# Osseous System

Osseous system or skeletal system or Musculoskeletal system are the system which works as a support structure for our body. It gives the body its shape, allows movement, makes blood cells, provides protection for organs and stores minerals.

- Osteology :- It is the branch of science that deals with the study of the skeletal system, their structure and functions.

⇒ The skeletal system :-

parts :-
- Bones
- Joints
- cartilages
- Ligaments

Divided into two divisions :- ( 206 bones)

① Axial skeleton ( 80 bones)

② Appendicular skeleton ( 126 bones)

⇒ functions :-
- support of the body
- protection of soft organs
- Movement due to attached skeletal muscle
- Storage of minerals and fats
- Blood cell formation.

## ⇒ classification of bones based on shape:—

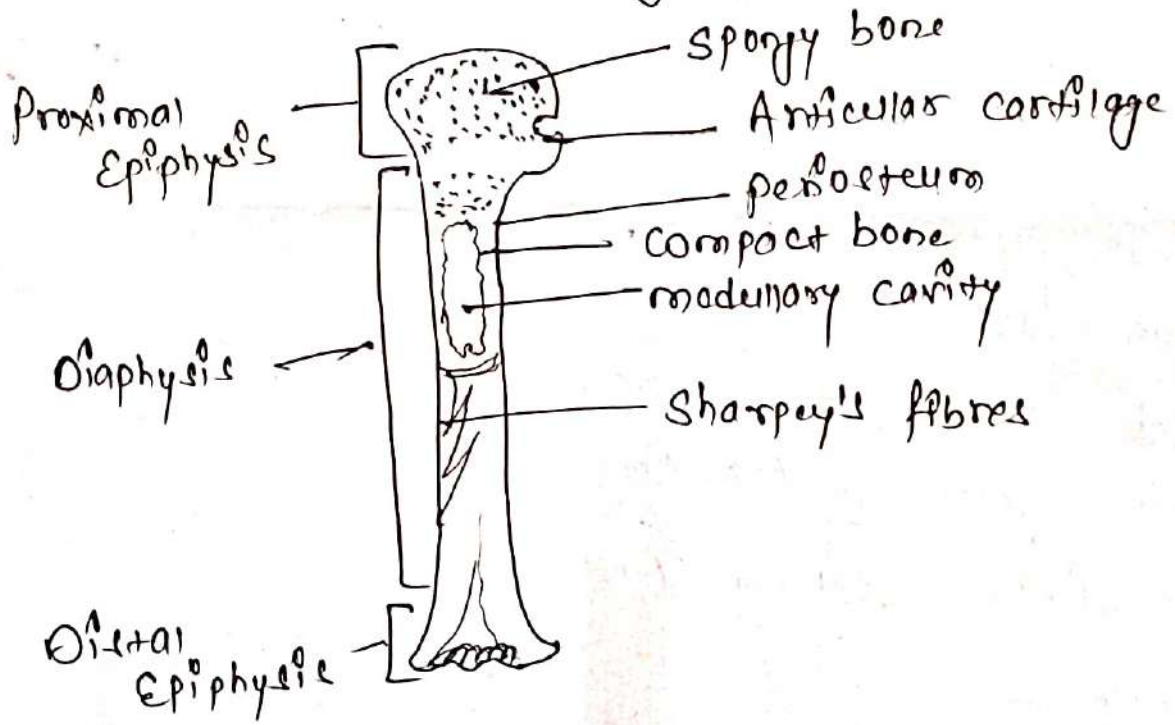
- Long
- Short
- flat
- Irregular

## * Long bones:—

- Typically longer than wide
- Have a shaft with heads at both ends.
- contains mostly compact (homogeneous) bone.

example:- femur, humerus

## ⇒ Gross Anatomy of a long bone:—




- Diaphysis:—
  - shaft and composed of compact bones.
- Epiphysis:—
  Ends of the bones and composed mostly of spongy bones
- periosteum:—
  - outside covering of diaphysis and composed of fibrous connective tissues membrane.

* Short bones:-
  - Generally cube-shape
  - contains mostly spongy bone
  Examples:- carpals, tarsal

* Flat bones:-
  - Thin and flattened
  - usually curved
  - Thin layers of compact bones aroud a layer of spongy bones.
  Examples:- Skull, ribs, Stemum

* Irregular bones:-
  - Irregular shape
  - DO not fit into other bone classification categories.
  Example:- Vertebrae and hip.

⇒ Types of Bone cells:-
- osteocytes:-
  Matured bone cells.
- osteoblasts:-
  Bone forming cells
- osteoclasts:-
  Bone-destroying cell & remodelling, release of calcium.

⇒ Composition of skeleton :-

* Bone contains an abundant extracellular matrix that surrounds widely separated cells.
* The extracellular matrix is about 25% water, 25% collagen fibres and 50% of crystallized mineral salts.
* The most abundant mineral salt is calcium phosphate $[Ca_3(PO_4)_2]$. It forms crystals salt.
* They combine other crystal salts to form calcium carbonate $CaCO_3$ and ions like magnesium, fluoride, potassium and sulphate.
* As this mineral salts are deposited in a frame work formed by collagen fibre of the extracellular matrix, they crystallize and tissue hardens. This process is called calcification.

## Appendicular skeleton calculation

No. of total bones = 126

- Upper limbs (Two hands)

Humerus — $1 \times 2 = 2$

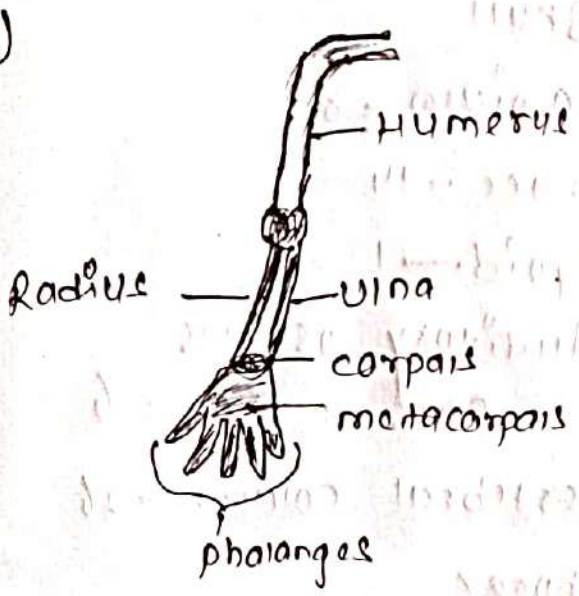
Ulna — $1 \times 2 = 2$

Radius — $1 \times 2 = 2$

Carpals — $8 \times 2 = 16$

metacarpals — $2 \times 5 = 10$

phalanges — $14 \times 2 = 28$




- Lower limbs (Two legs)

Femur — $1 \times 2 = 2$

patella — $1 \times 2 = 2$

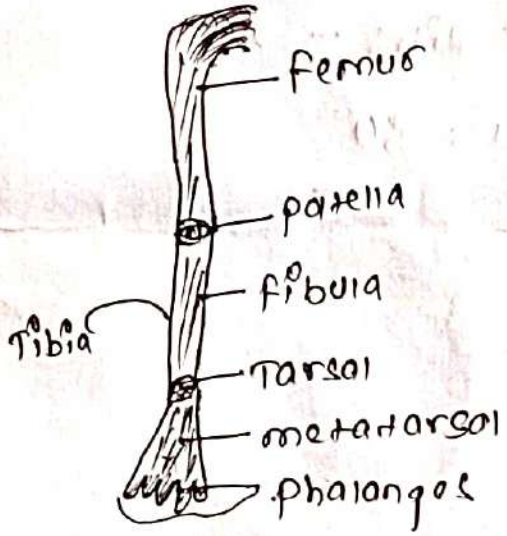
fibula — $1 \times 2 = 2$

Tibia — $1 \times 2 = 2$

Tarsals — $7 \times 2 = 14$

Metatarsals — $5 \times 2 = 10$

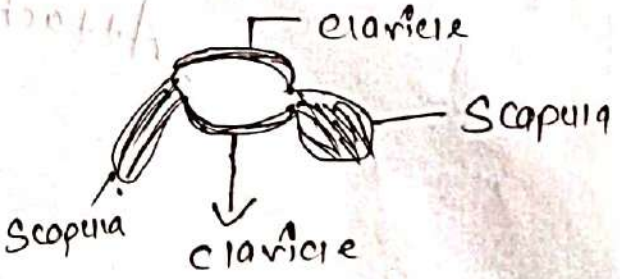
phalanges — $14 \times 2 = 28$




- pectoral girdles (shoulder)

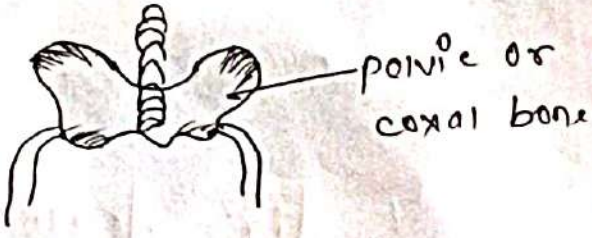
clavicle — $1 \times 2 = 2$

Scapula — $1 \times 2 = 2$




- pelvic girdle (Hip)

coxal bone — $1 \times 2 = 2$




Total = 126 bones

⇒ Axial skeleton :—

No. of bones = 80

= Skull

Cranium - 8

Face - 14

= Hyoid - 1

= Auditory ossicles

ears - 3 × 2 = 6

= Vertebral column - 26

= Thorax

- Sternum - 1
- Ribs - 24

Total = 80

∴ Total no. of bones in body =

126 + 80 = 206

Attached photocopy

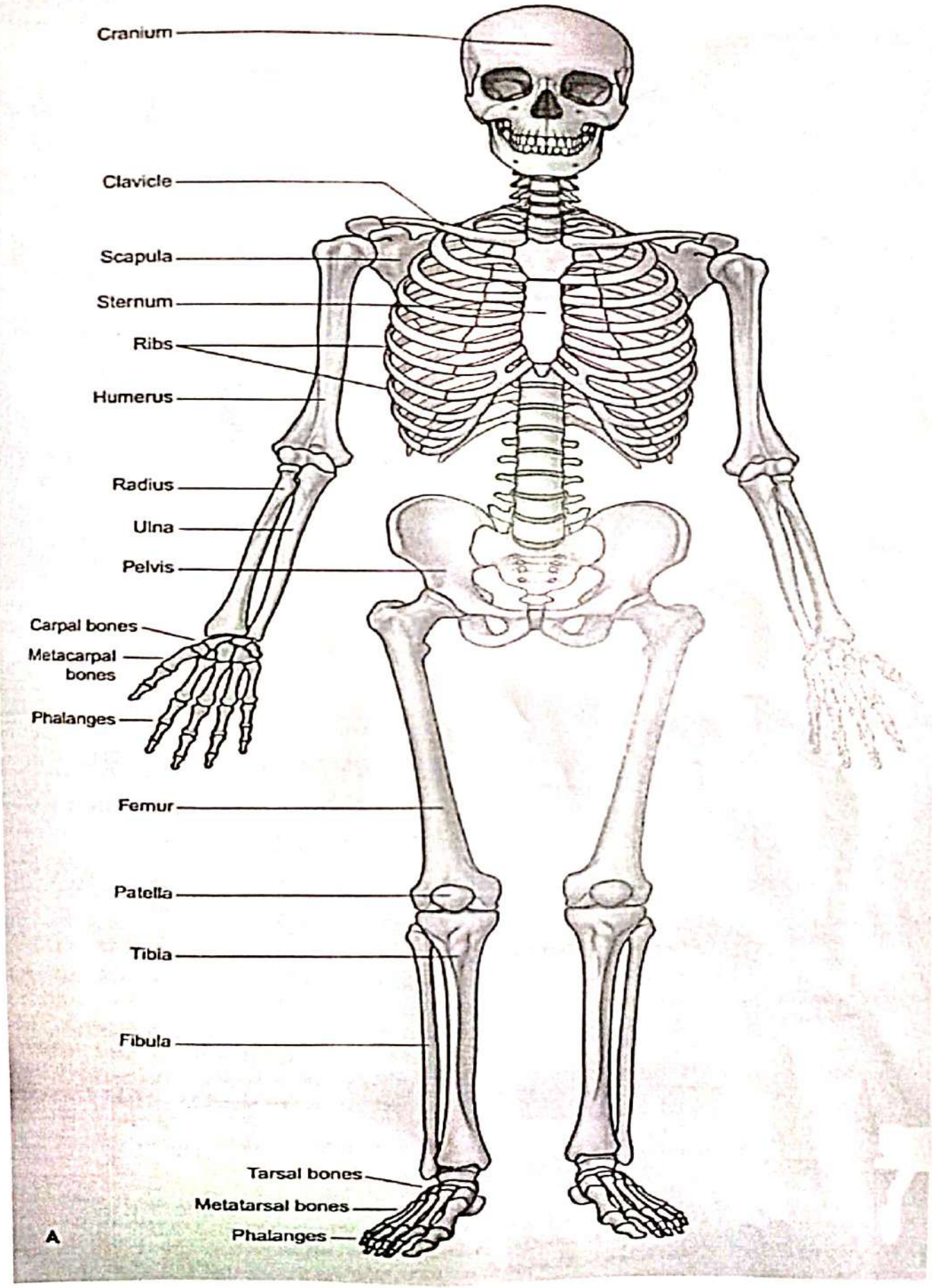



fig:- Anatomy of Appendicular skeleton

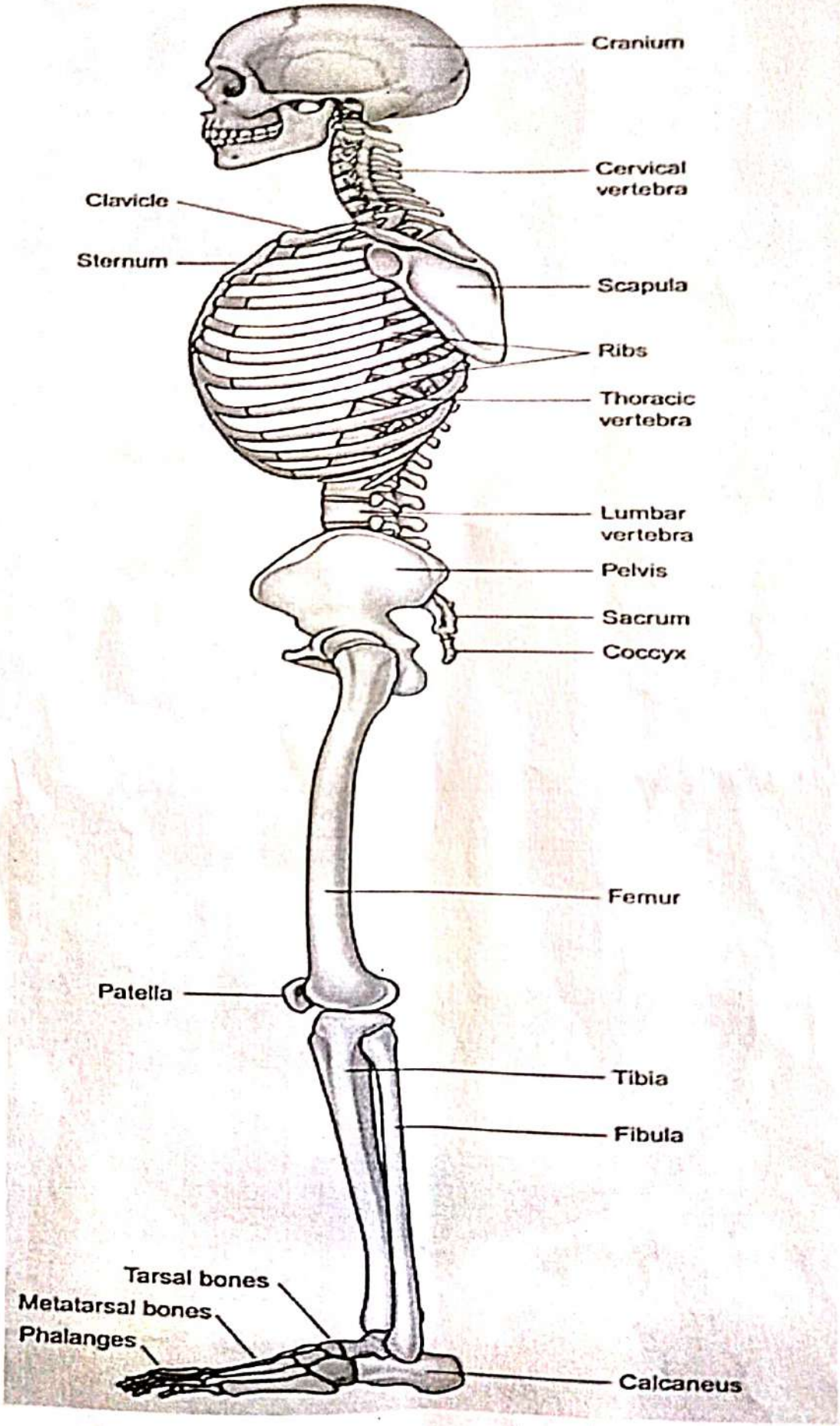



fig:- Anatomy of Axial Skeleton.

# Joints

A Joint is the site at which any two or more bones articulate or come together, meaning the ends or edges of the bones are held together by connective tissues.

Joints may allow flexibility, and the movement of the skeleton. In some joints however, the participating bones are contacted together due to which movement doesn't occur.

## ⇒ Classification of Joints :-

Joints has been classified into three main forms. They are follow below :-

1. Fibrous Joints
2. Cartilaginous Joints
3. Synovial Joints

### * Fibrous Joints :-

Bones forming these joints are linked with tough, fibrous material such arrangement of fibrous material permits no movement.

for example :- * The joints between the skull bones,
* The tibia and fibula in the legs are joint together along their shaft by a sheet of fibrous tissues called interosseous membrane.

* Cartilaginous Joints :—

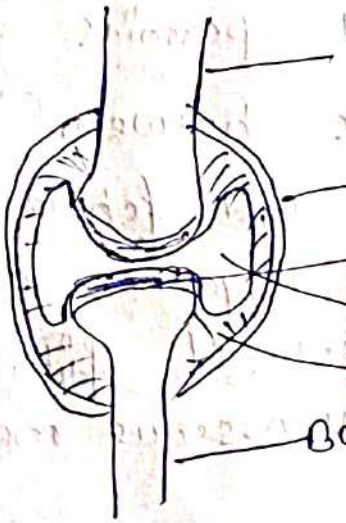
These joints are formed by a pad of tough fibrocartilage between the bones that acts as a shock absorber. The joint may be immovable and somewhere slightly movable. Some cartilaginous joints permits limited movement.

Example :— * vertebral column, which are separated by invertebral discs.

* Symphysis pubis, which is softned by circulating hormones during pregnancy to allow for expansion during childbirth.

* Synovial Joints :—

Synovial joints are characterised by the presence of a space or capsule between the articulating bones. The ends of the the bones are close together by a sleeve of fibrous tissue and lubricated with the small amount of fluid. Synovial joints are the most movable of the body.



→ Capsule or Joint capsule :-

The joint capsule is wrapped in a bunches of fibrous tissues that holds the bone together. It allows freedom of moement and also prevent from injury.

→ Articular cartilage :-

The parts of bones in contact with each other are coated with hyaline cardilage which provides smooth surface, reduces friction, prevent damaging from bone to bone contact.

→ Synovial cavity :-

Synovial cavity is such cavity in which synovial fluids are filled. Synovial fluids are thick, sticy fluid of egg-white type.

- It nourishes the synovial cavity
- contains pathogens, remores microbes & cellular bedris
- lubricates moving part of joints
- Maintains joints stability
- etc.

⇒ Moements at synovial joints :-

moement at any given joints depends on various factors, such as the tightness of ligaments holding the joint together, how well the bones are fit. Generally more stable bones, the less mobile it is.

⇒ Types of Synovial Joints :-

Synovial joints are classified according to the range of movement possible or shape of the articulating parts of the bones involved.

① Ball and socket Joints :-

The head of one bone is ball-shaped and articulates with a cup-shaped socket of another. These joints allow a wide range of movement, including * flexion (bending forward occassionally backward eg:- Hand knee joints/elbow
* extension - Straightening or bending backwards eg:- Leg knee
* adduction - movement towards middle line of body. eg:- movement of whole legs from hip.
* abduction - movement away from middle line of the body. eg:- movemet of whole hand up & down from shoulder.
* rotation - movement around long axis of bone. eg:- Left & right movement of head.
* circumduction - movement of a limb so that it describe the shape of a cone. or eg:- rotation of hand in circular motion.

③ Hinge Joints :-
The articulating ends of the bones fit together like a hinge on a door, and the movement is therefore restricted to flexion and extension. e.g:- Elbow, knee, ankle, joints between the phalanges of the fingers & toe. which is also called interphalangeal joints.

⑤ Gliding Joints :-
The articulating surfaces are flat or very slightly curved and glide over one another but the amount of movement possible is very restricted.
Examples:- * Joints between the carpals bones in the wrist.
* The tarsals bones in the foot etc.

④ pivot joints :-
These joints allow a bone or a limb to rotate. one bone fits into a hoop-shaped ligaments that holds it close to another bone and allow it to rotate in the ring thus formed. Ex:- The head rotate.

⑤ condyloid joints :-
A condyle is a smooth, rounded projection on a bone. One bone sits within cup-shaped depression on another bone or oval ~~complex~~ convex within Eclipsoid cavity.
e.g:- * Movement ~~between~~ of mandible & temporal bone.
* movement between metatarsal and phalangeal
* movement between metacarpals & phalangeal

(6) Saddle Joints:-

The articulating bones fits together like a person sitting on a saddle. example:- Base of thumb, Trapezium of wrist, first metacarpal bone, range of the movement is similar to condyloid joints but additional flexibility i.e ability to touch each finger tips.

⇒ Disorders of Joints:-

Disorders of Joints occurs mainly because synomial membrane, hyaline cartilage and bone gets more effected.

Some of the disorders are as follow below:-

* Rheumatoid arthritis:-

Rhematoid arthritis is a chronic progressive inflammatory autoimmune disease mainly affecting synovial joints. Rheumatoid arthritis is autoimmune disorder in which immune system identifies synovial membrane as "foreign and begins attacking it".

* Risk factor:-
  - age :- Increases with age
  - Gender :- In premenopausal women more than men. (3:1)
  - Genetic risk:- link familial history
  - vitamin D difficiency
  - Smoking

* Swelling of hand,

* Osteoarthritis (osteoarthrosis)

Osteoarthritis is a degenerative non-inflammatory disease that result in pain and restricted movement of affected joints. In this, the articular/hyaline cartilage gradually becomes thinner and bones begins to degenerate. When hyaline gets thinner, synovial membrane gets thinner lack of synovial fluid and due to which phagocytes doesn't destroys tissue debris and because of over accumulation of tissue debris Joint mobility restricted and causes pain. e.g. Hip, knees etc

* Gout:- This condition is caused by the deposition of Sodium urate crystals in joints and tendons, provoking an acute inflammatory response. In short, Increase in uric acid.

- Risk factor → male gender, obesity, heredity, hyperuricemia and high alcohol intake.
- Sites affected:- meta-tarsophorngeal joint, knee, wrist etc

⇒ primary gout — Reduced or Increased urinate production

⇒ Secondary gout — Reduced urinate and kidney failure.

* Ankylosing spondylitis :-

It is kind of polyarthritis which means inflammation of more than one joint. This tends to occurs in young adults and effects the joints of the vertebral column. calcification of the intervertebral joints and laying down of new bone lead to reduced spinal ~~cord~~ flexibility and permanent deformity

* carpel tunnel syndrome :-

This occurs when the median nerve is compressed in the wrist as it passes through the carpal tunnel. It is common, especially in women, between the ages of 30 and 50 years. There is pain and numbness in the hand and wrist affecting the thumb, index & middle fingers and half of the ring fingers. cause- prolonged playing games and using keyboard.