

Structure and Physiology of Bone

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Bone

- Part of the human psyche
- Skeleton – literally lives for ever
- Pirates – skull and cross bones

Bone

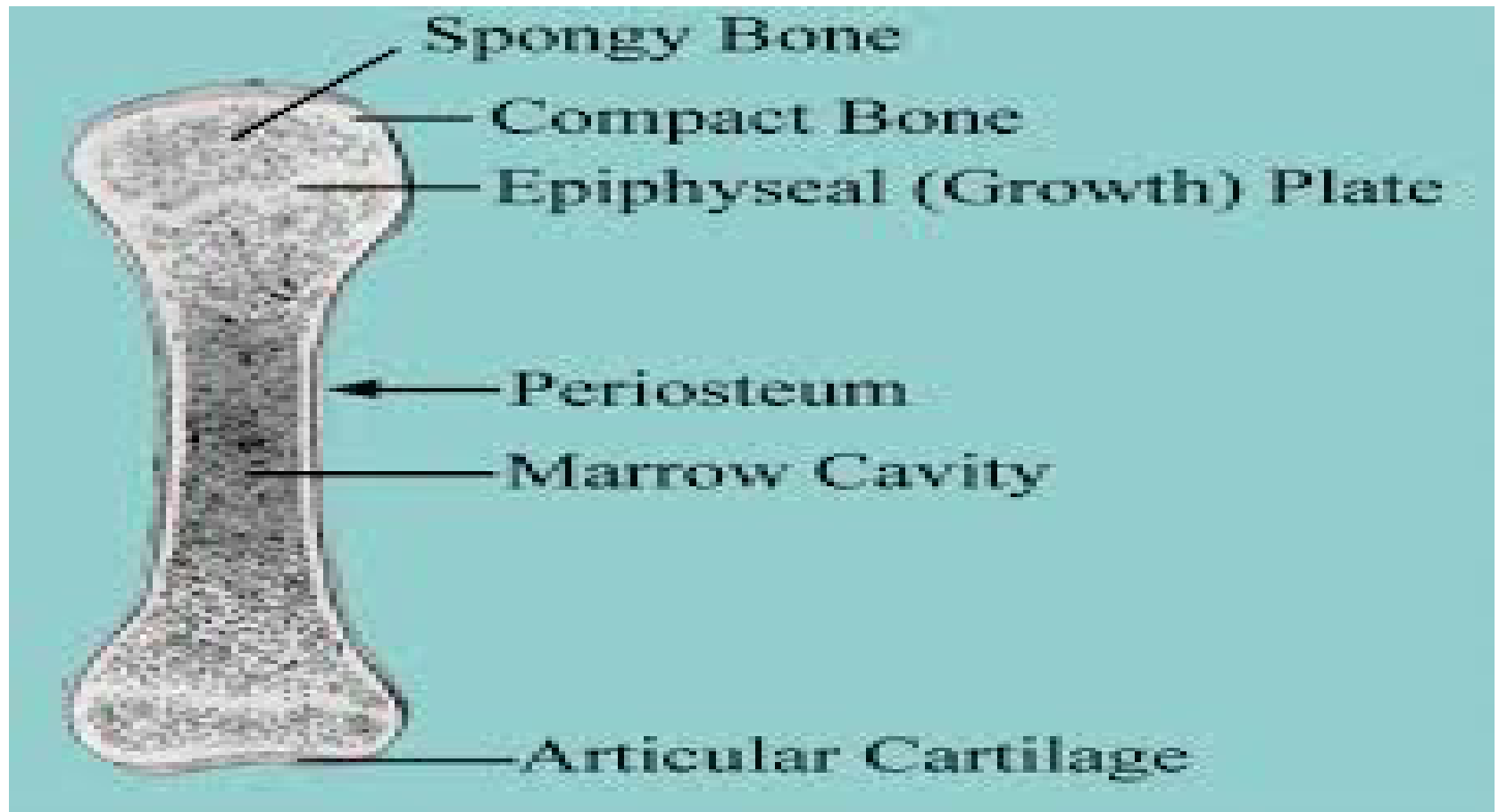
- Various shapes & sizes
- Provide
 - support
 - protection
 - leverage

bone

- Dynamic and alive
- Reacts to metabolic
and mechanical stimuli

physical and chemical stimuli

Bone



Anatomy

- Long
- Flat

structurally

- Cortical
- Cancellous

- Lamellar
- Woven bone

composition

- **Connective tissue**
- **Extracellular Matrix (ECM)**

ECM

- Organic 20 – 25%
- Inorganic 60 – 70%
- Water the rest

collagen

- Type I - 90%
- Other types found in bone
 - not strictly of bone
 - eg. Type II actually from cartilage
 - Type III fibrous tissue
 - Type IV from blood vessels

collagen

- Glycine
- Proline
- Hydroxyproline

Tropocollagen the structural unit

Triple helix

Trimers ($\alpha 1$ X2, $\alpha 2$)

Length 300nm

cells

- Embryonic progenitor cells
- Osteoblasts -- mesenchymal
- Osteocytes
- Osteoclasts -- monocytes

bone

- Store

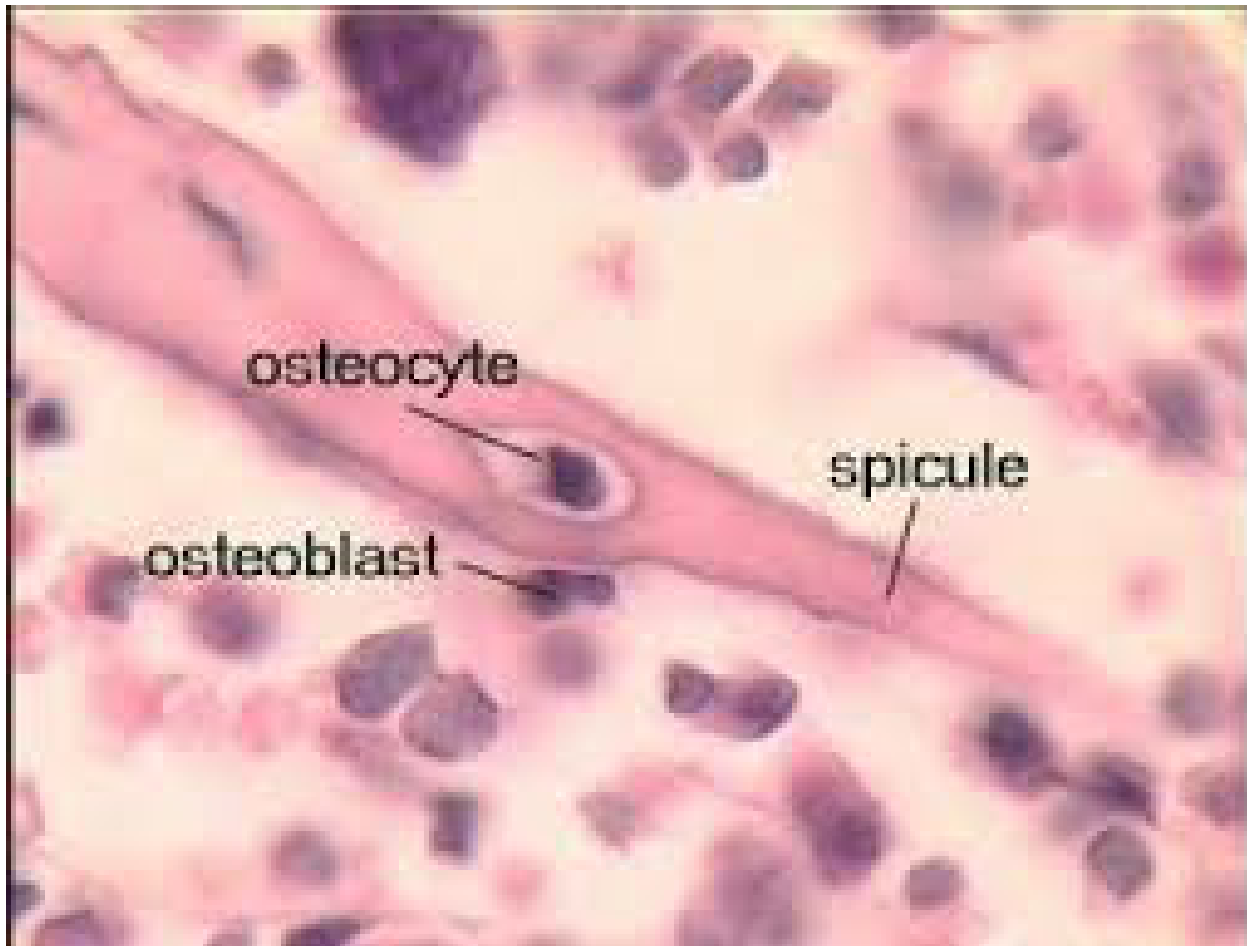
- Calcium

- Phosphate

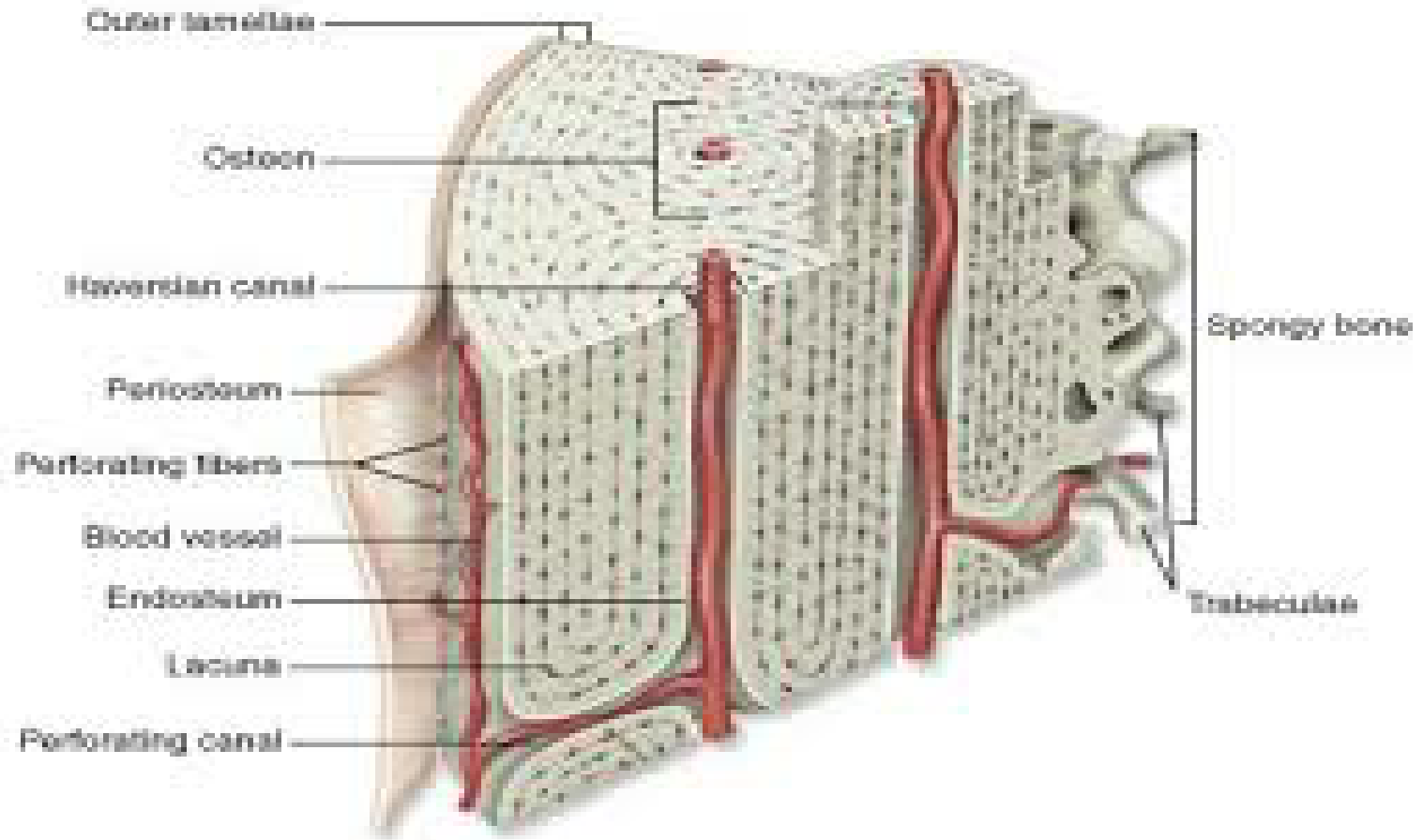
Calcium hydroxy apatite

(50%)

Bone cells



Bone structure



Bone structure

Outer surface is the periosteum... contains osteoblast, nerve and blood supply

Spongy inner surface is composed of Bone marrow

Haversian system v osteon?

Bone stock

Men lose 0.3% per year (20-40 years)

Women heavy postmenopausal losses;
becomes equal to men after 60 year.

After 70 years remains the same

Bone mass is the quantity/volume

Bone density (% mineralisation)

Bone strength due to decrease in bone mass;
creating holes in the trabaculae and slower
bone activity.

Calcium

Serum 2.2 - 2.6 mmol/l

Intake 400 - 800 mg/day

Urinary retention 100 - 400 mg/day

Local factors

- Biomechanics:
- Electrical stimulation:

Role: kidney, liver, GIT

Investigations

1. Blood: serum calcium, PTH, serum phosphate
2. Radiological: osteoporosis XR one will have lost 30% of bone.
3. Biopsy: bone mineral density.

Case: Lady with osteoporosis.

Importance

1. Osteoporosis
2. Osteomalacia or rickets
3. Parathyroid
4. Thyroid
5. Renal osteodystrophy
6. Vitamins

Nutrition

Vitamins: C and D

Calcium

Phosphate

Phosphate

Magnesium

Endocrine

1. Thyroid
2. Parathyroid
 - a. Thyroxine
 - b. Calcitonin
3. Adrenals
4. Gonads
5. Pituitary

Steroids “dissolve” bone.

Malignancy

- Carcinomas
- Multiple myeloma
- Leukemia

Lifestyle

Cigarettes and alcohol (avascular necrosis of hip)