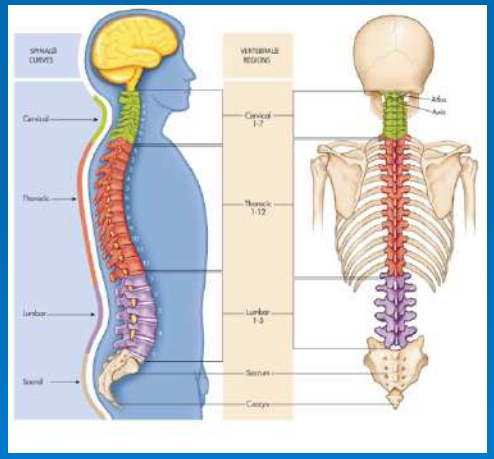
Health Sciences & Occupations

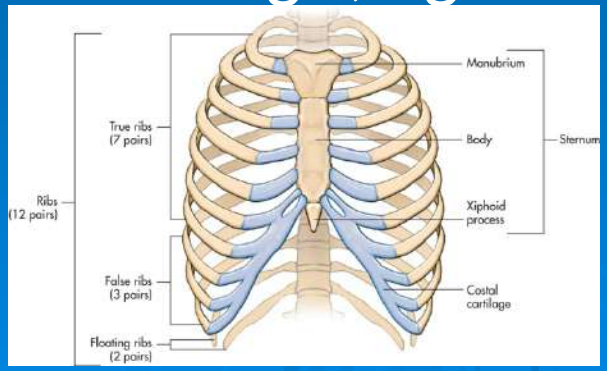
Anatomy, Physiology and Disease

Chapter 6
The Skeletal System



Introduction

- Skeletal system
  - provides support and allows us to move
- Bones (osseous tissue)
  - protects soft body parts
  - produces blood cells
  - acts as storage unit for minerals & fat
- 206 bones in adult skeleton
  - along with cartilage, ligaments, and joints



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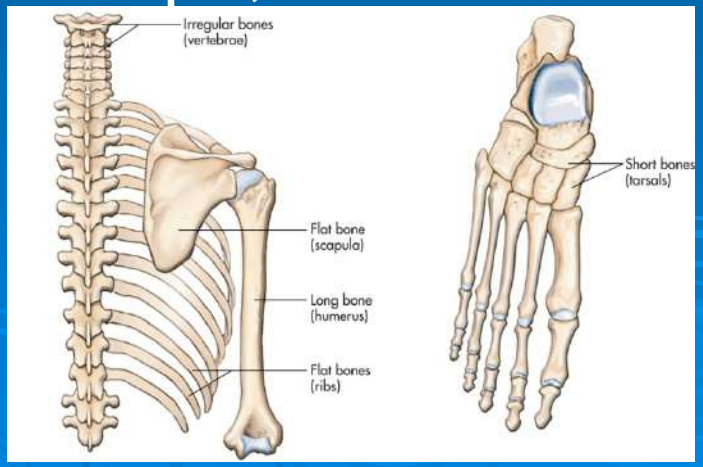
Bones

- Word ‘bone’ comes from Greek meaning “dried up body.”
- Composed of non-living minerals such as calcium and phosphorous, bones are very much alive, constantly building and repairing themselves.

Bone Classifications

- Long Bones: found in arms and legs
- Short Bones: equal in width and length & found mostly in wrists and ankles
- Flat Bones: thinner, flat or curved; can be plate-like & would include skull, ribs, and sternum (breast bone)
- Irregular Bones: odd in shape, and include hip bone and vertebrae



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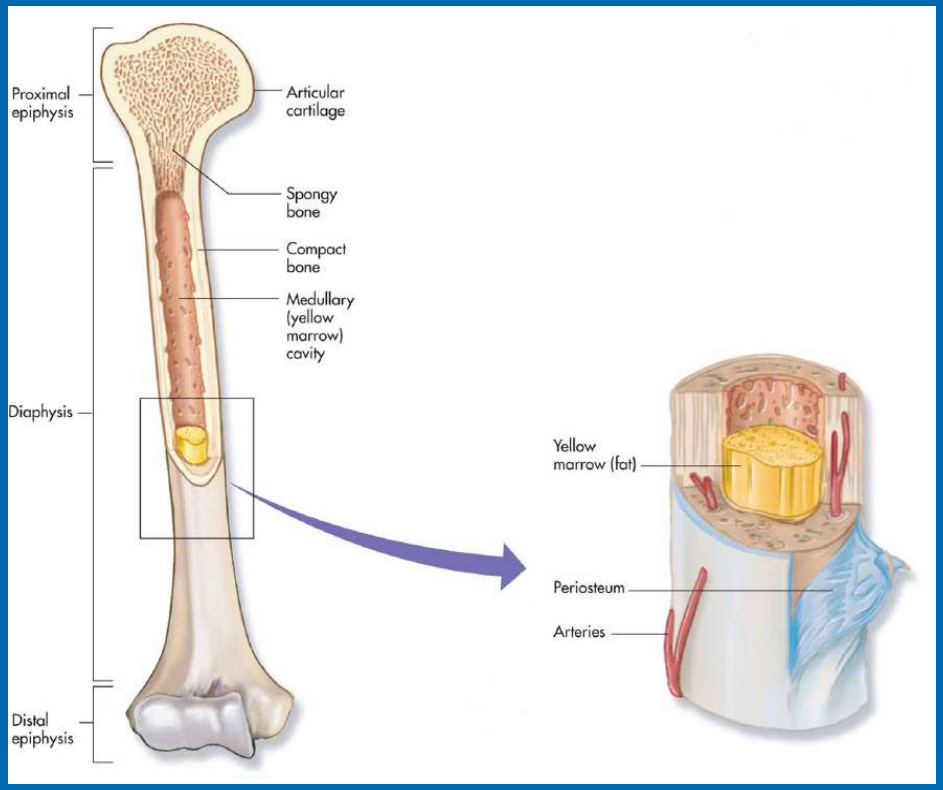
Bone Anatomy

Periosteum:

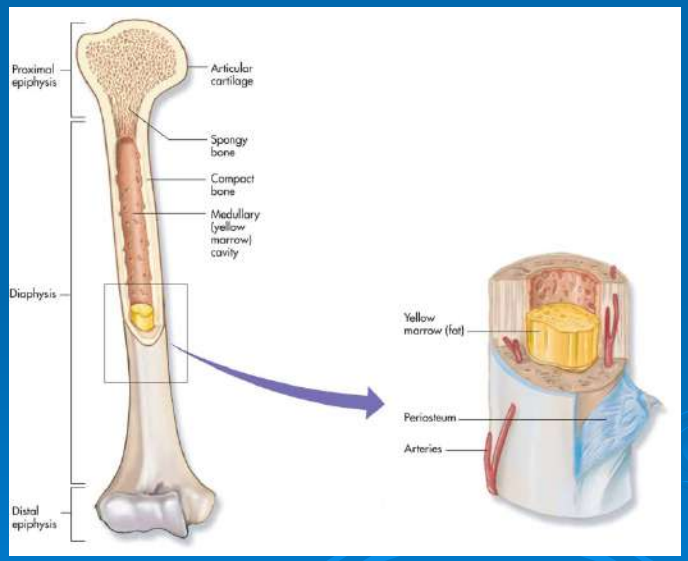
- Tough and fibrous connective tissue covering bone.
- Contains lymph vessels & nerves & blood vessels which transport blood & nutrients to nurture bone cells.
- Acts as anchor point for ligaments and tendons.



Bone Anatomy Con't

Epiphysis & Diaphysis

- Epiphysis: formed by increase in size of both ends of long bone.
- Diaphysis: region between two epiphyses
- Medullary Cavity: hollow area acts as storage area for bone marrow.
- Bone Marrow:
  - Yellow marrow:
    - has high fat content
    - can convert to red marrow in an emergency.
  - Red marrow:
    - produces red blood cells



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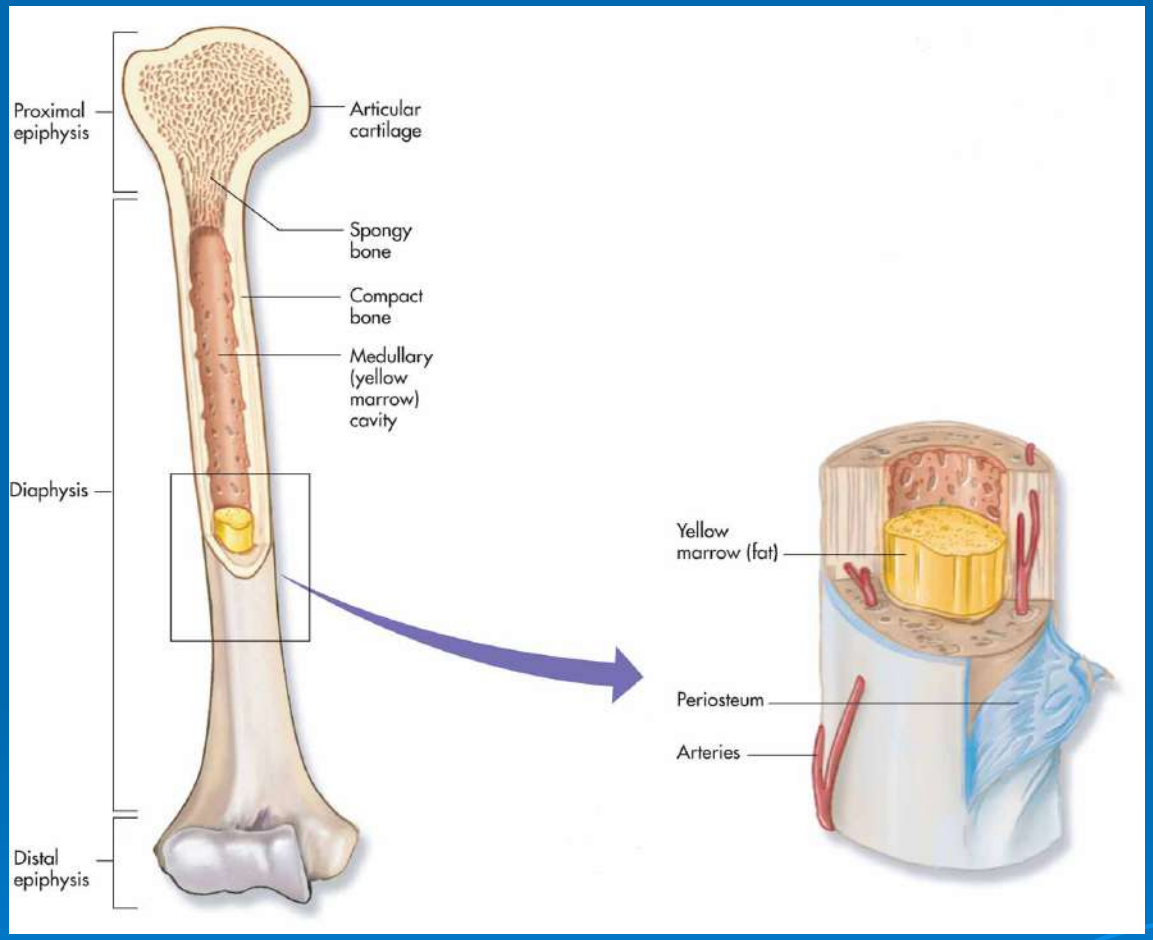
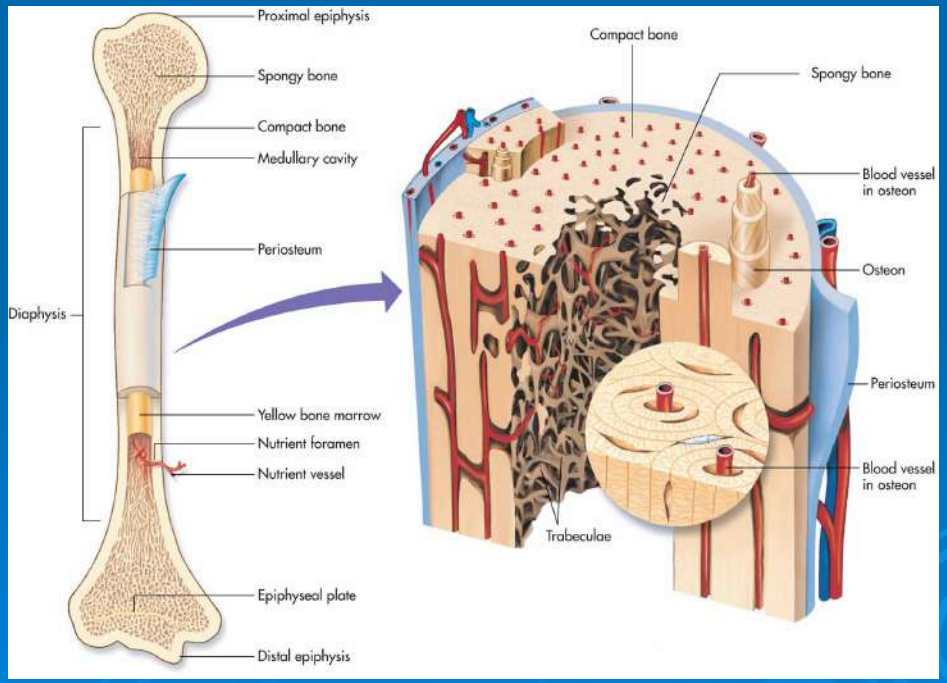
Bone Anatomy



Bone Tissue

- Dense, hard tissue that composes shafts of long bones.
- Forms microscopic, cylindrical shaped units called osteons, or Haversian systems



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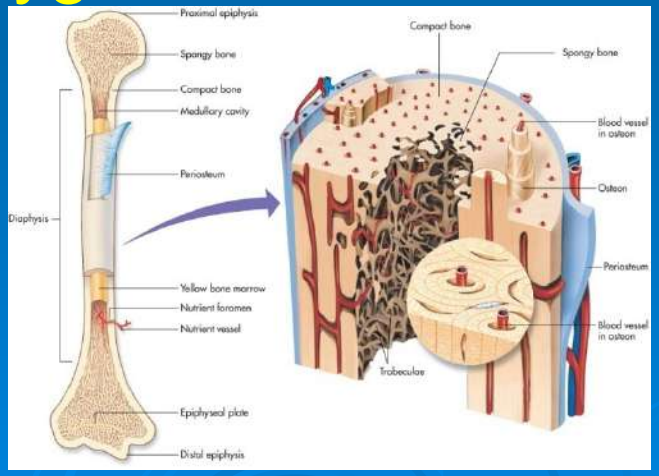
Bone Tissue Con't

- Osteocytes: mature bone cells forming concentric circles around blood vessels
- Area around osteocyte is filled with protein fibers, calcium, and other minerals
- Osteons run parallel to each other with blood vessels literally connecting with them to ensure sufficient oxygen and nutrients for bone cell



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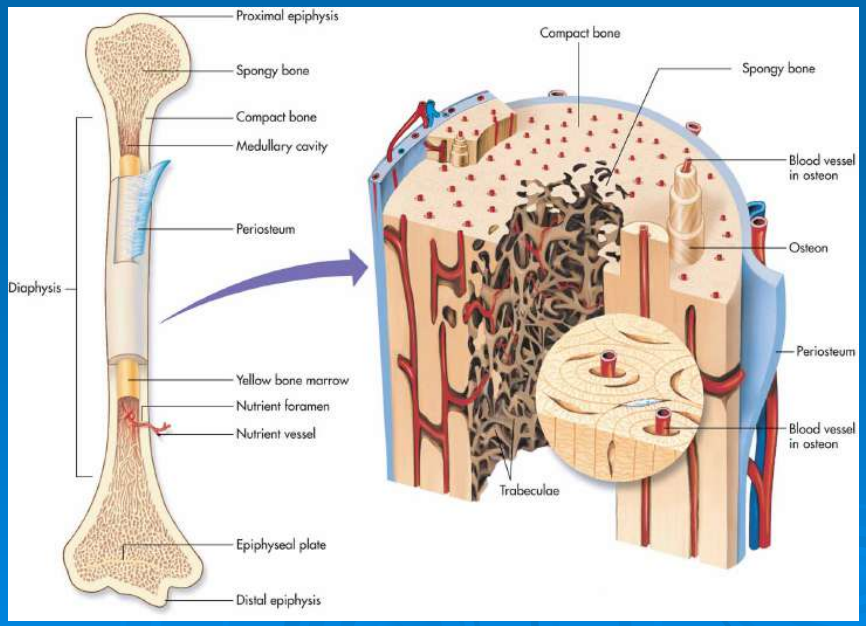
Bone Tissue Con't

Spongy (cancellous) bone

- Arranged in bars and plates called trabeculae
- Irregular holes between trabeculae make bone lighter in weight and provide space for red bone marrow, which produces red blood cells
- Holes give bone spongy appearance



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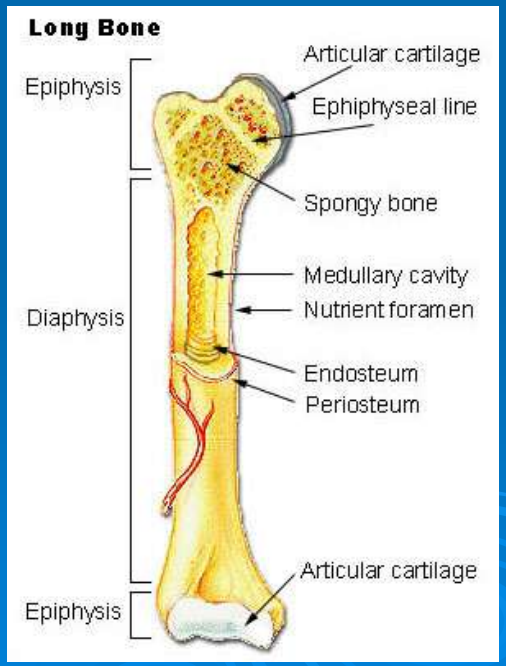
Surface Structure of Bones

Bone is not perfectly smooth

- Projections act as points of attachment for muscles, ligaments, or tendons
- Grooves and depressions act as pathways for nerves and blood vessels



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Bone Features

TABLE 6-1 Bone Features

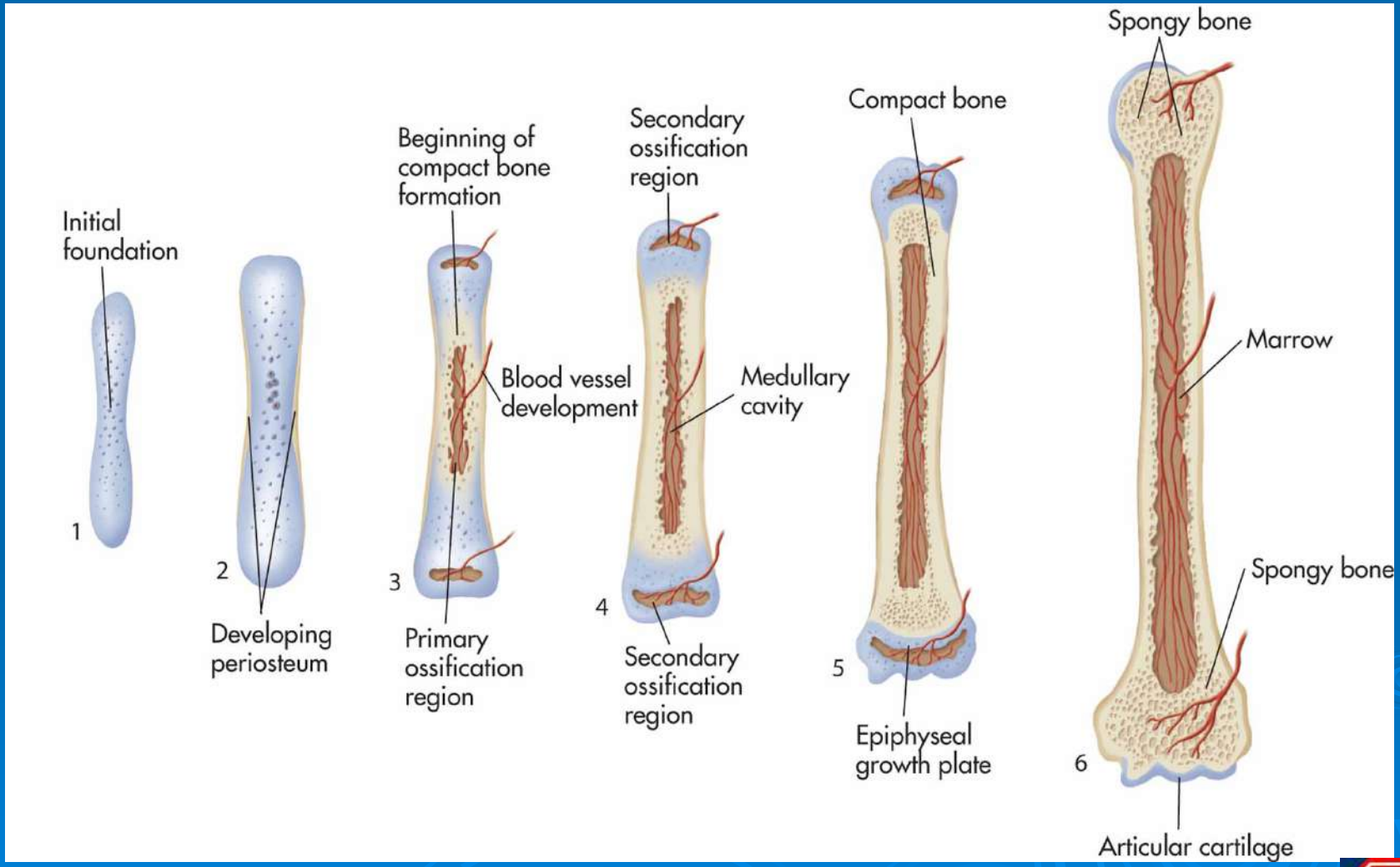
BONE SURFACE STRUCTURES	DESCRIPTIONS
Projecting Structures and Processes	
Condyle	A large, rounded knob, usually articulating with another bone
Crest	A narrow ridge
Epicondyle	An enlargement near or superior to a condyle
Facet	A small, flattened area
Head	An articulating end of a bone that is rounded and enlarged
Process	A prominent projection
Spine	A sharp projection
Trochanter	Located only on the femur; a larger version of a tubercle
Tubercle	A knoblike projection
Depressions and Openings	
Foramen	A passageway through a bone for blood vessels, nerves, and ligaments; a hole
Fossa	Either a groove or shallow depression
Meatus	A tube or tunnel-like passageway through bone
Sinus	A hollow area

Bone Growth and Repair

Epiphyseal plate (growth plate)

- After birth epiphysis on long bones continues to grow.
- Plate is thin band of cartilage formed between primary and secondary ossification centers.
- Plate exists as long as bones need to lengthen and widen; controlled by hormones, plate will eventually ossify and stop growth process.

How bones develop over time



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Osteoporosis

- As we age breakdown of bone becomes greater than formation of new bone (causing bone mass to gradually decrease).
- Bones become lighter & weaker
- holes in spongy bone becoming more prominent
- weakened bones more prone to breakage
- decreasing bone density called osteoporosis

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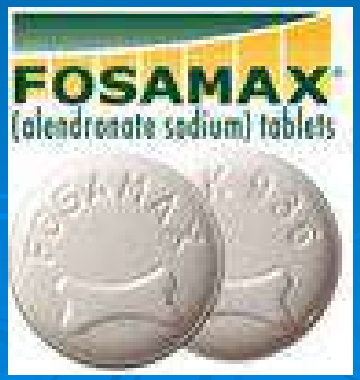
Rx for Osteoporosis

- Increase calcium: forms matrix of bone
- Increase fluoride, & vitamin D: helps body absorb ingested calcium from digestive tract.
- Stop smoking and decreasing caffeine consumption: both aid in calcium depletion.
- Do weight-bearing exercise
- Take medications to increase bone mass such as alendronate/Fosamax.



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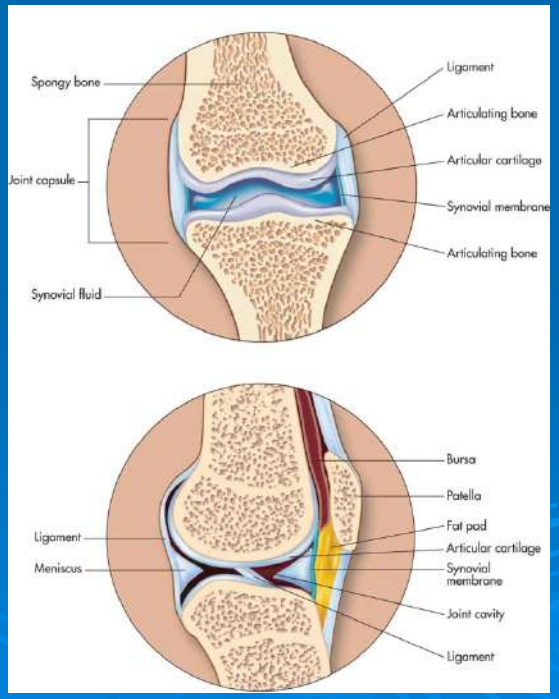
Cartilage

- Connective tissue that can withstand fair amount of flexing, tension, and pressure: Nose & Ears.
- Flexible connection between bones, as between ribs and sternum, allowing chest flexion during deep breathing & CPR.



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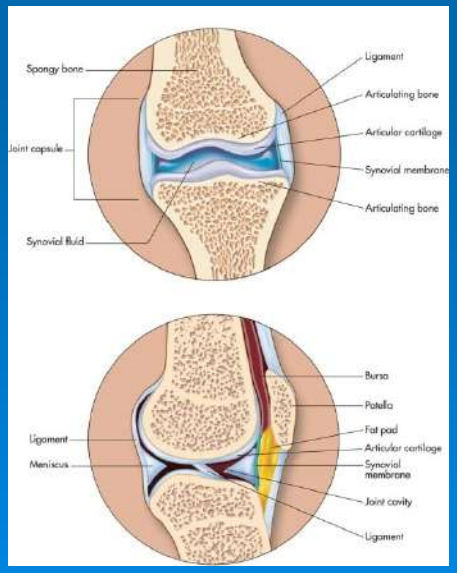
Cartilage Cont

- Acts as cushion between bones; "articular" cartilage located on ends of bones and acts as shock absorber/anti-grinding.
- Bursa: small sacs secrete lubricant called synovial fluid.
- Osteoarthritis: Inflammation of joints



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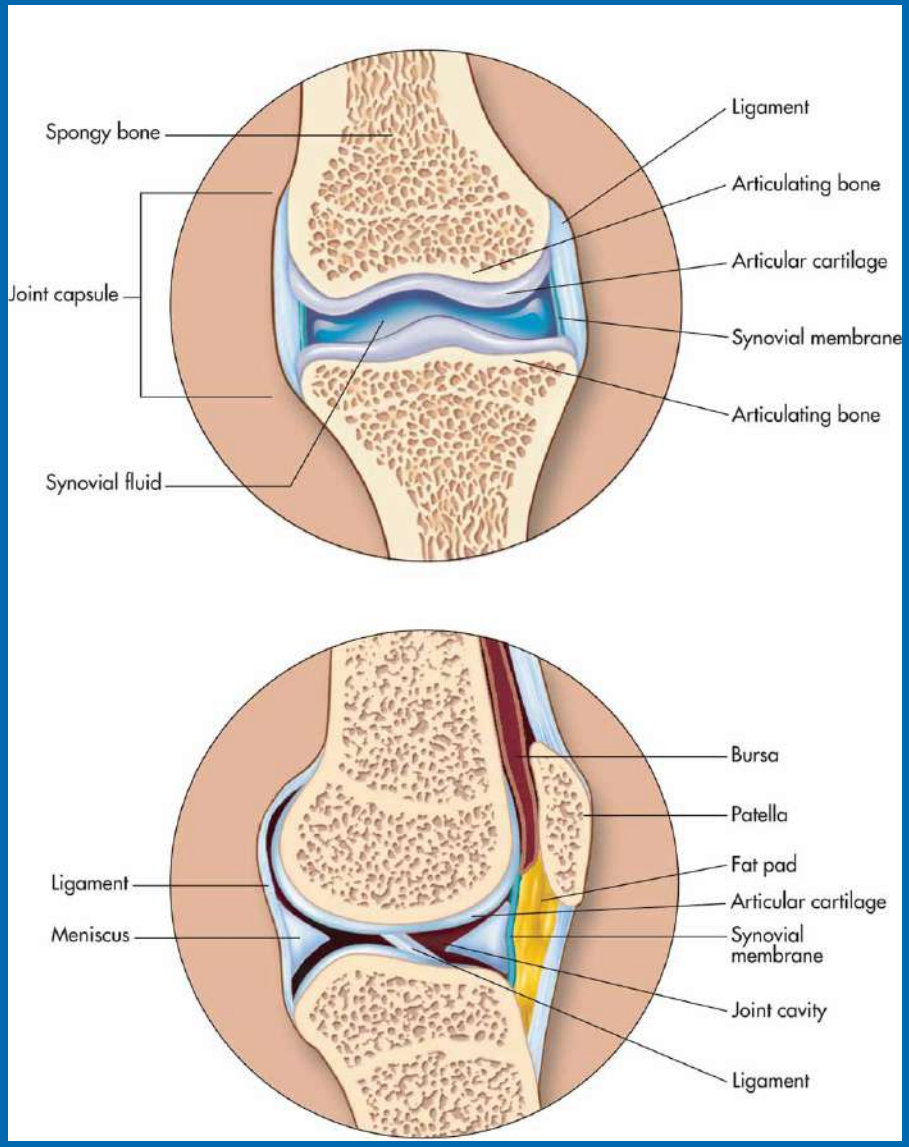

Figure 6-5 Articular cartilage and synovial joint.

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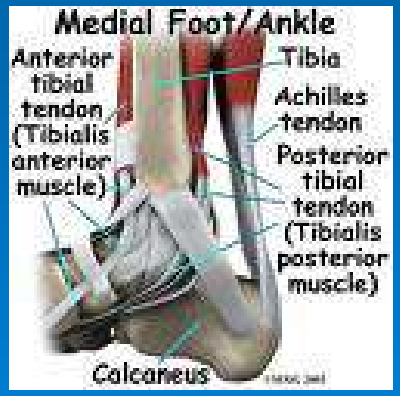
Joints and Ligaments

- Joint or Articulation: When two or more bones join together.
- Ligaments: Tough, whitish bands that connect bone to bone.
- Tendons: cord-like structures that attach muscle to bone.



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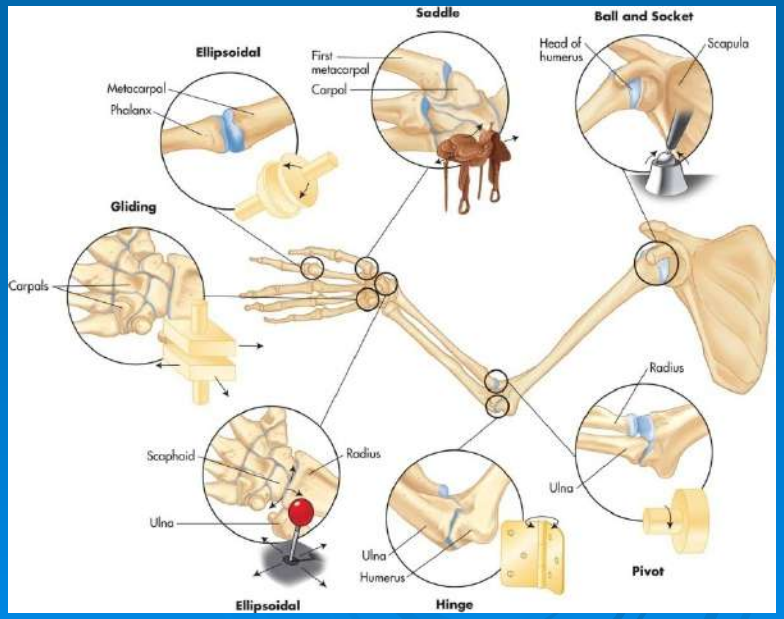
Types of Synovial Joints

- Pivot Joint: turnstile movement in neck and forearm
- Ball and socket joint: hip and shoulder mvt rotation
- Hinge joint: allow opening and closing movement in knees and elbows.
- Gliding joint: wrists and ankles; provides sliding back and forth movement



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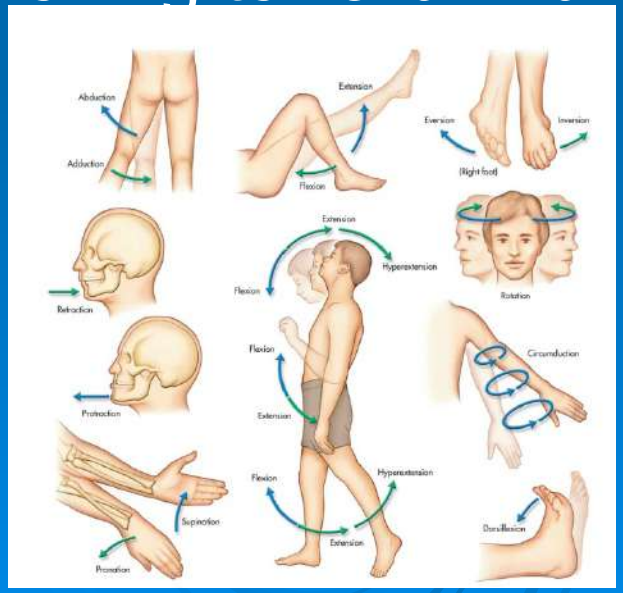
Movement Classifications

- Flexion: bending a joint
- Extension: straightening a joint
- Plantar flexion: pointing toes down
- Dorsiflexion: bending foot up toward body
- Abduction: moving away from body's midline
- Adduction: moving toward midline of body



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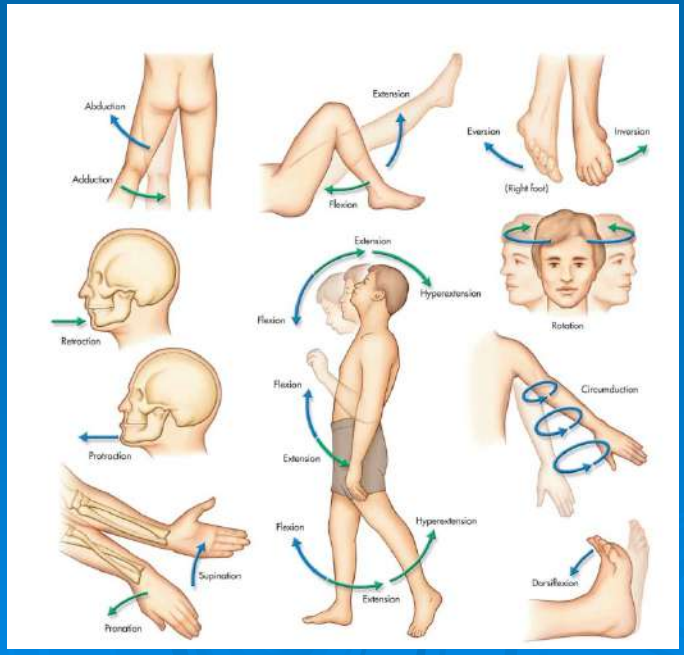
Movement Classifications con't

- Inversion: turning foot medial
- Eversion: turning foot lateral
- Supination: turning hand palm up
- Pronation: turning hand palm down
- Circumduction: circular arm movement of a pitcher



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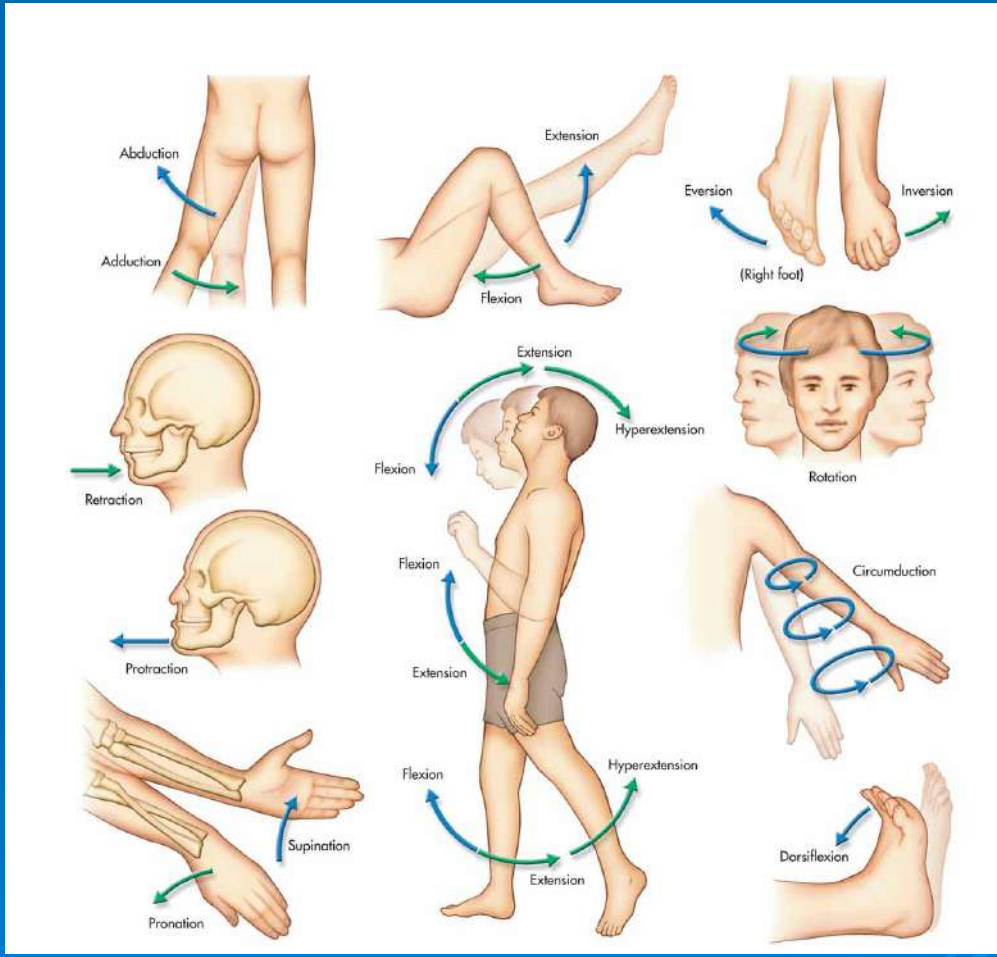
Movement Classifications



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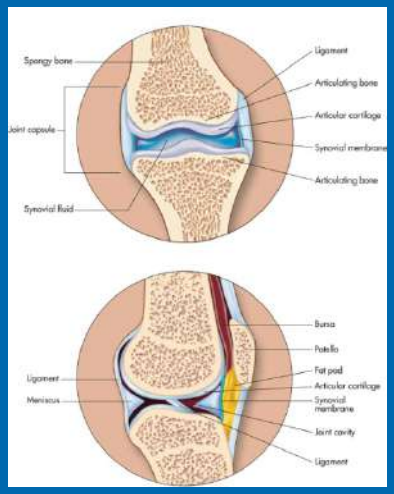
Common Skeletal Disorders



Osteoarthritis

- Etiology: joint cartilage “wears out”
- S/S: painful inflammation
- Dx: visual exam; X-ray
- Rx: rest, analgesics, anti-inflammatory meds, steroid injections (into affected joint), surgical intervention joint replacement.

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Common Skeletal Disorders cont

Rheumatoid arthritis:

- **Etiology**: autoimmune disease that attacks connective tissue; especially joints.
- **S/S**: stiffness, swelling and pain joints; inflammation of synovial membrane; pronounced joint deformities.
- **Dx**: visual exam; X-ray; antibody screening (rheumatoid factor).
- **Rx**: aspirin; NSAID; corticosteroid meds; methotrexate; rest & range of motion exercises; surgical intervention (in extreme cases)

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Common Skeletal Disorders cont

Septic arthritis

- **Etiology**: infection inside joint, usually preceded by penetrating joint wound, or pathogen carried in blood.
- **S/S**: pain & edema; filling of joint with inflammatory exudates; destruction of joint & replacement with fibrous tissue & eventually bone.
- **Dx**: visual exam; X-ray; fluid culture for infection
- **Rx**: antibiotics; prevent septic arthritis with good “aseptic techniques.”

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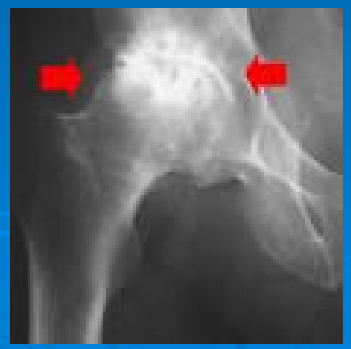
Common Skeletal Disorders cont

Bursitis:

- **Inflammation of a bursa**
- **Etiology**: repetitive movement; strain; congenital defect; rheumatic diseases
- **S/S**: pain on movement; limited range of motion; inflammation and swelling at affected site
- **Dx**: visual exam; X-ray
- **Rx**: rest; moist heat/cold therapy; analgesics; NSAID; corticosteroid injection at affected site; draining (of fluid).



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Common Skeletal Disorders cont

Cruciate ligament tears:

- **Tear in one or more of ligaments of knee**
- **Etiology**: trauma induced when leg is twisted, planted (weight bearing) leg receives anterior or posterior blow.
- **S/S**: pain in knee; instability of knee; limited mobility
- **Dx**: physical exam (especially joint stability tests); radiologic exam (especially MRI).
- **Rx**: NSAID, rest, immobilization, surgical repair

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Common Skeletal Disorders cont

Gout:

- Etiology: metabolic disease where uric acid levels become too high; causes uric acid crystals to deposit in joints
- S/S: pain in affected joint with inflammation & palpable heat tenderness with edema.
- Dx: visual examination; blood testing for excessive uric acid.
- Rx: low fat & low protein diet, rest & immobilization, Meds: anti-inflammatory medications & allopurinol. Monitor blood uric acid levels.

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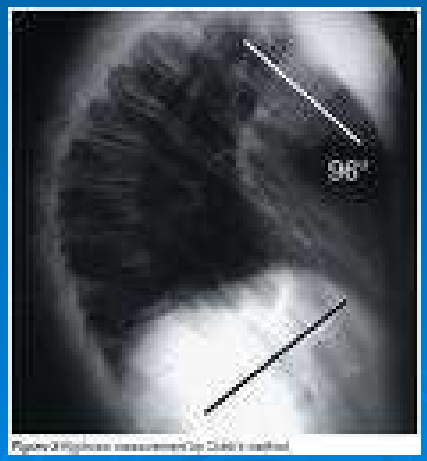
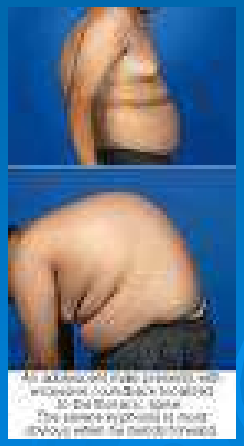
Common Skeletal Disorders cont

Kyphosis:

- Etiology: osteoporosis
- S/S: exaggerated curve of upper back ("humpback"); may lead to backache, dyspnea/pulmonary insufficiency
- Dx: visual exam, X-ray
- Rx: depends on age and severity; may include: exercise; bracing; surgery; electrical stimulation; weight control





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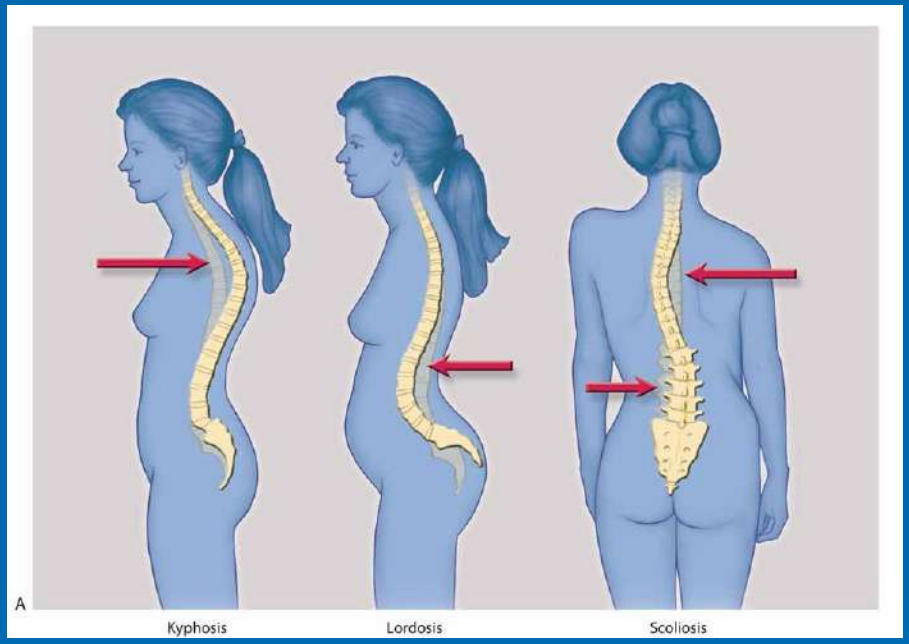

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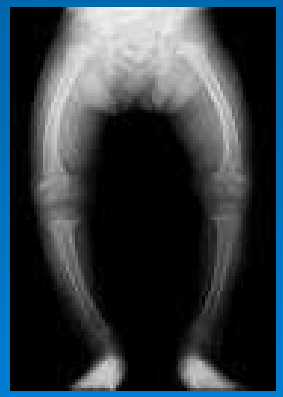
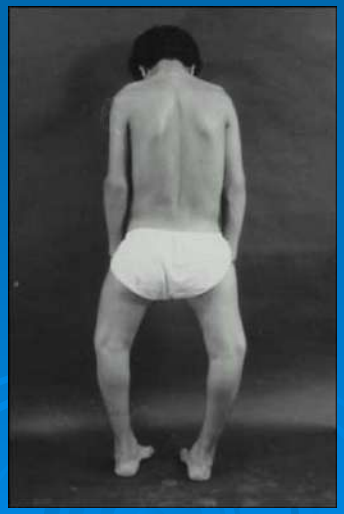
Common Skeletal Disorders cont

Osteomalacia/Rickets: softening of bone

- Etiology: decreased mineralization of bone due to insufficient vitamin D, lack of sufficient sunlight, malabsorption conditions.
- S/S: bone pain & deformity; loss of height
- Dx: visual examination; bone scan
- Rx: correct nutritional deficiency: increase vitamin D





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Common Skeletal Disorders cont

Plantar fasciitis: (runner's heel)

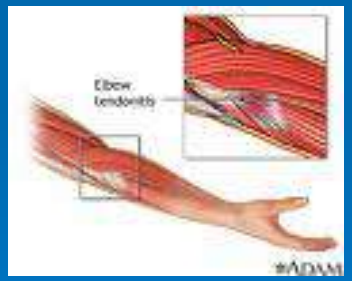
- Etiology: repetitive impact on heel, resulting in inflammation of connective tissue on plantar surface of foot
- Predisposing Factors: high arches, flat feet, shoes with poor support, increased body weight, & sudden increase in activity
- S/S: intermittent pain
- Dx: X-ray
- Rx: rest, ice; NSAID; padding heel; possible surgery

End Of Slide

Common Skeletal Disorders cont

Tendonitis: inflammation of tendon

- Etiology: repetitive movement
- S/S: pain on movement with inflammation of involved area
- Dx: visual exam; x-ray
- Rx: rest; application of moist heat/cold; NSAID; injection of affected site with corticosteroids.



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Common Skeletal Disorders cont

Osteomyelitis:

- Etiology: infection in bone, often preceded from wound in skin; staphylococcus aureus a common pathogen.
- S/S: sudden pain, swelling, heat, & tenderness of affected site; high fever & chills, nausea & malaise.
- Dx: visual exam, culture wound for pathogen
- Rx: antibiotics; surgical debridement

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Types of Bone Fractures

- Simple: (closed): break without puncture to skin
- Compound: (open): bone has been pushed through skin
- Hairline: does not completely break or displace bone
- Spiral: caused by severe twisting of bone
- Greenstick: incomplete breaks, more common in children
- Comminuted: when bone has been fragmented or splintered






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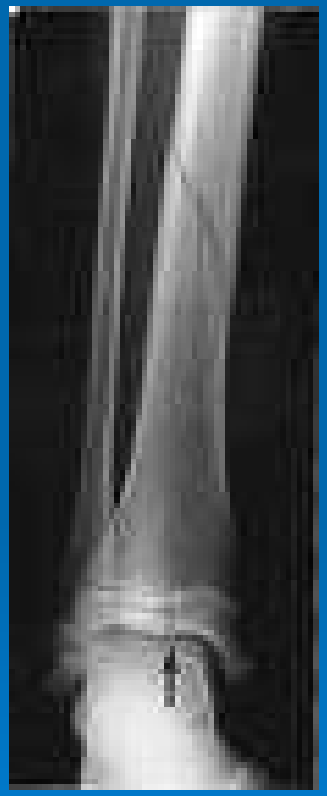
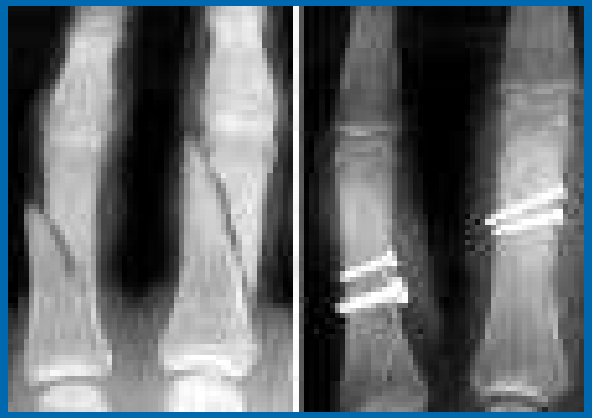
Simple: (closed): break without puncture to skin

Compound: (open): bone has been pushed through skin

Hairline: does not completely break or displace bone

Spiral: caused by severe twisting of bone





Greenstick: incomplete breaks, more common in children

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Comminuted: when bone has been fragmented or splintered