

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)

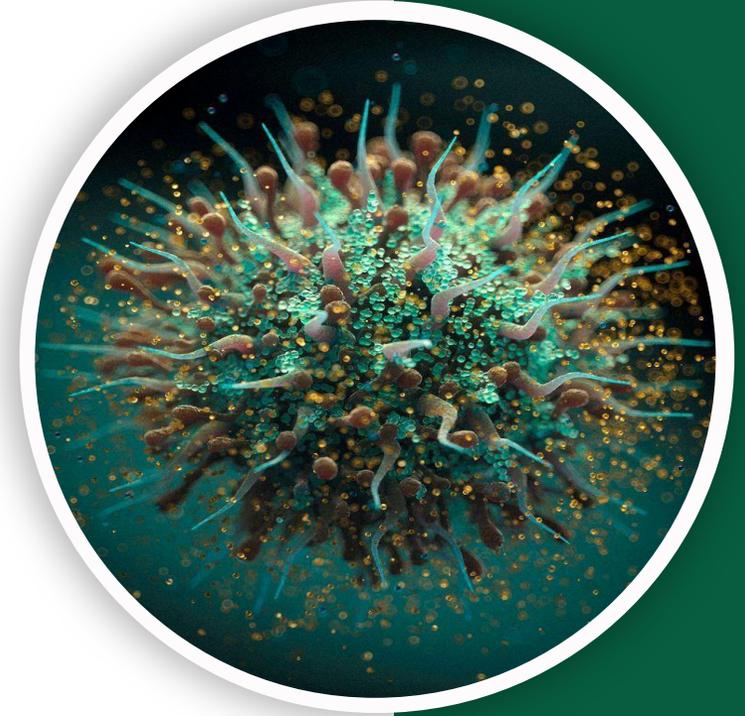


جراح

Pathology | MID 1

# MSS & Skin Tumors

## Pt.1



Written by : Abdallah Al-Abdallat  
Abdalkareem Al-Salamat

Reviewed by : Rawan Okour

# MSS & Skin Tumors

## Pathology 2026

### Lecture 1

*Mousa Al-Abbadi, MD, FCAP, CPE (=MBA),  
CPHQ, FIAC, ABMQ*

*Professor of Pathology & Cytopathology  
University of Jordan  
College of Medicine*

**!!!**

**[YOU SHOULD NOT ONLY STUDY  
FOR THE EXAM] [YOU ARE NOT  
STUDYING FOR ME EITHER]  
[YOU ARE LEARNING SO THAT YOU  
WILL BE A GOOD CARING &  
THOROUGH PHYSICIAN WHO WILL  
APPLY THE STNADRAD OF CARE]**

# □ **OUTLINE & OBJECTIVES**

- **Remember the basic structure & function of bone**
- **Congenital diseases of bone and cartilage**
- **Metabolic disorders of bone**
- **Paget disease of bone**
- **Fractures**
- **Osteonecrosis**
- **Osteomyelitis**
- **Bone tumors and tumor-like conditions**

# □ ...OUTLINE & OBJECTIVES

- **Arthritis:**
  - **Osteoarthritis; RA; Juvenile Idiop A**
  - **Seronegative Spondyloarthropathies**
  - **Infectious arthritis; Lyme arthritis**
  - **Crystal-induced arthritis**
- **Joint tumors & tumorlike conditions**
- **Soft tissue tumors:**
  - **Adipose tissue; fibrous tissue; skeletal muscle**
  - **Smooth muscle; tumors of uncertain origin**
- **Skin neoplasms**

# E learning (will be sent to you too)

Bone development	<a href="https://www.youtube.com/watch?v=xXgZap0AvL0&amp;ab_channel=INTELECOM">https://www.youtube.com/watch?v=xXgZap0AvL0&amp;ab_channel=INTELECOM</a>
Osteoporosis	<a href="https://youtu.be/eT_G9NHlyV0">https://youtu.be/eT_G9NHlyV0</a> <a href="https://youtu.be/VwCkyf0lQwo">https://youtu.be/VwCkyf0lQwo</a>
Osteoarthritis	<a href="https://youtu.be/BBqjltHNORc">https://youtu.be/BBqjltHNORc</a> <a href="https://youtu.be/pnKaBMvVUs0">https://youtu.be/pnKaBMvVUs0</a>
Rheumatoid arthritis	<a href="https://youtu.be/Yc-9dfem3IM">https://youtu.be/Yc-9dfem3IM</a> <a href="https://youtu.be/ld8PhyAHov8">https://youtu.be/ld8PhyAHov8</a>
Osteoarthritis vs rheumatoid arthritis	<a href="https://youtu.be/6lx_774GuTw">https://youtu.be/6lx_774GuTw</a>
Osteomyelitis	<a href="https://youtu.be/mpUq6Ui6yew">https://youtu.be/mpUq6Ui6yew</a>
Gout	<a href="https://youtu.be/bznoU5bke4U">https://youtu.be/bznoU5bke4U</a>
Bone tumors	<a href="https://youtu.be/wezFzUX-UWY">https://youtu.be/wezFzUX-UWY</a>
Bone and soft tissue tumors	<a href="https://youtu.be/gPCzAdD6mlw">https://youtu.be/gPCzAdD6mlw</a>
Soft tissue tumors	<a href="https://youtu.be/qpkPKk3HxUQ">https://youtu.be/qpkPKk3HxUQ</a>
Ossifications	<a href="https://youtu.be/Vwethc4jt7U">https://youtu.be/Vwethc4jt7U</a> <a href="https://youtu.be/vOKLFdP4pjE">https://youtu.be/vOKLFdP4pjE</a>
Skin neoplasms	<a href="https://www.youtube.com/watch?v=Too2MtxEFoQ&amp;ab_channel=MedFlix">https://www.youtube.com/watch?v=Too2MtxEFoQ&amp;ab_channel=MedFlix</a> <a href="https://www.youtube.com/watch?v=-uf1mOu98V8">https://www.youtube.com/watch?v=-uf1mOu98V8</a>

# □ BONE FUNCTIONS



- I. Mechanical support** through the whole body .
- II. Forces transmission** (force on one organ is equally distributed on the rest of the body)
- III. Protection** (e.g., brain and skull)
- IV. Mineral homeostasis** Calcium and phosphorus metabolism is mainly controlled by the physiology of bone
- V. Hematopoiesis** (by bone marrow, many of your hematological cells are produced by bone marrow especially bone marrow of the long bone )

This is why any disease in the bone, most of these will be affected & this will give you clues what are the signs & symptoms of bone disease in different patients

# □ BONE STRUCTURE , consists of 2 major components:

- 1. Matrix** (which consist of **osteoid (35%)** and **minerals (65%)** (calcium, phosphorous and others)):
  - **Osteoid** mainly consists of **organic type I collagen** (one of the strongest types of collagen) and **glycosaminoglycans & other proteins**
  - **Inorganic hydroxyapatite** [ $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ]
  - **Woven vs lamellar bone** (depending on the type of the matrix & the arrangement of the cells)
- 2. Cells** (3 major types) :
  - **Osteoblasts: forms bone**, the major component of bone cells as they synthesize bone.
  - **Osteoclasts: resorbs bone**, (the bone eating cells) ,they originate from the macrophage-monocyte system.
  - **Osteocytes: mature bone cells**, less active, smaller in size than osteoclasts and osteoblasts and do not have too many cytoplasmic organelles for metabolic activity.

# □ Extra Notes Regarding BONE STRUCTURE

- Recall types of collagen :

Collagen type 1 : bone forming

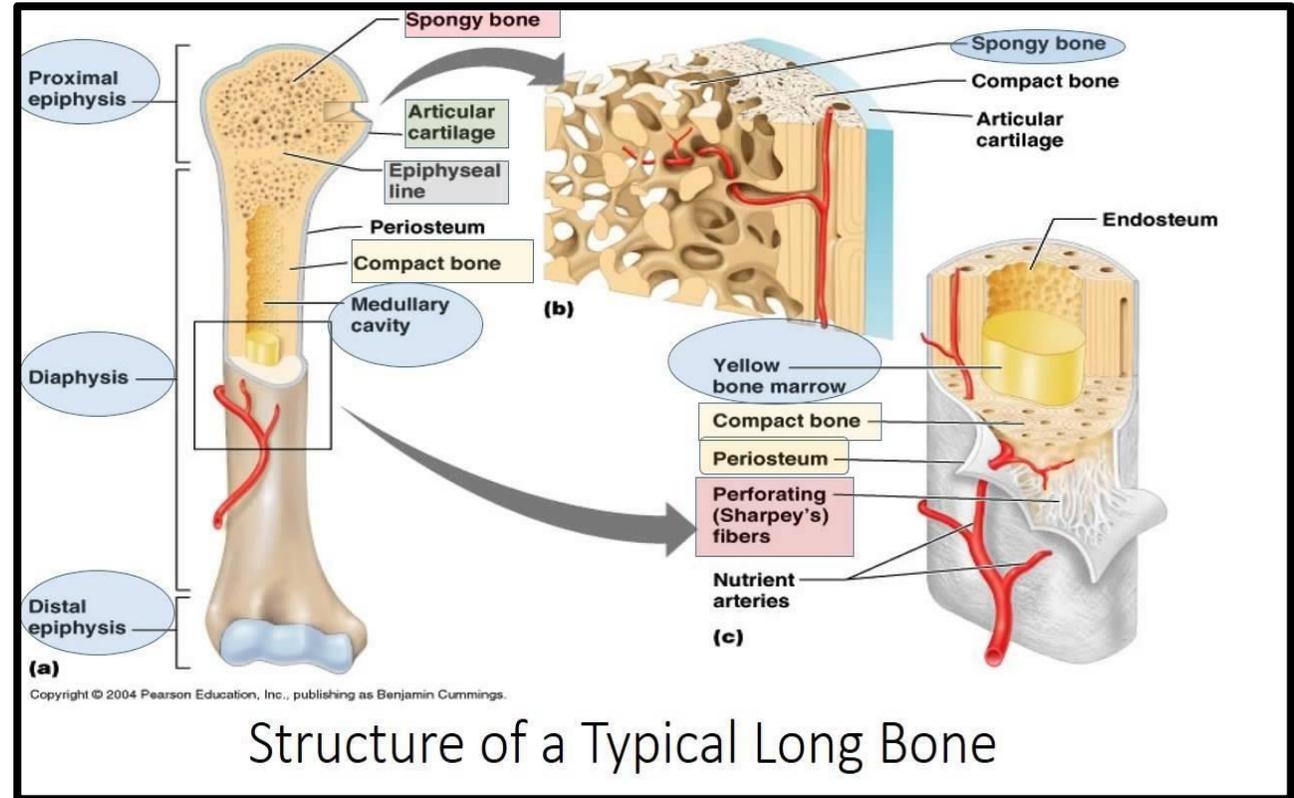
Collagen type 2 : cartilage forming

Collagen type 4 : basement membrane forming

- An imbalance between osteoblast and osteoclast activity is an important pathogenic mechanism in many diseases (e.g. osteoporosis)

# □ The histology of bone

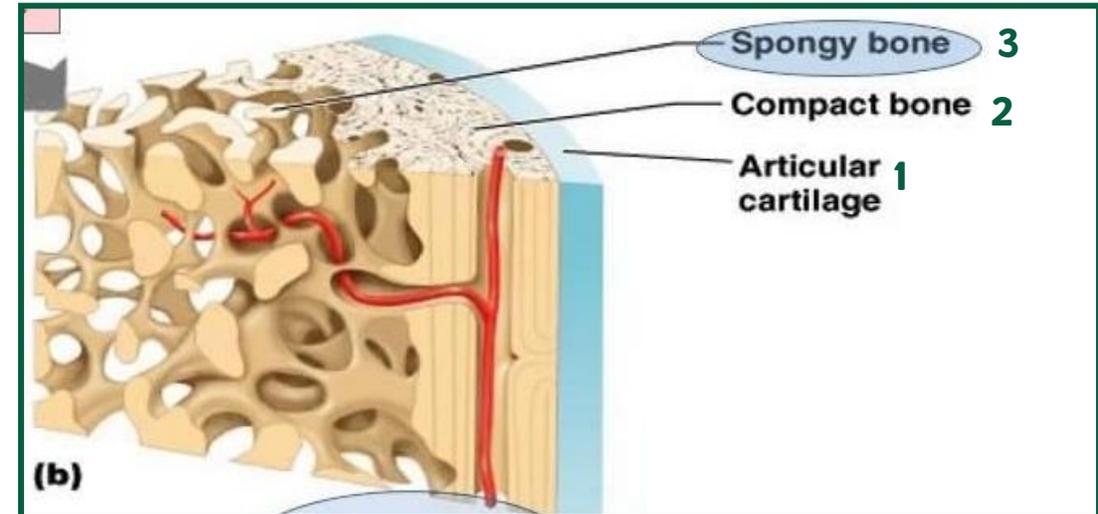
- Proximal and distal Epiphysis.
- Epiphyseal plate: where the growth occurs.
- Periosteum: the outer part of the bone which contains nerves [any irritation of periosteum will cause pain].
- Articular Cartilage
- Compact bone: below the periosteum and before getting into spongy bone marrow [it is very hard].
- Medullary cavity: which contains bone marrow particles where the major Hematopoiesis occurs.
- Diaphysis: the area located between proximal and distal epiphysis.
- The endosteum: The inner part of the compact bone



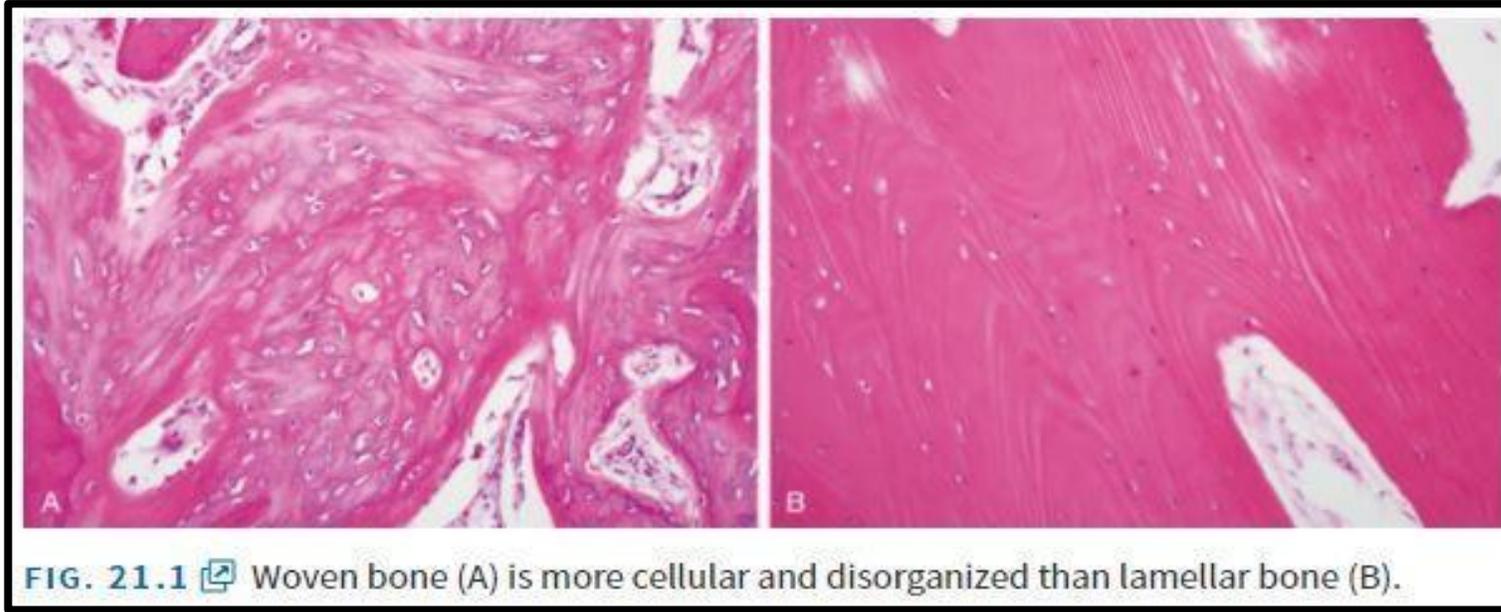
# □ The histology of bone

❖ There are certain fractures & diseases that affect the proximal epiphysis, some of them affect Diaphysis and some of them affect metaphysis.

➤ As a summary, This figure shows the articular cartilage shown as number (1) below it we have compact strong bone shown as number (2) then trabeculae bone shown as number (3) , the blood supply comes from outside then goes to the penetrating arteries.



# ❑ WOVEN VS LAMELLAR BONE



## ❖ Woven bone :

- More haphazard.
- More cells.
- Less organization
- Seen in fracture / malignancy / young early formed bone

## ❖ Lamellar bone :

- Mature, linear, and nice looking bone.
- Less cells and more collagen.
- Strong regularly arranged bone.

# Describing the previous images

- The difference between lamellar bone and woven bone is mainly histologically .
- Performing a cross section of woven bone and lamellar bone as shown in the previous slide, the woven bone is more cellular, and it has more cells in 1cm area compared to that of the lamellar bone
- The trabeculae is whiter in woven bone and the arrangement between cells and type I collagen is Haphazard.
- Instead, in the lamellar bone ,the arrangement is more linear and organized.
- Lamellar bone is the main structure of the mature long bones.
- Woven bone is found normally in early young born in children and in certain diseases.
- Observing a woven bone in adult is an abnormal sign, it could be malignancy or some fracture site or etc...
- DOCTOR said he might give the pictures and ask about the types of bone and then ask about certain structure and in which type of bone those structures are found

## □ OSTEOLASTS vs. OSTEOCLASTS

How to differentiate between osteoclast and osteoblast histologically

- Osteoblast are smaller cells with nuclear-cytoplasmic ratio which is a little bit high, and they're observed around the areas where osteoid has been formed.
- Osteoclast are considered from the macrophage monocytic system , so they are eating up mature bone. That's why they're called the white pits [Osteoclast].
- Each osteoclast can have up to 100-150 nuclei, sometimes called multinucleated giant cell or multinucleated osteoclast.
- In short, osteoblast are mononucleated cells [one cell one nucleuse] with relatively high nuclear-cytoplasmic ratio compared to osteoclast.

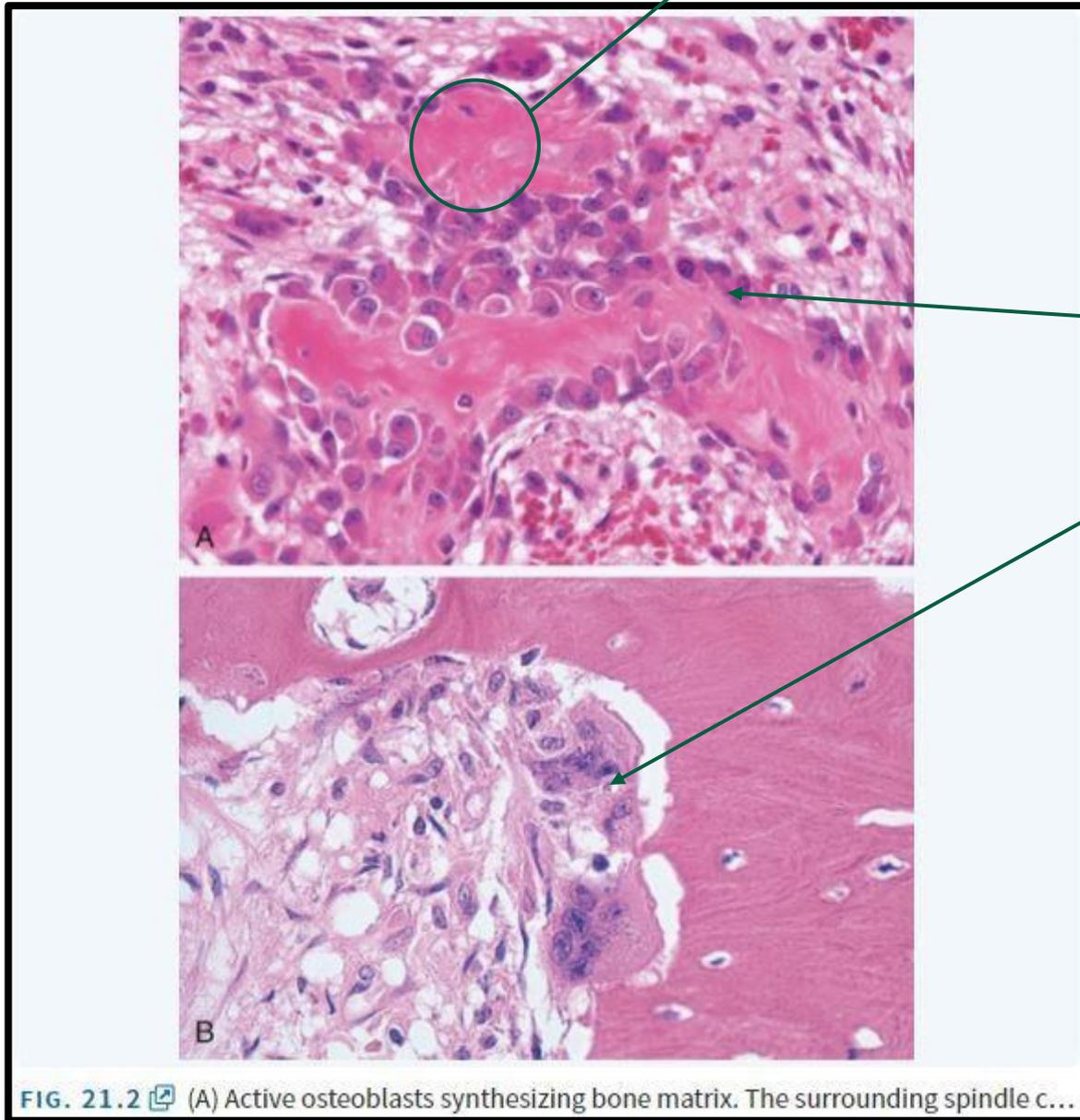
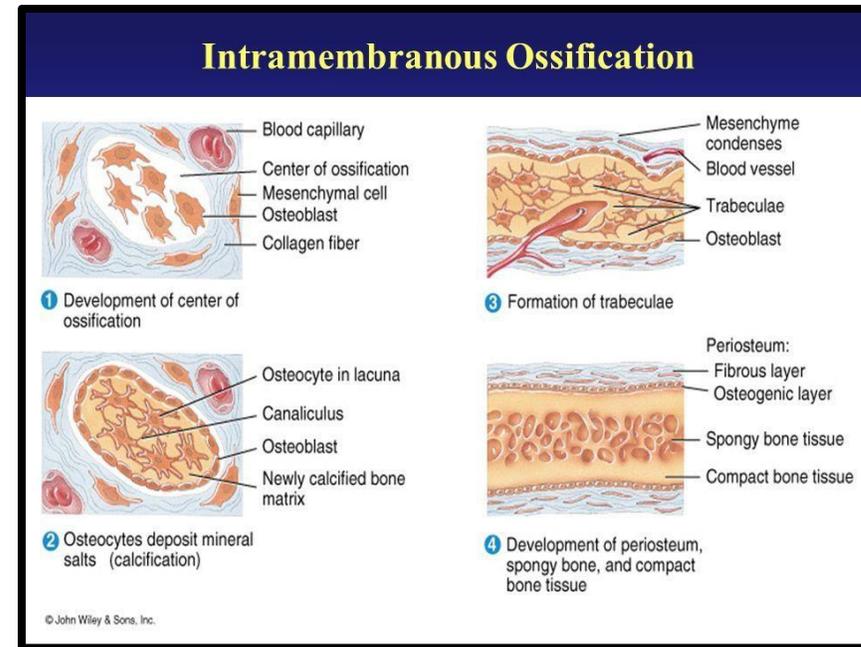
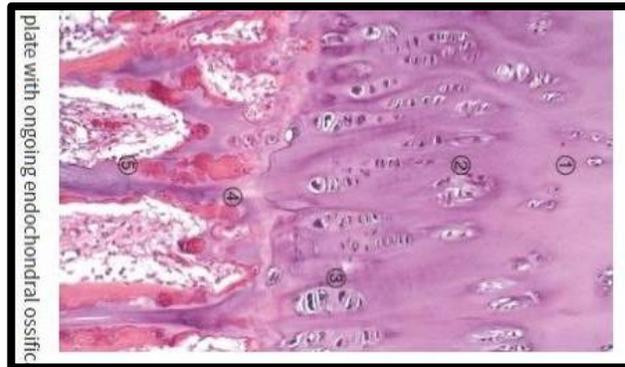
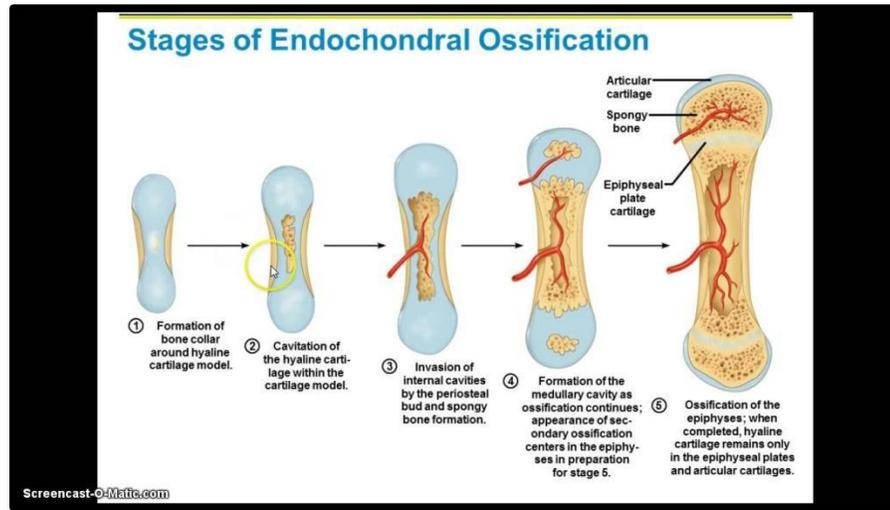


FIG. 21.2 (A) Active osteoblasts synthesizing bone matrix. The surrounding spindle c...

# DEVELOPMENT

## LONG BONES

## FLAT BONES



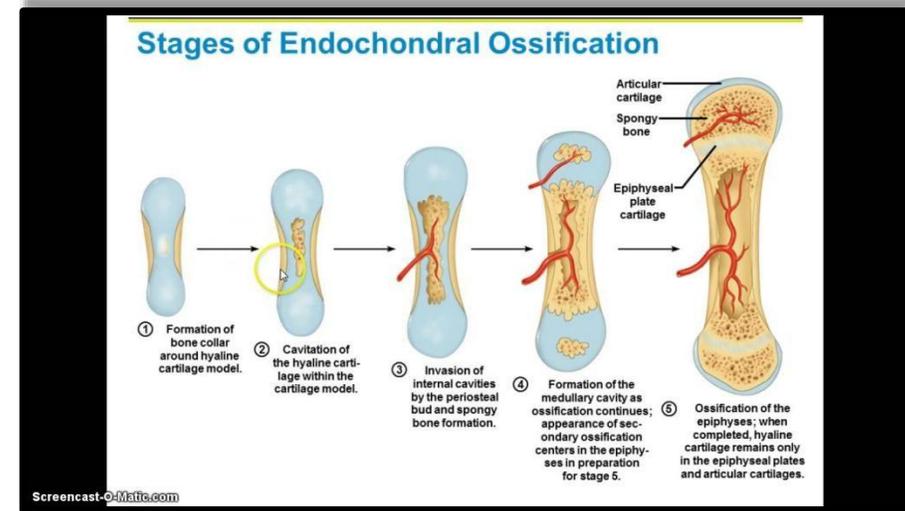
# ➤ A little bit touch about embryogenesis of bone

Prof. Mousa indicated in the lecture that you have to see YouTube animation and other videos in order to understand both methods very well, he also recommend that you read this part from the book.

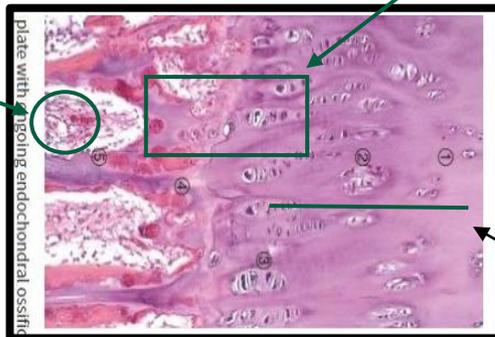
- There is two major ways in which bone development occurs ;

## 1. Bone formation by endochondral ossification (main method):

By the name this indicates formation of bone from young mature cartilage in etyro until mature bone in adult.



Process of endochondral ossification



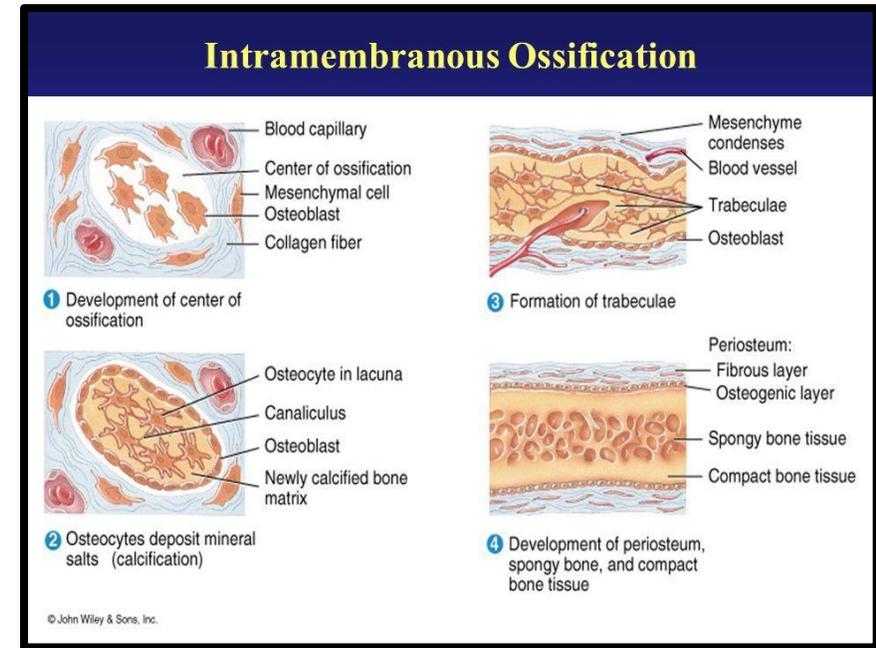
Bone marrow

Mature cartilage

All you need to know from this Images is that the endochondral ossification starts with a cartilage and then ossification begins from the center until most of the long bone is replaced by bone except a remnant articular cartilage at both ends

## 2-Intramembranous ossification

- Flat bones like clavicle, scapula, pelvic bones, and skull bones follow this method.
- This method does not require cartilage.
- Intramembranous ossification begins when basic mesenchymal cells start the process in the nidus and then bone formation continues without passing through ossification of cartilage.



➤ Quick summary for bone embryogenesis

	Endochondral Ossification	Intramembranous Ossification
The need for cartilage:	Yes - Formation of bone from young mature cartilage in utero until mature bone in adults.	No - Doesn't require cartilage.
In which types of bone it happens?	Main process (method) in which <b>long</b> bones are formed.	Main method of <b>flat</b> bones formation ;e.g.: clavicle, scapular, pelvic bones, skull,...etc.
The progression of ossification:	cartilage -> endochondral ossification starts in the center -> most of long bone is replaced by mature bone	Basic mesenchymal cells start the process in the nidus and then bone formation continues without passing through ossification of cartilages.
Additional notes	there is only a remnant of articular cartilage at both ends.	—

# HOMEOSTASIS & REMODELING

- Continuous **metabolizing** and dynamic complex process even in adult mature skeleton (microscopic level)
- **Balance between osteoblast and osteoclast function is changing continuously depending on the age and the location of the bone.**
- Peak bone mass is reached in early adulthood after completion of skeletal growth [**around the age of 20-23 until 30**] **After this age it starts to decline depending on the athletic activity , movement , nutrition and supplies**
- Resorption > bone formation on 4<sup>th</sup> decade **Here is the main pathogenesis of the major metabolic syndrome of osteoporosis**
- **Increasing the quality of life could decrease/delay the difference between resorption and bone formation**

## Extremely Important!!

### + Osteoclast differentiation

**PTH** parathyroid hormone--produced by parathyroid gland

**IL-1** [one of the inflammatory mediators]

**Steroids**

- **Osteoclast** are the main bone resorption cells
- **Factors** that stimulates/activates and tip the balance toward **more osteoclastic** activity which leads to more resorption
- **Patients** who have endogenous steroid production or exogenous steroid usage for autoimmune diseases or cancer will have more osteoclastic activity/more resorption activity, that's why they are advised to take vitamin D supplements along with calcium products

### - Osteoclast differentiation

**BMPs** (bone morphogenic proteins)

**Sex hormones** (estrogen & test.)

- **Here** the factors tipping the balance toward **less resorption**[more bone formation]
- **Some athletes** use the **Androgenic sex hormones** to increase their bone and muscle mass

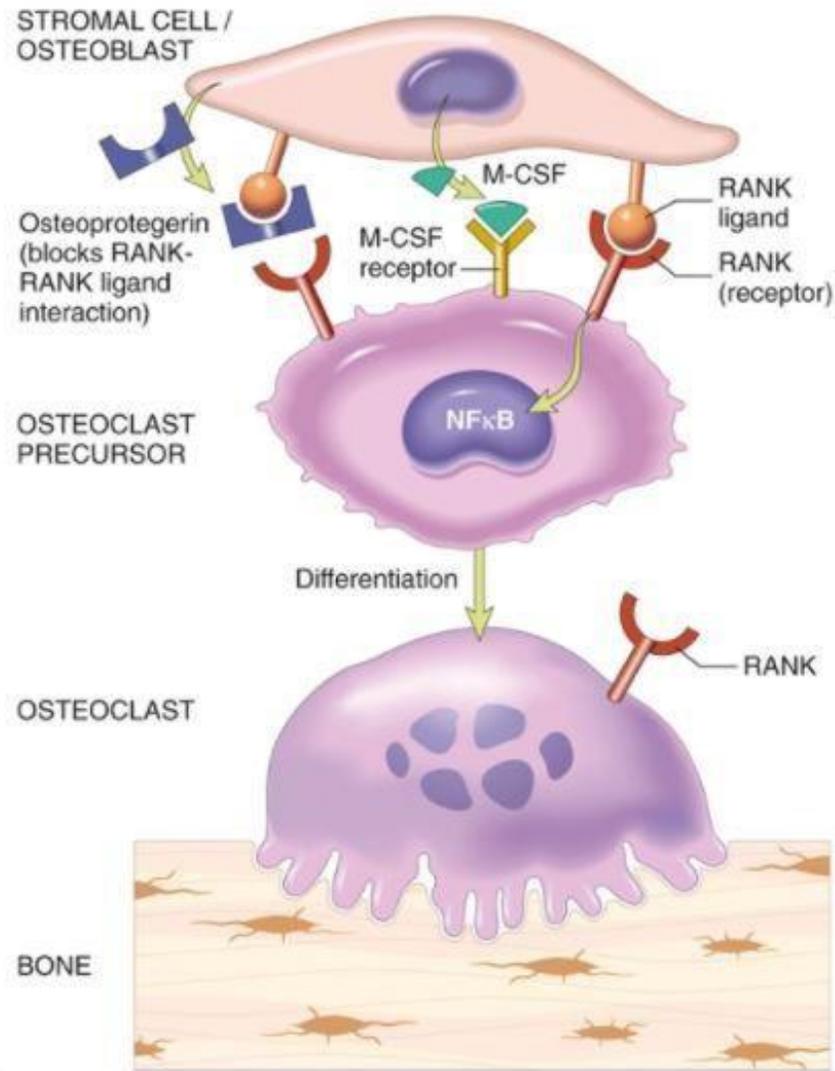


FIG. 21.4 Paracrine molecular mechanisms that regulate osteoclast formation and fun...

- This cartoon explains the formation of active multinucleated osteoclast that will start working on bone resorption
- The stromal stem osteoblastic cells secrete M-CSF (monocyte colony stimulating factors)
- Osteoclast precursor cells have certain receptors that bind M-CSF and other receptors that bind RANK ligand
- Binding of M-CSF and RANK ligand produced from stromal osteoblast on the receptors of osteoclast precursor triggers the differentiation to mature osteoclast
- RANK [Ligand-receptor] complex is a target of many medications and therapeutic modalities
- Osteoprotegerin receptors blocks this complex
- Some medications stimulate osteoprotegerin activity

Click on the bone for a short quiz



# رسالة من الفريق العلمي:

قيل لمعروف الكرخي: كيف اصطلحت مع ربك؟  
فقال: بقبولي موعظة ابن السماك  
قيل له: وكيف؟

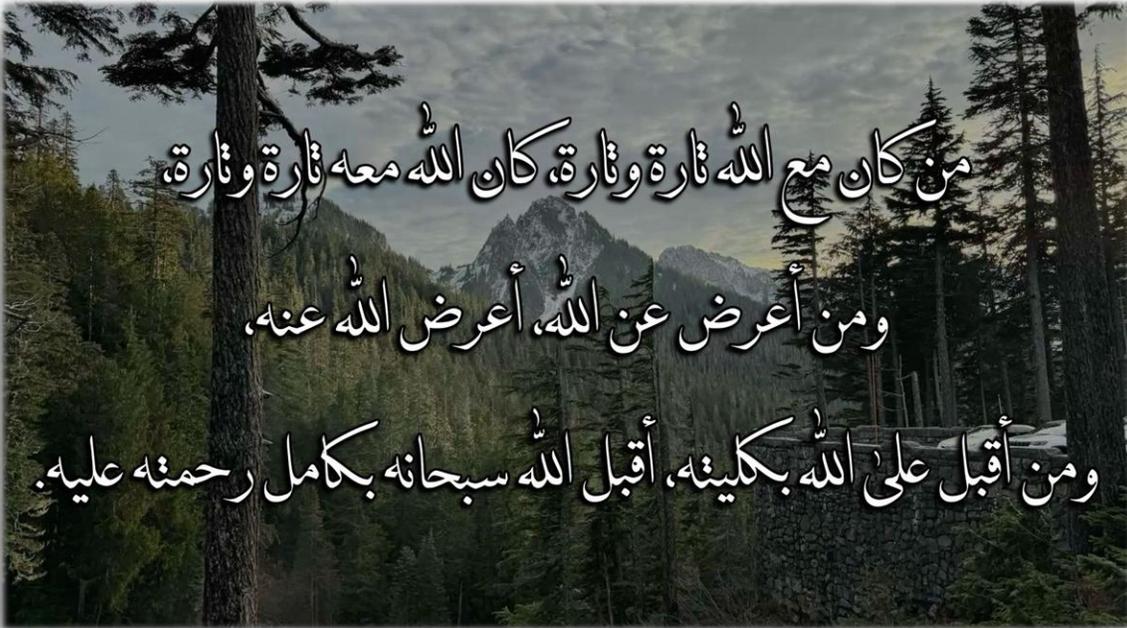
قال: كنت مارًا بالكوفة، فدخلت مسجدًا أبتغي صلاة العصر، وبعد الصلاة  
وجدت رجالاً يعظ الناس فقلت في نفسي لأجلس وأستمع، وكانت عليه  
علامات الهيبة والوقار، فكان مما قال:

من كان مع الله تارة وتارة، كان الله معه تارة وتارة،  
ومن أعرض عن الله، أعرض الله عنه،  
ومن أقبل على الله بكليته، أقبل الله سبحانه بكامل رحمته عليه.

فأدهشني كلامه ووقع في قلبي، وقلت إن مكنتي ربي لأفوزن بأعلاها،

فأقبلت على ربي بكليتي وأقبل ربي على بوسع رحمته وعطائه!

"مَنْ نَقَلَهُ اللَّهُ مِنْ ذَلِّ الْمَعَاصِي إِلَى عِزِّ التَّقْوَى  
فَقَدْ أَغْنَاهُ بِلَا مَالٍ وَأَعَزَّهُ بِلَا عَشِيرَةٍ وَأَنَسَهُ بِلَا أُنَيْسٍ."



# For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			