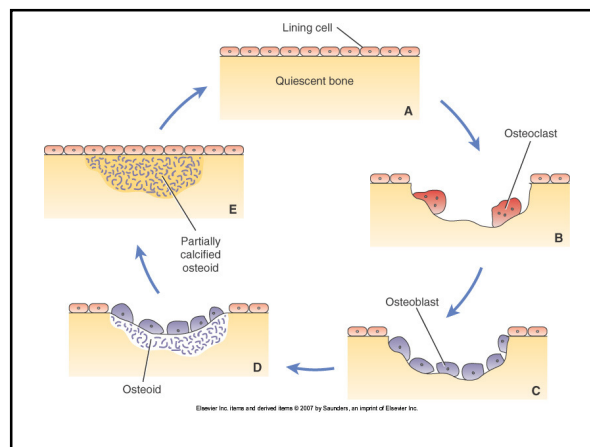
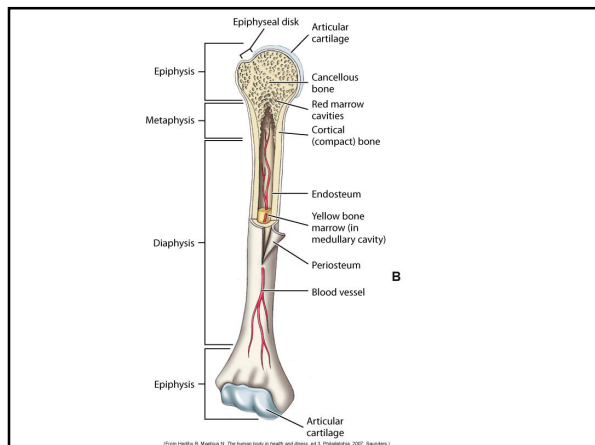


## Bones, Calcium, and Osteoporosis

### Bone

- Bone is living, constantly remodeled
- Reservoir of Calcium
  - Calcium levels of blood take precedence over bone levels
  - Under influence of
    - Calcitonin
    - Parathyroid hormone
    - Vitamin D
  - Calcium cycle
    - Absorbed from intestine
    - Excreted in urine
    - Absorbed and resorbed from bone



### Bone Disorders Related to Calcium

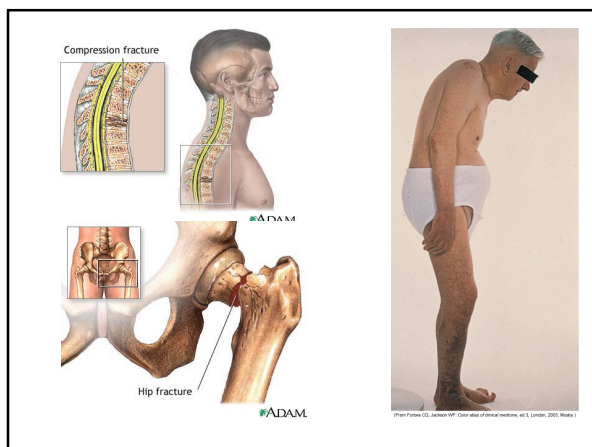
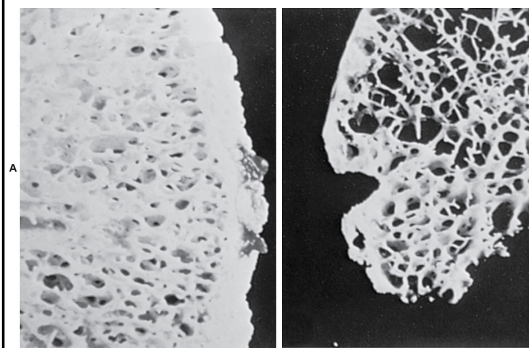
- Rickets
  - Defective bone growth from lack of Vitamin D
  - Deformities due to softened bone
- Osteomalacia: Adult form of rickets
- Paget's Disease
  - Increased Bone resorption
  - Replacement with abnormal bone
  - Most asymptomatic
    - Fractures, deformities, deafness
- Osteoporosis: Demineralization of bone

### Osteoporosis

- Demineralization of bone with age
- Demographics
  - 10 million outright, and 34 million with osteopenia
    - Women: 80%
    - Men 20%
- Pathophysiology
  - Maximum bone density ~30 years
  - Stable until ~50
  - Decreases after 50, accelerated for women 1% vs 2-3%
  - Decreased bone deposition occurs with age
  - Loss of calcium deposits and density leads to fragility

## Osteoporosis

- Manifestations
  - Loss of height
  - Kyphosis, scoliosis
  - Increased risk of fracture
    - Wrist fractures
    - Compression fractures
    - Femoral neck



## Osteoporosis

- Evaluation
  - X-ray: typically once a fracture is suspected
  - BMD: Dual-energy x-ray absorptiometry (DEXA)
    - Results reported in standard deviations
    - 1SD = 10% bone loss
    - 1 – 2SD below normal = osteopenia
    - < 2.5SD = osteoporosis
    - Site of measurement: wrist, vertebrae, femoral neck
    - BMD is higher predictor of fracture risk than BP of stroke
  - Family Hx of osteoporosis
  - Personal hx of fractures
  - Propensity to fall

## Osteoporosis

- Treatment
  - Prevention!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
  - Prevent bone loss
  - Promote bone formation
- **All three require adequate calcium and vitamin D!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!**

## Calcium salts

- Indications
  - Mild hypocalcemia
  - Osteopenia, osteoporosis
- Adverse effects
  - Hypercalcemia with chronic high doses
  - Interactions with some drugs

## Calcium Salts: Dose/Age

Age	Adequate Level of Calcium Intake
9 – 18	1300 mg daily
19 – 50	1000 mg daily
> 51	1200 mg daily

- Must take into account elemental calcium
  - Calcium carbonate (most common)
  - Calcium citrate (best absorbed)
  - Calcium gluconate (most common IV form)
- Orally: no more than 600mg at one time

## Vitamin D

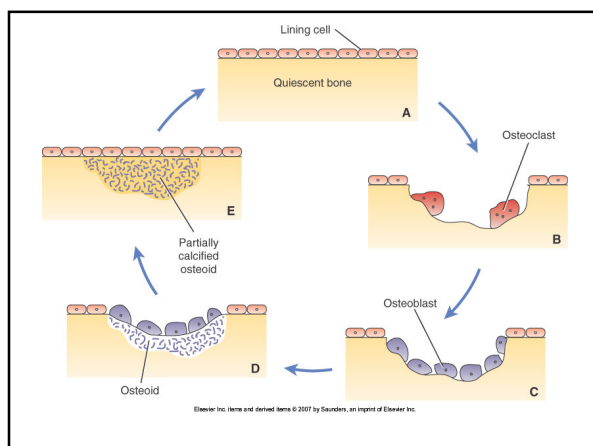
- Sources: Sun and Fortified Milk
  - Older adults often do not get enough Vitamin D
  - Osteoporosis treatment should include Vitamin D supplementation
- <http://www.medscape.com/viewarticle/541149>
- <http://ods.od.nih.gov/factsheets/vitaminD.asp>

## Calcitonin (Miacalcin)

- Injection or nasal spray
- Inhibits osteoclasts
- Inhibits resorption of calcium in kidney.
- Used for
  - Treatment of osteoporosis, but not prevention
  - Hypercalcemia

## Biphosphonates

- Structural analogs of pyrophosphate
- Inhibit resorption of bone
- Therapeutic uses
  - Postmenopausal and glucocorticoid osteoporosis
  - Paget's disease
- Preparations: 6 on market
  - Alendronate (Fosamax) (weekly or daily)
  - Actonel (weekly or daily)
  - Boniva (monthly)



## Biphosphonates

- Administration considerations
  - Must give on empty stomach (OJ or coffee decreases absorption by 60%)
  - Must stay upright for 30 minutes afterward (GI upset)
  - Can be given either daily or weekly
  - Do not chew or suck on tablet
  - Full glass of water (min 8 oz)
- Adverse effects
  - Esophagitis

### Raloxifene (Evista)

- Selective Estrogen Receptor Modifiers
- Mimics estrogen in bone, lipids, blood clotting
- Blocks estrogen effects: breast and endometrium
- Postmenopausal Osteoporosis
- Adverse effects
  - Fetal Harm
  - Not for use in women who can become pregnant
  - Caution in patients who smoke: DVT
  - Hot flashes

### Teriparatide

- Parathyroid hormone
- Only drug that increase bone formation
- If given continuously causes bone loss
- If given intermittently causes bone formation