

### ORGANIC vs. INORGANIC extracellular matrix

### Compact bone vs. Spongy bone

Cortical bone	Cancellous bone
Heavy, tough, and compact in nature.	Light, spongy, and soft
Composed of closely packed osteons or haversian systems.	Composed of trabeculae (thin columns) without central canals.
<b>OUTER</b> layer of most bones	<b>INNER</b> layer of most bones
Forms the <b>shaft</b> or diaphysis of long bones	Forms the <b>ends</b> or epiphyses of long bones
Present in the outer layer of long bones	Present in the middle of long bones.
Denser with a porosity of 5–10% and apparent density of 1.5–1.8 g/cm <sup>3</sup> .	Less dense with a porosity of 50–90% and apparent density of 0.5–1.0 g/cm <sup>3</sup> .
Can withstand higher stress (up to about 150 MPa) but lower strain (up to about 3%) before failure	Can withstand lower stress (up to about 50 MPa) but much higher strain
Consists of proteins like collagens and osteoids, inorganic mineral salts, blood vessels, nerves, and bone marrow within lamellae	Balances the weight of compact bones and provides flexibility for movement
Contains cylindrical osteons with concentric lamellae and osteocytes in lacunae.	Contains red bone marrow, trabeculae forming a spongy grid, and less calcium density.

### Describe the anatomy of a long bone.

Use the following terms: epiphysis, diaphysis, metaphysis, medullary cavity.

### Osteoporosis

Explain why osteoporosis risk may increase with increasing age. Define two types of fractures associated with each. Which type of osteoporosis will occur in elderly women who are 15-20 years post-menopause?

### alendronate sodium

How does alendronate sodium increase bone mineral density? Discuss specifically its effects on bone cell activity. What do studies show regarding incidence of fractures with patients on alendronate sodium vs. patients on a placebo?

### Osteoblasts, Osteoclasts and Osteocytes

OsteoBlasts	OsteoClasts	Osteocytes
<b>B= "builds"</b>	<b>C= "Cleans Up"</b>	
These are bone-forming cells responsible for synthesizing and depositing new bone matrix during bone growth and repair. They are primarily involved in bone formation.	Large, multinucleated cells responsible for bone resorption, the process by which old or damaged bone tissue is broken down and removed.	Mature bone cells derived from osteoblasts that're embedded in the bone matrix. They maintain bones by regulating mineral content and responding to mechanical stress.

### The OSTEON

- Lamellae in bones resist torsion forces by bending and twisting.
- Bones widen under compression and narrow under tension.
- Bones can handle stress because of their anisotropic (having different properties in different directions) and viscoelastic (combining solid and fluid-like characteristics) features.
- Dynamic response to forces allows bones to resist torsion effectively.

### Zones of the growth plates in a long bone.

Be sure to describe what occurs in: proliferation zone, hypertrophic zone, calcification zone, ossification zone.

### Fractures

What is a hip fracture? What is a vertebral wedge fracture?

### Endochondral Ossification

- When does bony collar formation occur during this process?
- Describe how "cavitation" occurs within the diaphysis.
- Describe the formation of the medullary cavity.
- Which type of bone (spongy or compact) forms around the medullary cavity of the diaphysis?
- Which type of bone (spongy or compact) forms inside the epiphyses?
- Contrast articular cartilage vs. epiphyseal plate cartilage (growth plate)

### PERIOSTEUM vs. ENDOSTEUM

Glistening white, double-layered membrane	Covers <b>internal</b> bone surfaces
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### PERIOSTEUM vs. ENDOSTEUM (cont)

Covers entire <b>external</b> bone surface.	It covers the trabeculae of spongy bone and lines canals passing through compact bones
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<b>OUTER FIBROUS LAYER</b> is dense irregular connective tissue	Also is an osteogenic layer lined with osteoblasts and precursors to osteoblasts
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<b>INNER OSTEOGENIC LAYER</b> contains <i>osteoprogenitor cells</i> (bone stem cells)	**
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Contains osteoblasts & osteoclasts	**
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Full of nerves & blood vessels	**
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Secured to bone via <i>perforating fibers</i> (collagen fibers)	**
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Anchoring point for tendons and ligaments	**
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### BONE REMODELING

Define

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### Low bone density

Low bone mineral density and risk of falling are both risk factors associated with fractures. What are some risks of falling? How can exercise counteract these risks?

