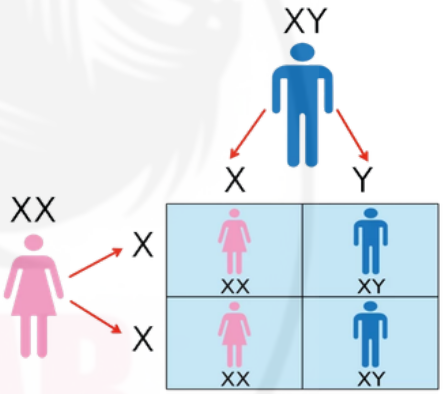
- In the first generation of the dihybrid cross, Mendel found that all the offspring showed both dominant traits (round and yellow seeds), with no sign of the recessive traits (wrinkled and green).
- When these first-generation plants were self-fertilized, the second generation showed new combinations of traits.
- **Mendel observed four types of offspring:** some showed both dominant traits, some showed both recessive traits, and some showed one dominant and one recessive trait. This resulted in a 9:3:3:1 ratio.

Sex Determination

- Sex determination is the biological system that decides whether an individual organism will develop as male or female.
- It is based on genetic, chromosomal, environmental, or a combination of factors.

In humans

- In humans, there are 23 pairs of chromosomes:
- 22 pairs are autosomes
- 1 pair is the sex chromosomes



Sex chromosomes in humans

- **Females**: Have XX chromosomes.
- **Males**: Have XY chromosomes.

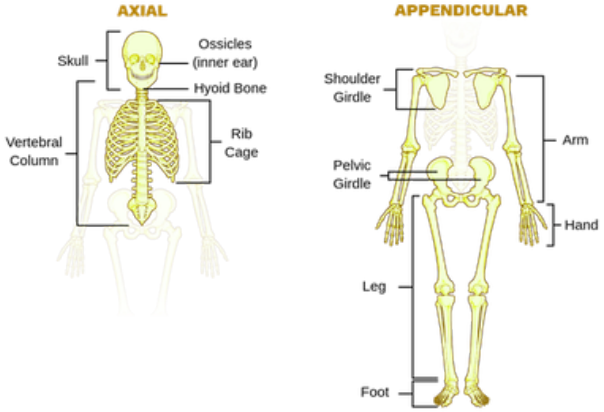
Who Determines the Sex of the Baby?

- The father's sperm determines the child's sex.
- The mother's ovum always carries an X chromosome.
- The sperm may carry either:
- X chromosome > XX = Female child
- Y chromosome > XY = Male child

XO → Turner syndrome (Only in females)
XXY → Klinefelter syndrome (Only in Males)

Skeletal System

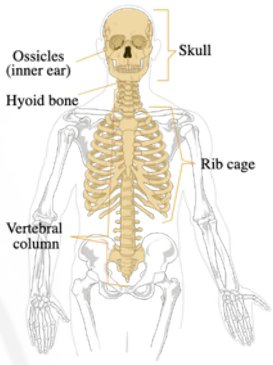
- The skeletal system is the body's framework, providing support, protection, and allowing for movement.
- It comprises bones, cartilage, and ligaments, and is divided into the axial and appendicular skeletons.

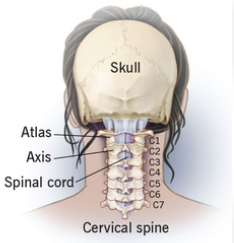


Bones in Human body	Count
Bones in adult human beings	206
Bones in children	300
Total Axial bones	80
Total Appendicular bones	126

Axial Skeleton

- It protects the brain, spinal cord, heart, and lungs; supports the head, neck, and body; and provides a rigid framework for muscle attachment.
- **E.g.** Bones in head, neck, back including skeleton etc.

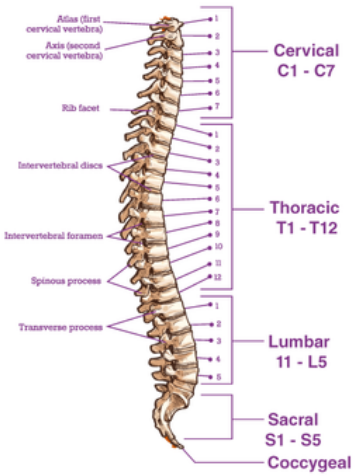


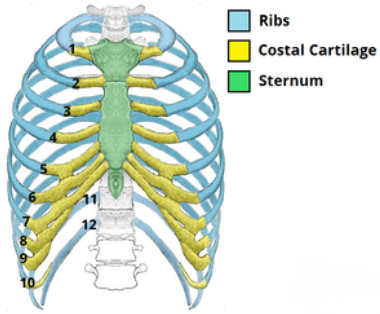


- Atlas is the bone that connects the scalp to the spine and supports the head.

Bones in Spinal Cord: Adults only have 26 bones.

- **Cervical**: 7 vertebrae
- **Thoracic**: 12 vertebrae
- **Lumbar**: 5 vertebrae
- **Sacral**: 5 vertebrae (fuse to form 1 sacrum)
- **Coccygeal**: 4 vertebrae (fuse to form 1 coccyx/tailbone)



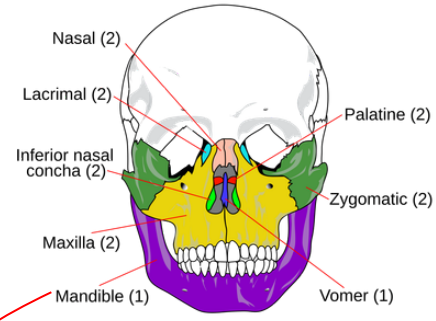


- **Sternum:** Central part of the chest. It is connected to ribs via cartilage.
- **Bones in Rib Cage: Total**: 24 + 1 (sternum) = 25.

- **True ribs (Vertebrosternal ribs)** : 1st to 7th pair.
- **False ribs (Vertebrochondral ribs)** : 8th to 10th pair.
- **Floating ribs (Vertebral ribs)** : 11th & 12th pair.

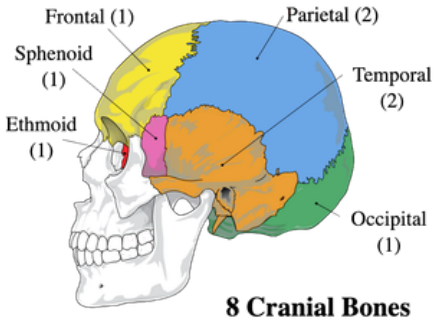
Bones in Skull

- **Total:** 22 bones
- **Cranial:** 8
- **Facial:** 14

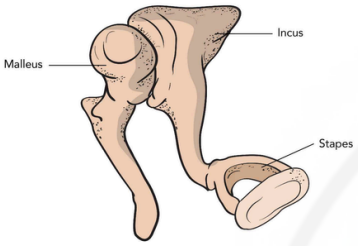


14 facial bones

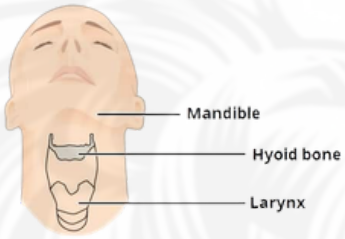
The only movable bone of the skull.



8 Cranial Bones





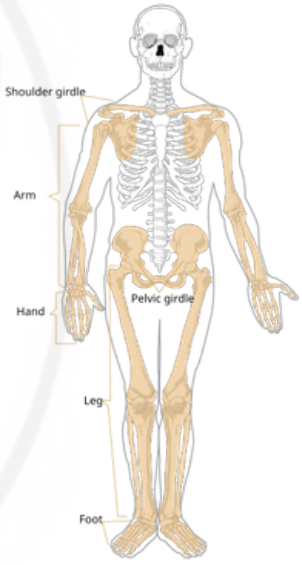


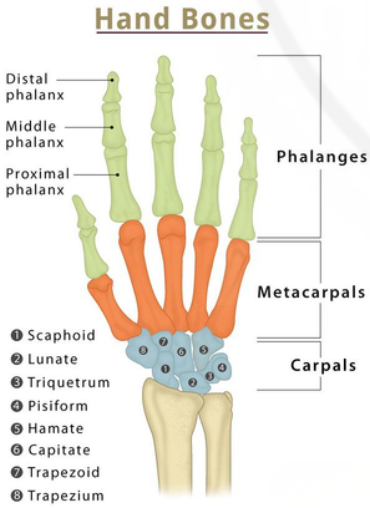
Bones in Ear

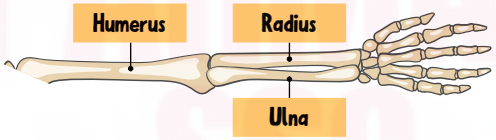
- **Total:** 3x2 = 6
- Incus, Malleus, Stapes

Appendicular Skeleton

- It provides support and leverage for limb movement; facilitates locomotion; and includes bones that are primarily involved in movement.
- E.g. bones in shoulder, pelvis, limbs, etc.







Bones in Arm

- **Total:** 3

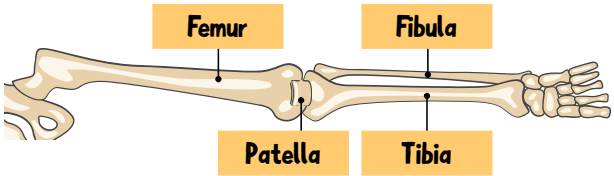
1. Humerus,
2. Radius,
3. Ulna

Bones in Hand

- **Total:** 27
- **Phalanges:** 14
- **Metacarpals:** 5
- **Carpals:** 8.

27+ 3 = 30

30x2= 60(ARMS)

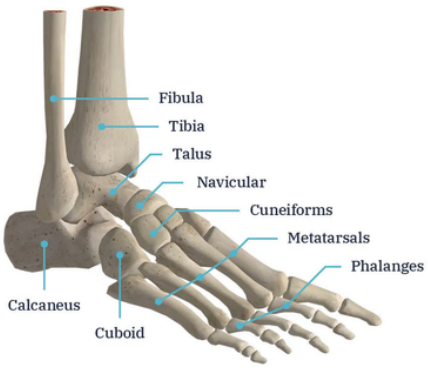


4x2 =8

Bones in Legs

Total = 4

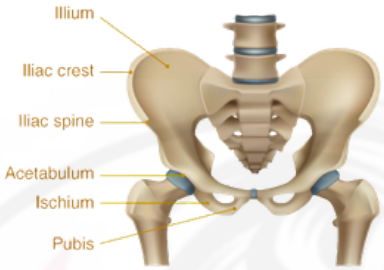
- **Femur (thigh bone): 1**
- **Patella: 1**
- **Tibia: 1**
- **Fibula: 1**



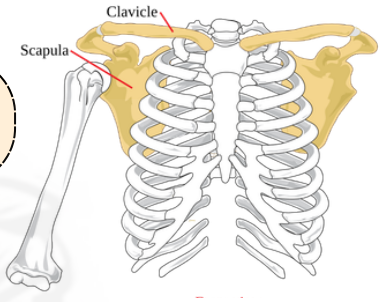
26 x 2 = 52

Bones in Foot
Total = 26
Tarsals: 7,
Metatarsal: 5,
Phalanges: 14.

Bones in Pelvis
Total = 2



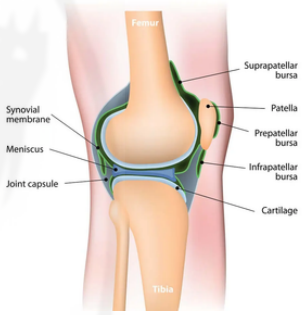
Clavicle = 2
Scapula = 2

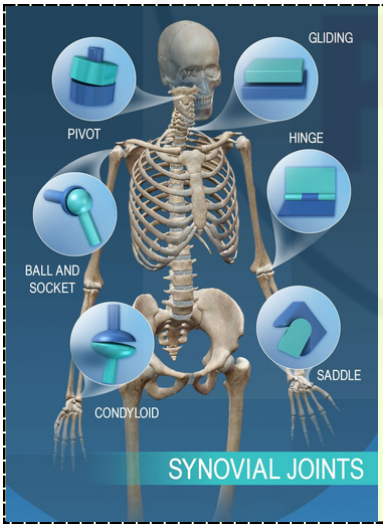


Joints

Synovial Joints

- These joints have a fluid-filled cavity between the bones, allowing for a wide range of motion. E.g. knee, elbow, and shoulder.

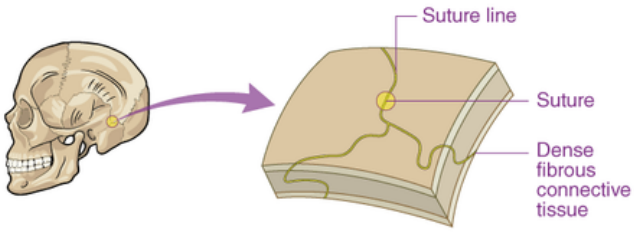




- **Ball & Socket:** 360° rotation (all directions).
- **Hinge:** 180° motion (open and close like a door).
- **Pivot:** Left/right twisting on a single axis.
- **Gliding:** Short, flat sliding movements.
- **Saddle:** 2-way movement (up/down & side/side, no full rotation).
- **Condyloid:** 2-way movement (similar to saddle, but for oval joints).

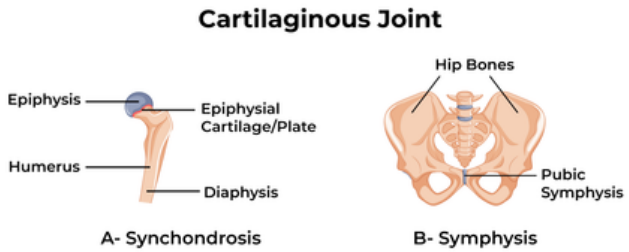
Fibrous Joints

- These joints connect bones with dense connective tissue, allowing for little to no movement.
- **E.g.** Sutures in the skull and the connection between teeth and the jawbone.

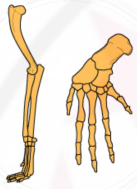


Cartilaginous Joint

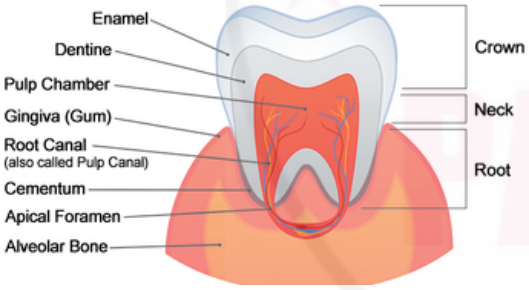
- In these joints, bones are connected by cartilage, allowing for slight movement.
- E.g. Joints between vertebrae and the connection between ribs and the sternum.



Homologous Organ and Analogous Organ

Homologous Organ	Analogous Organ
They are organs that have the same structure but different function and are inherited from an common ancestor	They are organs of different species that have different anatomical structure but perform similar functions
 Homologous structure	 Analogous structure

Teeth

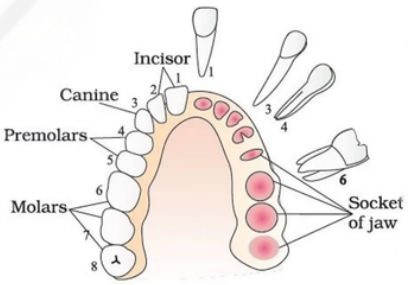


Enamel

- **Enamel**: Hardest part of the body (made of Calcium phosphate)

Total adult teeth: 32 permanent teeth

- (16 in upper jaw + 16 in lower jaw including wisdom teeth).
- **Incisors: 4** ›››› They are used for biting and cutting of food.
- **Canine: 2** ›››› They are used for tearing of food.
- **Premolars: 4** ›››› They are used in grinding of food.
- **Molars: 6** ›››› They are used for chewing and crushing of food.



Dental Formula

Milk teeth

Incisors, I = 2
Canines, C = 1
Molars, M = 2

$$\frac{212}{212} \times 2 = 20$$

Permanent teeth

Incisors, I = 2
Canines, C = 1
Premolar, PM = 2
Molars, M = 3

$$\frac{2123}{2123} \times 2 = 32$$



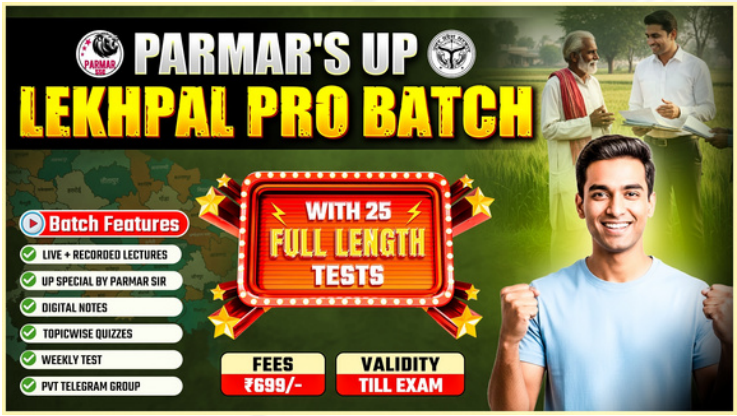


Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE





Join Now – Start Your Smart Preparation Today!

CLICK HERE

Join Now – Start Your Smart Preparation Today!

CLICK HERE





Join Now – Start Your Smart Preparation Today!

CLICK HERE