Lecture four

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Specialized Connective Tissue

Cartilage

General Features

It is an avascular structure nourished by diffusion

No nerves are present (insensitive) in cartilage

Regeneration of cartilage is poor. Its damage results in a scar.

Covered externally by a dense connective tissue sheath known as perichondrium

Components

1)Cells : chondrocytes
2)Extracellular matrix (ECM) which is composed of:

(a) fibers : mainly collagen type II

(b) ground substance

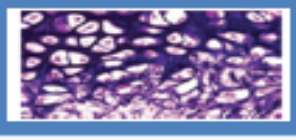
Function

1)Supports soft tissues.

2)Provides gliding area for the joint, facilitating movements

3)Essential for growth of long bones

Types of cartilage

Hyaline cartilage	Elastic cartilage	Fibrous cartilage
		
Site: e.g. Trachea	e.g. Epiglottis	e.g. Intervertebral disc
Perichondrium: Has perichondrium	Has Perichondrium	Does not have
Cells: Has small chondrocytes arranged in groups	Has large chondrocytes arranged in groups	Has chondrocytes arranged in linear rows
Fibers: Has type II collagen	Has type II collagen plus elastic fibers	Has type I collagen

Achondroplasia
(defect in cartilage cause short limbs and normal trunk)

Osteoarithritis
(due to damage of articular cartilage)

Bone

Function

1)It contains bone marrow, which is a haemopoietic tissue

2)Bone stores calcium and phosphate

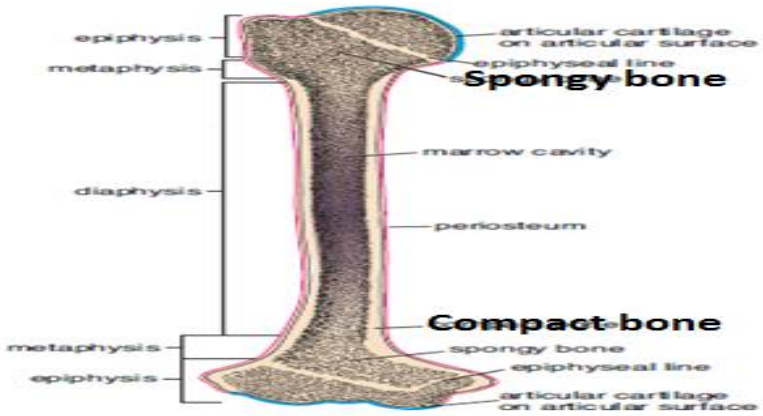
3)It protects vital organs like brain, heart and lungs

TYPES OF BONE

Morphologically, bone consists of:

1.compact bone: it is a solid shell of cortical bone. Form the outer layer of bones

2.spongy or cancellous bone : a network of trabeculae separated by marrow spaces. Form the inner layer of bones



BONE MEMBRANES

1. Periosteum

It is a dense connective tissue membrane covering the external surface of bone

It has rich nerve supply and is very sensitive

It is involved in bone growth and repair

2. Endosteum

It is a membrane of loose connective tissue lining the medullary cavity

It is involved in bone growth and repair

Bone composition

1. Cells

(a) Osteoprogenitor cells: they are pluripotential cells derived from mesenchymal cells

(c) Osteocytes

(b) Osteoblasts

(d) Osteoclasts

2.Extracellular matrix

(a)Fibres :composed of type I collagen.

(b) Ground substance

(c) Inorganic components: responsible for rigidity and hardness of bone

include:

(a) Calcium phosphate

(b) Calcium carbonate

Cells

Osteoblast	Osteocyte	Osteoclast
Bone producer	Bone maintainer	Bone destroyer (resorption)
Cuboidal 	Oval with cytoplasmic processes 	Multinucleated giant cells 
Found on the surface of bone	Found in bony matrix surrounded by lacuna(space)	Found on the surface of bone
Alkaline phosphatase activity positive		Acid phosphatase activity positive
Derived from osteoprogenitor cells	Derived from osteoblast	Derived from blood monocytes(has phagocytic activity)

Structure of the bone

Structure of compact bone

1. Circumferential system

– Outer (near the periosteum)

– Inner (near endosteum)

2. Haversian system or osteon(the main units)

3. Interstitial system(occupying the triangular spaces between Haversian systems)

Haversian system or osteon

Found between the outer and inner circumferential systems

Are long cylindrical structures

Each system consists of a central canal(Haversian canal) surrounded by concentric lamellae of bone matrix

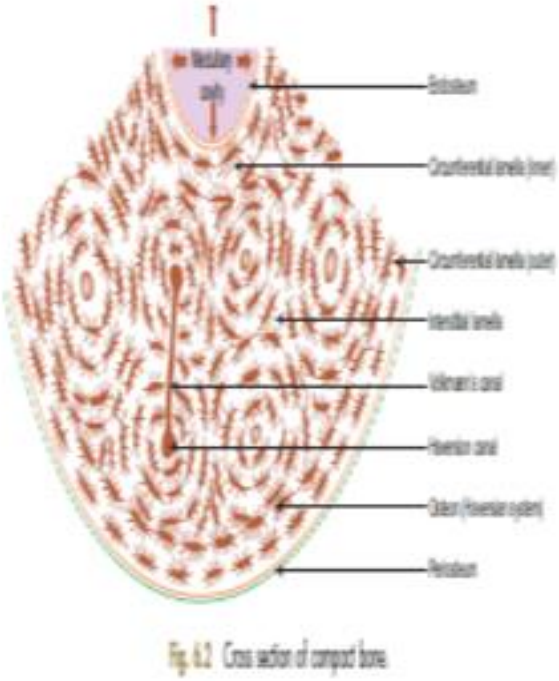
The canal contains blood vessels, nerves, lymphatics and connective tissue

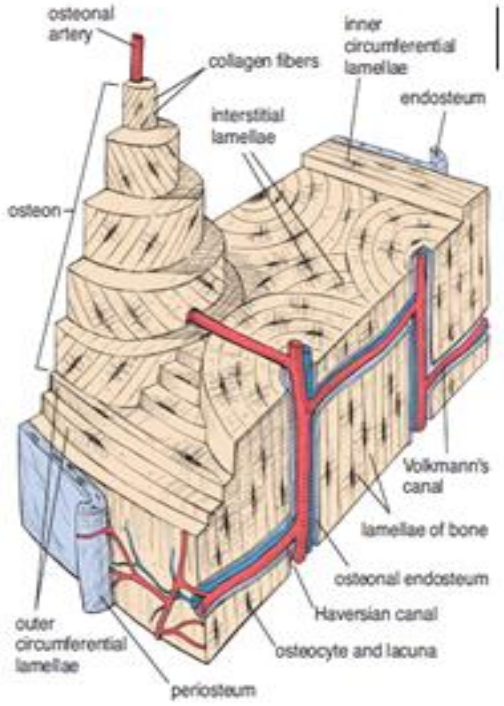
The canals communicate with each other, with the periosteum and with the internal medullary(marrow) cavity through Volkmann's canals.

Osteocytes are seen between lamellae in lacunae(spaces)

Interstitial system

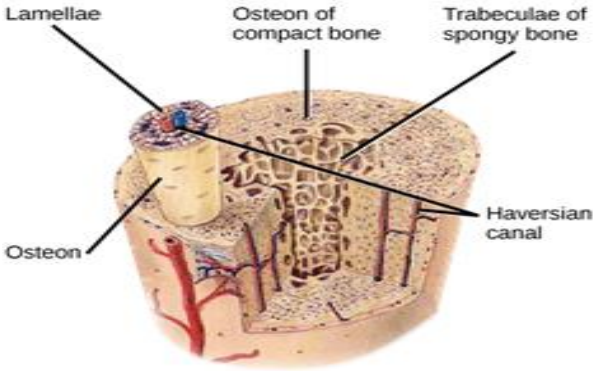
Are concentric lamellae occupying the spaces between the osteons

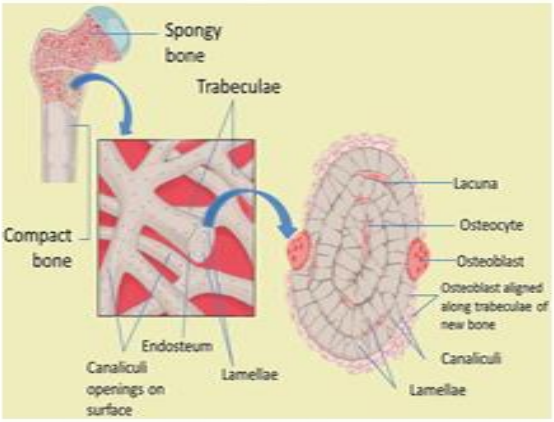




Structure of spongy bone

Spongy bone is made of bony trabeculae that branch and anastomose with one another surrounding marrow spaces between them which contain bone marrow





Role of Vitamins in Bone Formation

Vitamin D

Necessary for absorption of calcium from small intestine.

Deficiency:

in children → rickets, which is characterized by bowing of long bones due to loss of rigidity and hardness in the weight-bearing bones.

in adults → osteomalacia, which also causes softening of bone

Role of Hormones in Bone Formation

1. Parathyroid hormone—activates osteoclasts to resorb bone → ↑ calcium in blood.

2. Calcitonin—inhibits bone resorption by osteoclasts → ↓ calcium in blood.

3. Growth hormone—stimulates the growth of epiphyseal plate

Deficiency of growth hormone → Dwarfism

Excess of growth hormone →

– in children → Gigantism

– in adult → Acromegaly

Acromegaly

Gigantism

Dwarfism