Structured Notes According to

ORTHOPAEDICS

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading notes

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In case of any discrepancy between book and videos, Dr. Jambukeswaran's videos on PrepLadder should be considered.

CONTENTS

ORTHOPAEDICS

UNIT 7- SPINE+PELVIS+LOWER LIMB TRAUMATOLOGY

UNIT 8- COMPLICATIONS IN ORTHOPAEDICS

UNIT 9-METABOLIC DISORDERS

UNIT 10-ARTHRITIS

UNIT 11-SPORTS INJURIES

UNIT 12-PEDIATRIC ORTHOPEDICS

UNIT 13-MISCELLANEOUS

UNIT 14-IMAGES AND INSTRUMENTS

SYNOPSIS

BONE AND IMAGING

Introduction to Orthopaedics

1. Fracture
   - 1.1 Typical Fractures
   - 1.2 Atypical Fractures

Bone Structure

1. Introduction
2. Functions of Bone Tissue
3. Structure
4. Bone Types
5. Gross Anatomy
6. Bone composition
7. Extracellular Matrix
8. Bone Cells
9. Bone Marrow & Haematopoiesis
10. Functional Unit of Compact Bone
11. Metabolic Functions of Bone
12. Remodeling

X Ray Diagnosis

1. Myositis Ossificans (Heterotopic Ossification)
2. Myositis Ossificans Traumatica
   - 2.1 Causes
   - 2.2 Mechanism
   - 2.3 Clinical Features
   - 2.4 Differential Diagnosis
   - 2.5 X-Ray
   - 2.6 Confirmation
   - 2.7 Treatment
3. Myositis Ossificans Progressiva (Fibrodysplasia Ossificans Progressiva)
   - 3.1 Treatment
4. Acute Respiratory Distress Syndrome (ARDS)

4.1 Synonyms

4.2 Common aetiology

4.3 Iatrogenic cause

4.4 Clinical Criteria

4.5 Investigation

4.6 Management

5. X-Ray Diagnosis

MRI in Orthopaedics

1. Introduction
2. MRI Spine
3. Spinal Tumors
4. Spinal Cord Trauma
5. MRI Knee
6. MRI Shoulder
7. MRI Hip
8. MRI in Osteomyelitis
9. MRI in Bone tumors
10. Advantages and Disadvantages of MRI
11. Contraindications of MRI

Special X-Ray Views in Ortho

1. 450 Lordotic View (Cephalic Tilt View)
2. Serendipity View
3. Zanca's View
4. Westpoint View
5. Axial View
6. Velpeau View
7. Grashey's View
8. Scapular Y View
9. Stryker's Notch View
10. Coyle's View
11. Scaphoid View
12. Carpal Tunnel View
13. Clenched Fist View
14. Brewerton's View

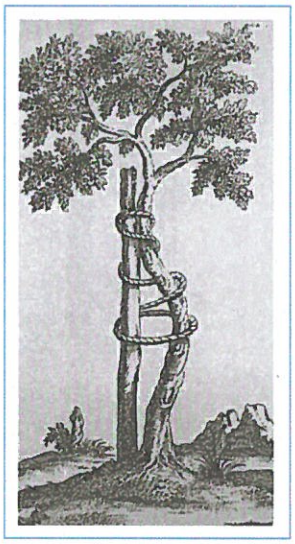
15. Robert's View
16. Dunn's View
17. Frog Leg Lateral View
18. Danelius- Miller's View
19. Clement's Nakayama View
20. Skyline Laurin or Axial View or Merchant View
21. Sunrise View

1 INTRODUCTION TO ORTHOPAEDICS

00:00:10

- **Ortho:** Straight.
- **Pedics:** Child.
- Making a bent bone straight in a child.

Universal Symbol of Orthopedics



- A bent tree is tied to a straight stick.
- As the tree grows, the bend will be gone, and the tree grows straight.

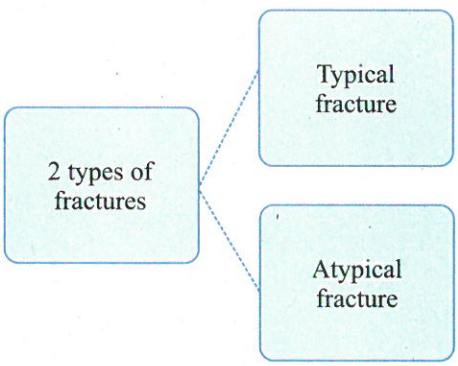
Important Information

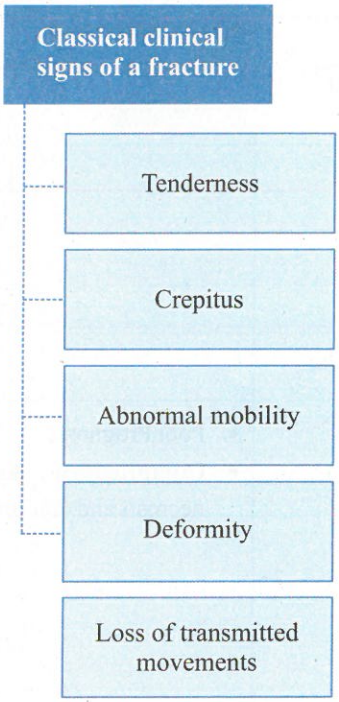
- Sir Nicholas Andry coined both, the term Orthopedics and the Universal symbol of Orthopedics.
- Father of Orthopedics: Sir Nicholas Andry.

Fracture

00:02:30

- Defined as Breach (break) in the continuity of periosteum/ bone/ both.
- Even a small tear in the periosteum can be considered as a facture.

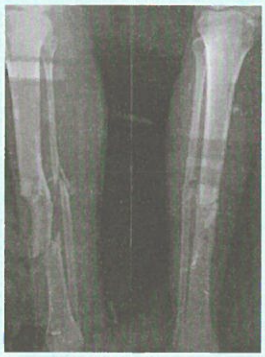
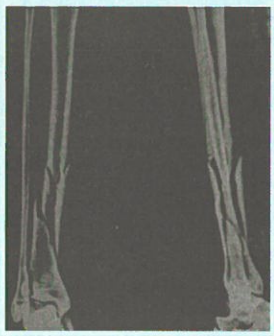




1. Typical Fractures 00:04:30

- Shows all classical signs of fracture.
- Divided based on the fracture pattern in the X-ray.

Types of typical fractures	Features	Prognosis and complications
Transverse fracture	 • Bone is broken perpendicular to its length.	• Very good prognosis.
Oblique fracture	 • Bone is broken in an oblique manner.	• Best prognosis.

Spiral fracture	 • Bone is broken with a twisting motion.	• Good prognosis. • Complication: Rotatory Malunion
Segmental fracture	 • Has two transverse fractures. • One is proximal. • Another is distal. • A piece of bone is separately present.	• Poor Prognosis • Complication: Avascular necrosis and non-union.
Comminuted fracture	 • Bone is broken into many pieces.	• Poor Prognosis

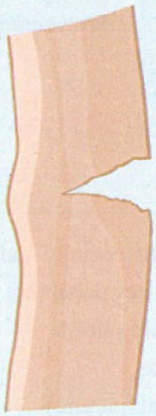
Important Information

- **Concept of Healing:** Surface area is more >> Hematoma formation is more >> Callus formation is more.
- **Stages of fracture healing**
  - Stage of impaction
  - Stage of induction
  - Stage of hematoma formation
  - Stage of callus formation
  - Stage of consolidation
  - Stage of remodelling

2. Atypical Fractures

00:12:15

- May not show all classical signs of fracture.

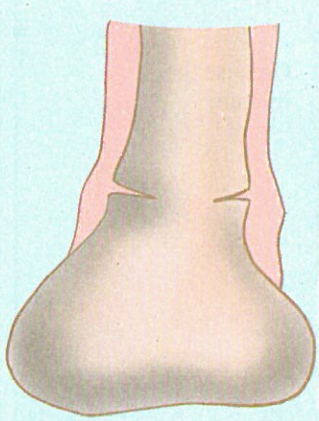
Types of fractures	Features
Greenstick fracture	• Most common fracture in children before epiphyseal closure. • MC bone involved is the forearm bone.  • One cortex is intact. • Another cortex is open.  Greenstick fracture • X-ray shows small opening at one cortex. • **Greenstick** - Young slender bamboo (diameter is small, when young bamboo is broken, only one cortex is broken, while a mature bamboo is broken both the cortex may be broken). • **Treatment** o Conservative Management - Plaster of Paris (POP). → The other intact cortex is also broken to form a complete fracture and cast is applied, which prevents delayed union or non-union and helps in complete and fast recovery. o Surgery not done before epiphyseal closure.

Hairline/ March/ Stress fracture

Hairline/ March/ Stress fracture

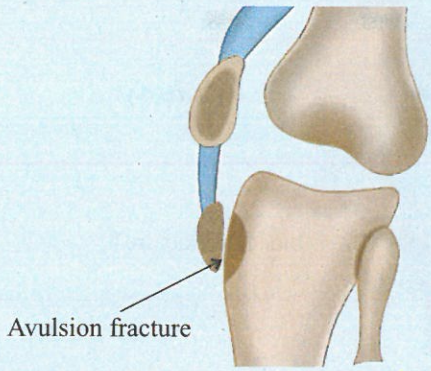
- Seen in all age groups.
- **Most common site:** Metatarsal bones (especially 2nd metatarsal)
  - March fracture because seen in military personnel who do march past.
  - Stress fracture caused by long standing stress.
- Presents with complaint of pain in the foot
- Swelling may/may not be seen (atypical fracture)
- **Diagnosis:** digital X-ray
- **Treatment**
  - POP is not necessary
  - Bed rest for 2-3 weeks.
  - NSAIDs for pain

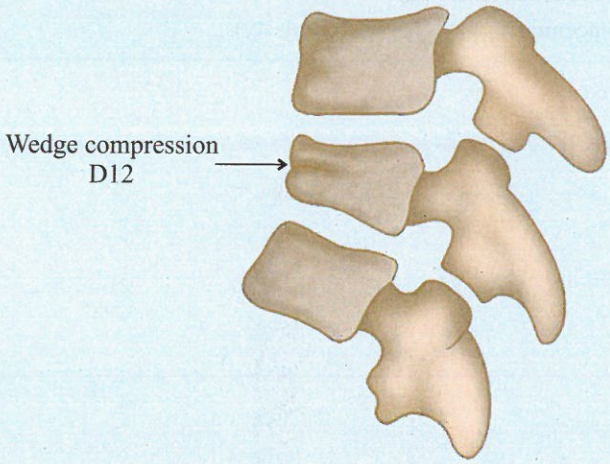
Torus/ Buckling fracture

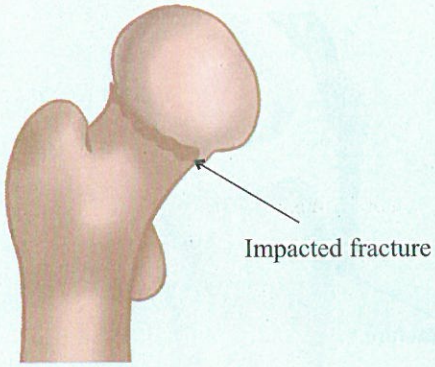


Torus/ Buckling fracture

- Buckling of the periosteum is seen.
- More common in children.
- Most common site is Tibia (weight bearing bone).
- MC site in Tibia is at the lower end.
- **Treatment**
  - POP Slab for 4-5 weeks.
  - Surgery is not needed

Avulsion fracture	 • Happens only at the site of tendon insertion. • Most common site: Tibial tuberosity. • Next common site: Tendo Achilles (due to Avulsion or pull). • The small chunk is always pulled by the patellar tendon - May go for non-union. • **Treatment:** Fixation with mini screws + immobilization.

Wedge compression fracture	
	• Bone becomes wedge shaped.
	• **MC site:** D12 vertebra (12th thoracic vertebra), as it is the most weight bearing vertebra.
	• **Pathophysiology:** It is a pathological condition following a trivial trauma.
	• **Pathological conditions leading to Wedge compression fracture:**
	  ○ Most common: Osteoporosis
	  ○ Rare: Malignancy
	• Presents with complaints of pain.
	• As it occurs in the body of the vertebrae, it does not cause any cord compression or neurological issues.
	• **Treatment**
	  ○ Reassurance.
	  ○ Analgesics.
	  ○ Surgery not done.
	  ○ Treatment of choice: Bed rest for 14 days, NSAIDs.

Impacted fracture	
	• Fracture not seen very easily.
	• **Most common site:** Neck of femur.
	• Proximal fragment (head of femur) is impacted with distal fragment (neck of the femur).
	• **Treatment**
	  ○ Disimpact the fracture.
	  → If blood supply is normal it is fixed.
	  → If not, joint replacement is done (hemiarthroplasty).

2 BONE STRUCTURE

Introduction

00:00:11

- At Birth, there are approximately 270 bones.
- While reaching Adulthood, it gets reduced to 206 Bones.
- During life, bone is constantly Remodeling, with most of the adult skeleton being replaced about every ten years.

Functions of Bone Tissue

00:01:02

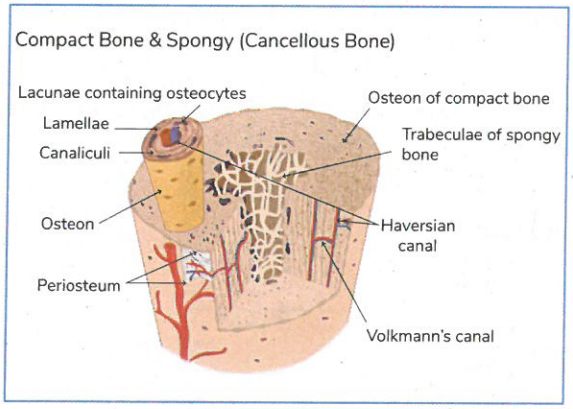
- Are both Supportive and Locomotive.
- Bones not only provide the physical platform of the body but also enable locomotion by providing attachment sites for muscles, tendons, and ligaments.
- **In addition,**
  - It Protects Vital Organs.
  - Facilitates Breathing.
  - Play a role in Homeostasis.
    - → Bone Marrow is critical for survival.
- Bone tissue is unique in that it can Regenerate, Restoring to a fully functional, Pre-injury state.

Structure

00:02:57

Bone is composed of

- Compact (cortical) bone
- Cancellous (Trabecular or Spongy) bone
- Bone cells & Bone matrix



Compact Bone

- Makes up 80% of the total bone in the body.
- Stronger than Cancellous or Trabecular bone.
- It is very Resistant to Bending, Torsion & Compression.
- It has a Minimal role in Metabolism.
- It is Seen Mostly in the Shaft of Long Bones.
  - Called as Diaphysis.

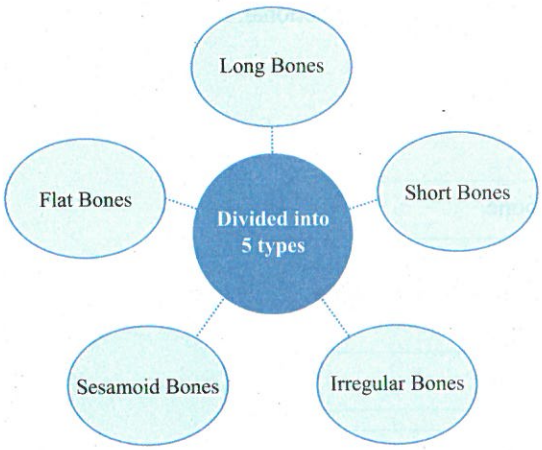
Cancellous Bone

- Makes up only 20% of the total bone but has ten times the Surface/volume Ratio of Cortical bone.
- It responds Eight Times faster to changes in load, making it far more Dynamic.
- Cancellous Bone is seen in areas that are more subject to Compressive Force such as:
  - Vertebral Body.
  - Pelvis.
  - Metaphysis.

Bone Cells & Bone Matrix

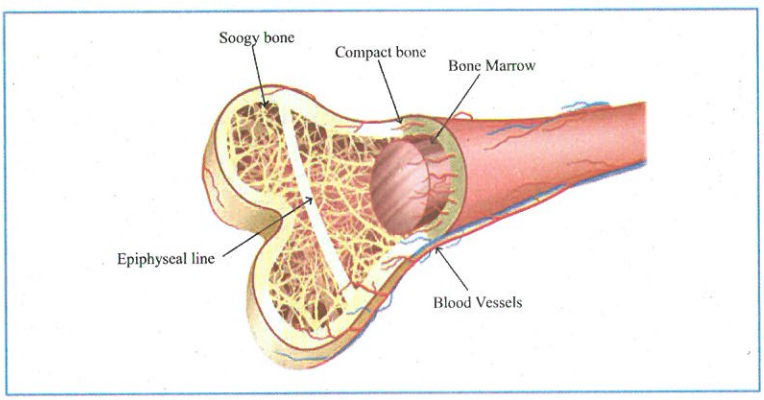
- Osteoblasts & Osteocytes: Bone Forming.
- Osteoclasts: Bone Resorbing.
- Osteoid: Mix of Collagen & Non Collagenous proteins.
- Inorganic Mineral Salts.
- Nerves and Blood vessels.
- Bone Marrow.
- Cartilage.
- Membranes, including the Endosteum and Periosteum.

Bone Types 00:06:56



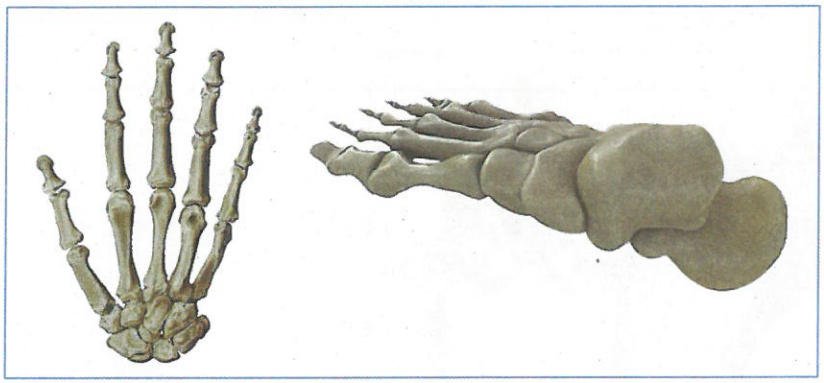
Long Bones

- Mostly made of Compact Bone.
- Have little bone marrow.
- They develop from Enchondral Ossification.
  - Except Clavicle.
- These bones tend to support weight and help movement.
  - E.g., Femur, Tibia, Fibula, Humerus.



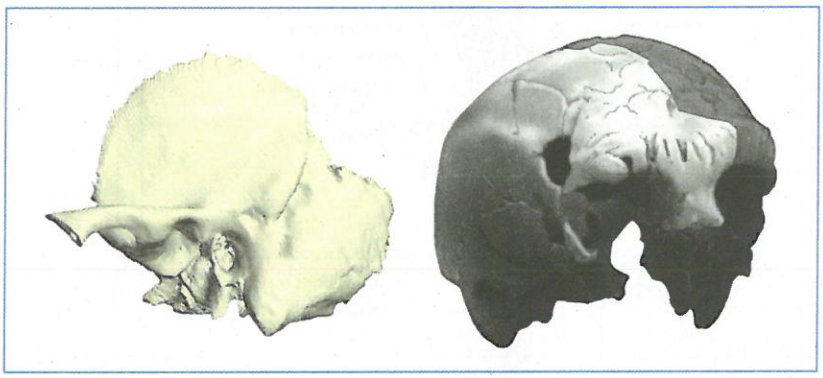
Short Bones

- Have only a thin layer of compact bone.
  - E.g., Carpal & Tarsal Bones.



Flat Bones

- Usually, bones that are thin and curved.
- They develop from Intramembranous Ossification.
- They have an Inner & Outer table of Compact Bone intervened by Trabecular Bone.
  - Eg; Skull, Sternum, Scapula, Ribs.

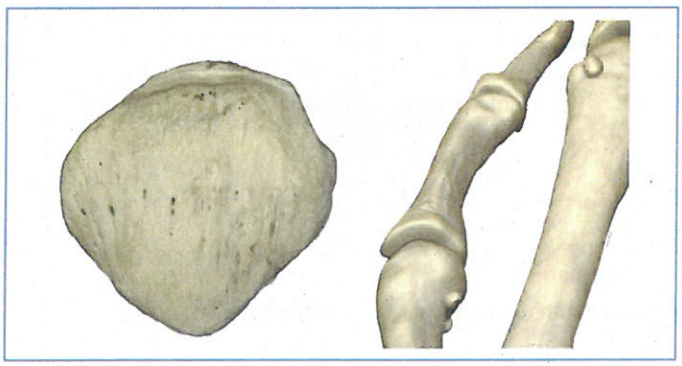


Important Information

- Pelvis is not a flat bone
- It's an irregular bone

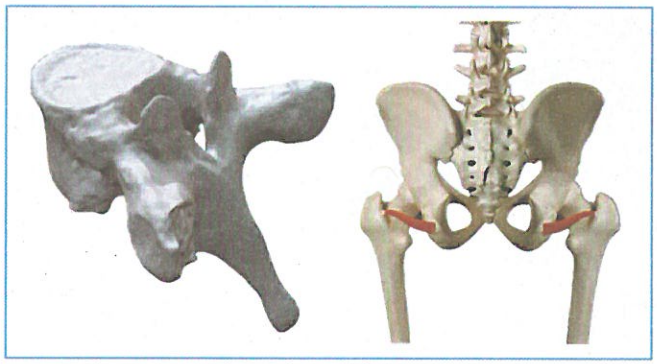
Sesamoid Bones

- Embedded in Tendons.
- They form without Ossification Centres.
  - Except Patella.
- They protect Tendons from Wear & Tear.

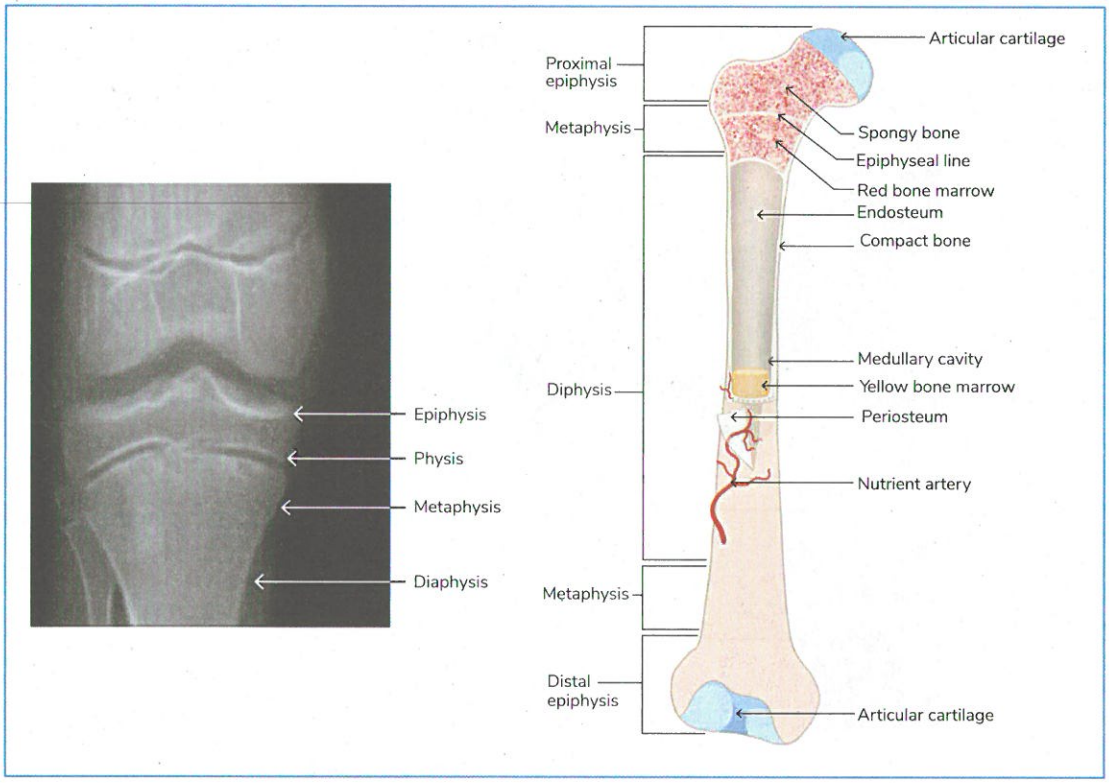


Irregular Bones

- As their name implies, these are bones that do not fit into the first four categories and have an unusual shape
  - Eg; Vertebra & Pelvis



Gross Anatomy 00:10:38

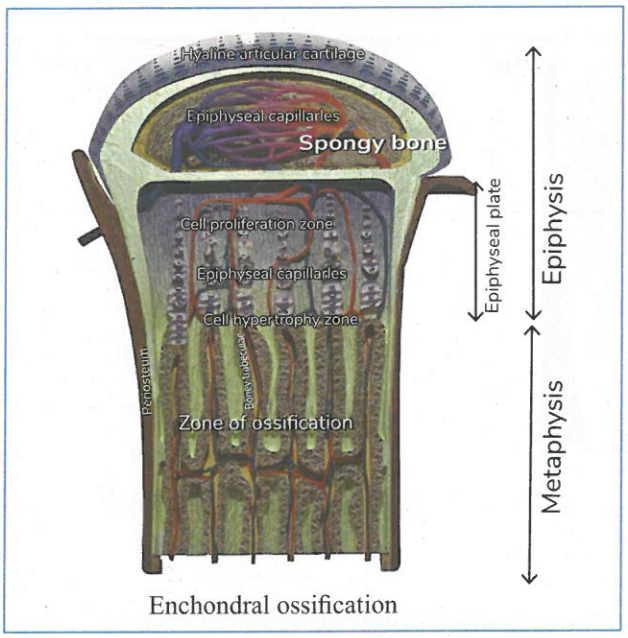


A long bone has the following parts

Epiphysis | Physis | Metaphysis | Diaphysis | Bone Marrow | Periosteum | Endosteum

Epiphysis

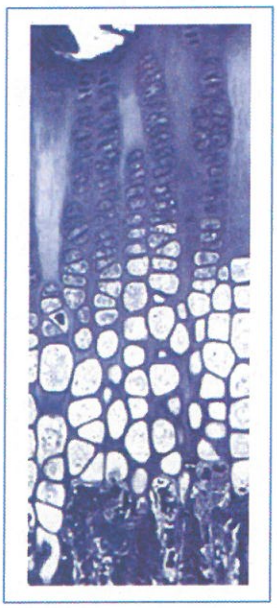
- It lies between Physis & Articular Cartilage.
- It is usually Intra Articular & takes part in Joint formation.
- This part Ossifies separately and later becomes Ankylosed to the main part of the bone.



Enchondral ossification

Physis

- The growing structure consisting of a flat portion adding length to the bone & circumferential portion adding width to the bone.

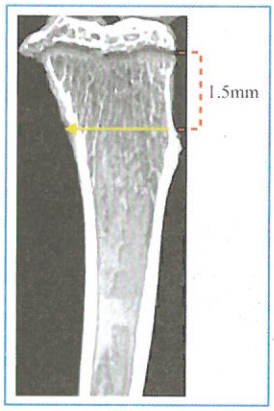


Physis is divided into Four Zones

- The Reserve Zone
- The Zone of Proliferation
- The Zone of Hypertrophy
- The Zone of Provisional Ossification

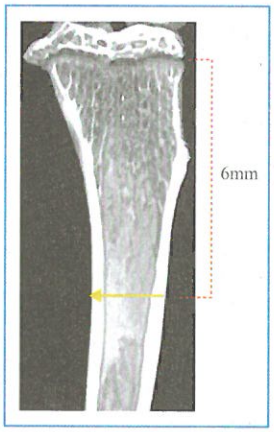
- Each zone contributes different aspects of longitudinal growth.
- Once the Growth Plate has fused.
  - The Epiphysis and Metaphysis are joined.
- If there is an injury to the zone of proliferation, there will be growth arrest.

Metaphysis



- It is a funnel-shaped part at the ends of Diaphysis that predominantly comprises Trabecular bone.
- It lies between Physis & Diaphysis.
- More susceptible area for Osteoporotic Fractures.
- More susceptible area for Remodelling Defects like Multiple osteochondromatosis or Exostosi.

Diaphysis



- Most Cortical Bone is found in this region, giving both tensile & compressive strength.
- This is the strongest part of the bone.
- Even though this is the strongest part, this is the most susceptible area for Fracture by virtue of extreme levered forces being transmitted through it.

Bone Marrow