

NOTES

for the

SKELETAL SYSTEM

Anatomy & Physiology

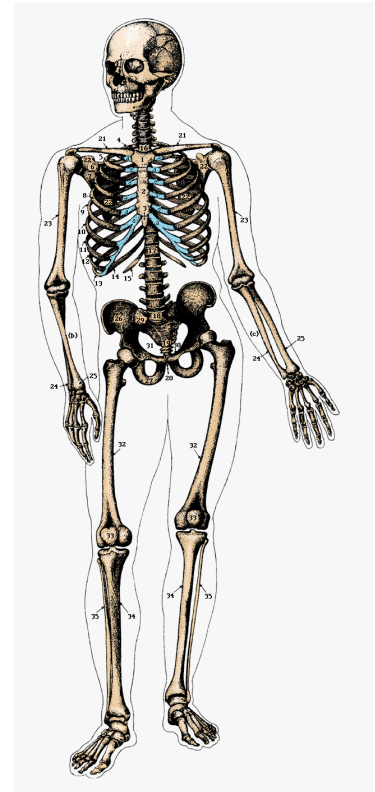
2016

Johnson

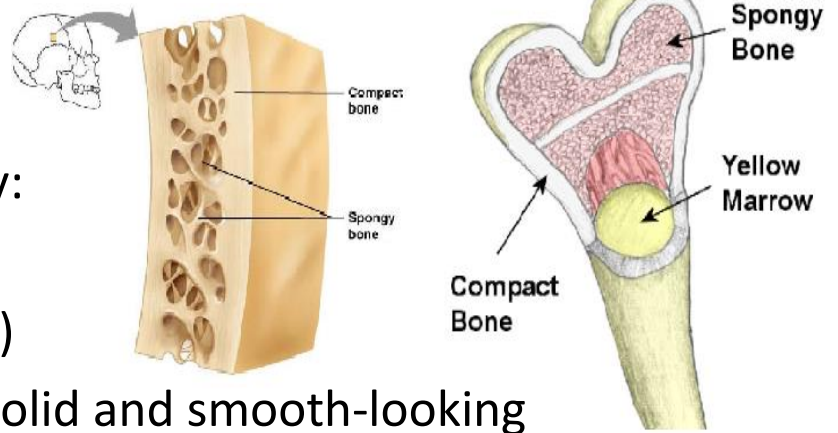
The Skeletal System

- I. System includes 4 basic parts:
 - A. Bones (206 of 'em)
 - B. Joints
 - C. Cartilages
 - D. Ligaments

- II. Bones have 5 basic functions:
 - A. Support
 - B. Protection
 - Skull protects brain
 - Vertebrae protects spinal cord
 - Ribs protect organs
 - C. Movement
 - Used by muscles as levers
 - D. Storage
 - Of fat and minerals (esp. Ca)
 - E. Hematopoiesis
 - Blood cell formation in marrow
 - 15 million red blood cells ***per second!!!***



III. Bones classified by:



A. Density (2 types)

- Compact – solid and smooth-looking
- Spongy – small “needles” with open spaces

B. Shape (4 types)

1. Long

- Longer than wide
- Shaft with head at both ends
- Most limb bones
- Mostly made of compact bone



Long bone (humerus)

2. Short

- Cube-shaped
- Wrist & ankle
- Mostly made of spongy bone



Short bone (trapezoid, wrist bone)

3. Flat

- Thin, flat, curved
- Protection or muscle attachment
- Skull, ribs, sternum



Flat bones (sternum)

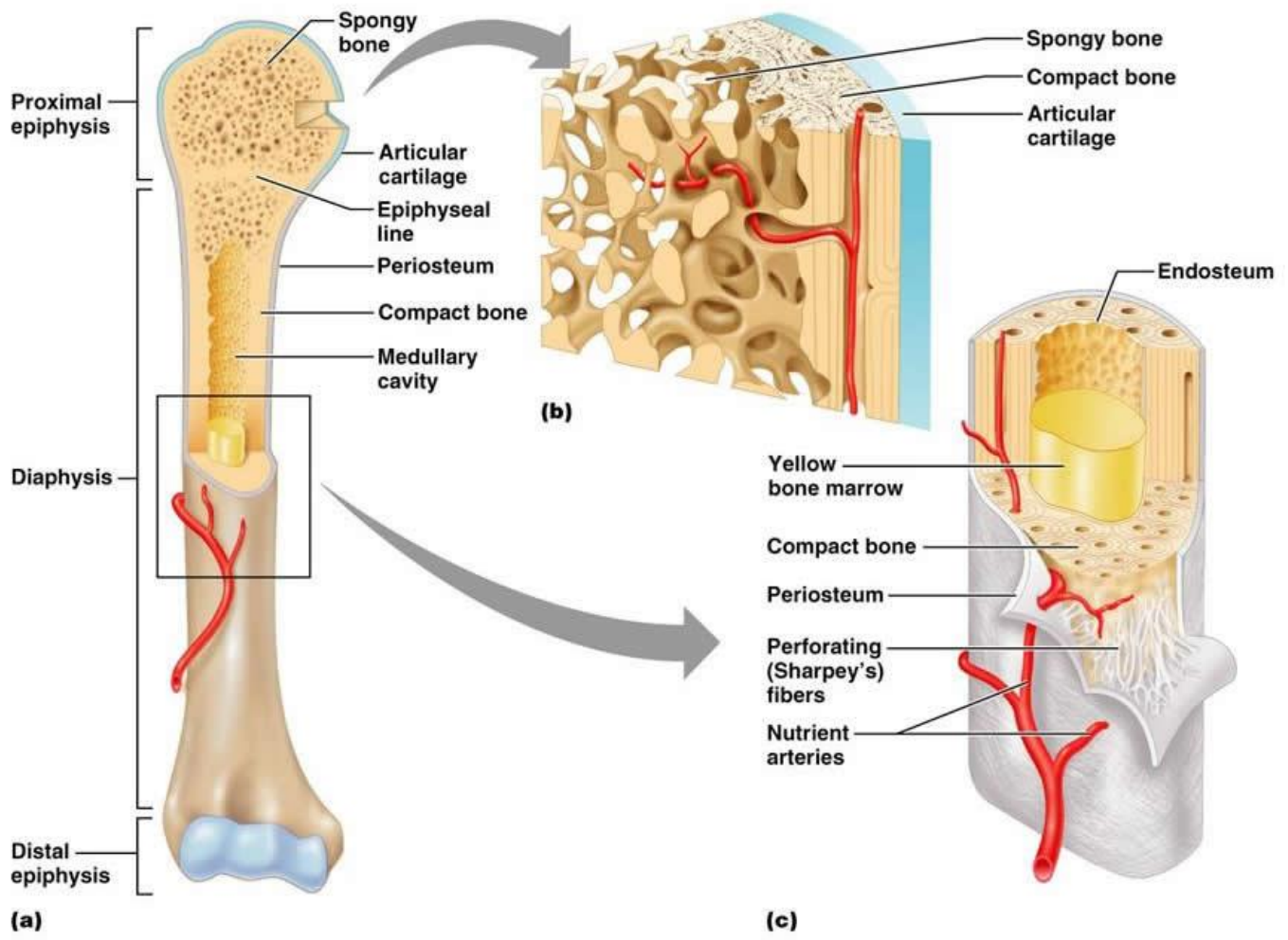
4. Irregular

- Everything else
- Vertebrae & hip Bones



Irregular bone (vertebra)

IV. Structure of a Long Bone



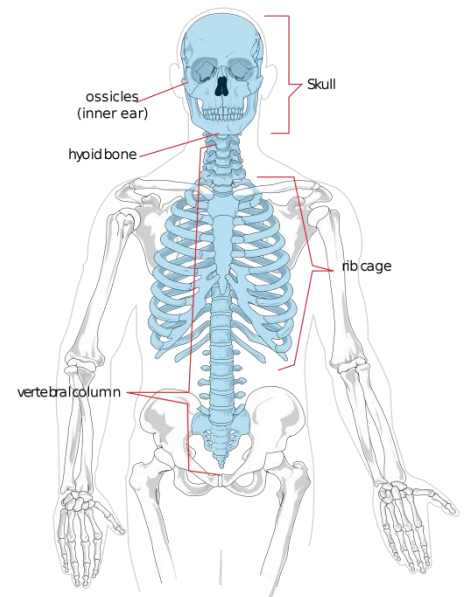
V. The skeleton is divided into two parts:

A. Axial Skeleton

1. Along the longitudinal axis of the body.

2. Three major divisions:

- Skull
- Vertebral column (spine)
- Bony thorax (ribs)

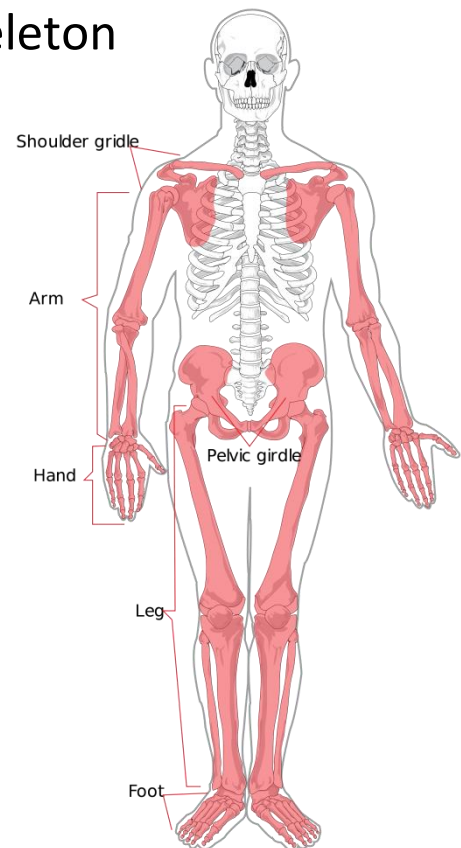


B. Appendicular Skeleton

1. Parts that attach to the axial skeleton

2. Four major divisions:

- Pectoral girdle
 - Upper limbs
 - Pelvic girdle
 - Lower limbs
- Superior
- Inferior



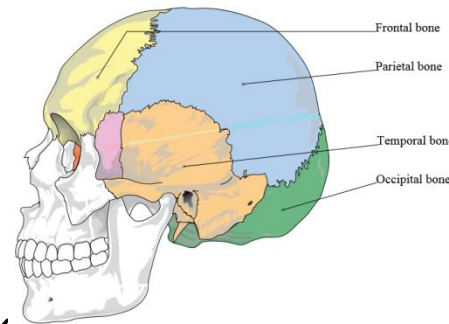
VI. The Axial Skeleton (skull, spine, ribs)

A. Skull

1. Formed by two sets of bones: cranium & facial
2. Cranium – large, flat bones that enclose and protect brain.

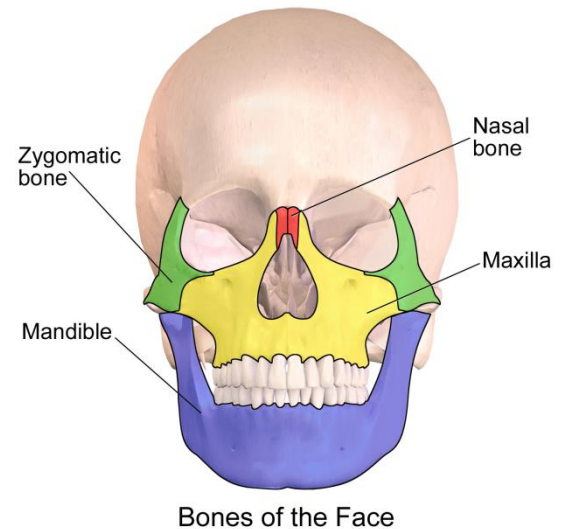
Bones to know in cranium:

- Frontal - forehead
- Parietal – sides & top
- Temporal – lower sides with many parts:
 - External auditory meatus – ear canal
 - Styloid process – attachment point for neck muscles
 - Zygomatic process – thin bridge
 - Mastoid process – large bump for neck muscle attachment
- Occipital – back
 - Foramen magnum – large hole that spinal cord enters



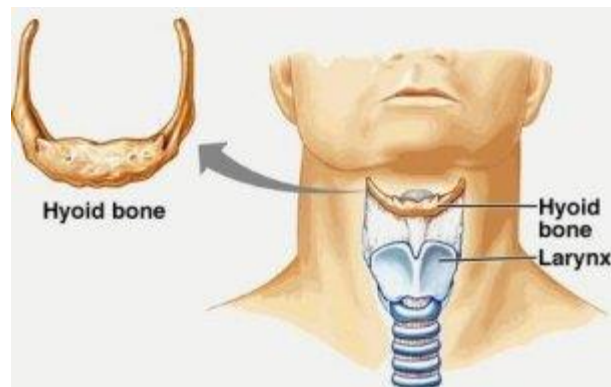
3. Facial Bones

- Maxilla – top jaw
- Zygomatic bone – cheekbone
- Nasal bones – bridge of nose
- Mandible – lower jaw



4. Hyoid Bone

- Suspended in anterior of neck
- Attachment point for tongue, larynx, neck muscles



B. Vertebral Column

1. General Structure:

a. 26 irregular bones that perform 2 functions:

- Support weight of the body
- Surround & protect the spinal cord

b. Vertebrae are separated by pads of fibrocartilage called intervertebral discs.

- Cushion the vertebrae
- Make spine more flexible

c. Vertebral column has an S-shape

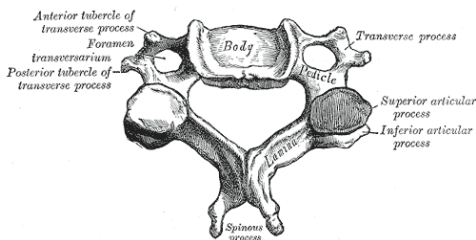
- Primary curvatures
(thoracic & sacral regions)
- Secondary curvatures
(cervical & lumbar regions)

2. Anatomy of a Vertebrae:

3. Five regions of the Vertebral Column

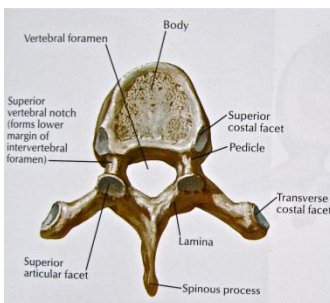
a. Cervical Vertebrae

- 7 most superior vertebrae (neck)
- C1 (atlas) and C2 (axis) work together to allow head to pivot
- Have transverse foramen for blood vessels to the brain



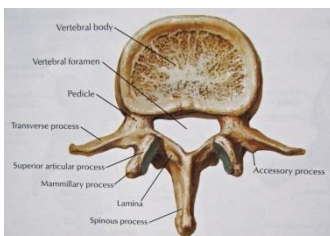
b. Thoracic Vertebrae

- 12 vertebrae
- All have facets for rib attachment



c. Lumbar Vertebrae

- 5 large vertebrae
- Bear most of body's weight

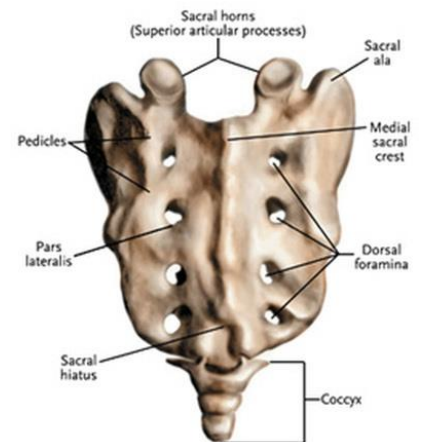


d. Sacrum

- 5 fused vertebrae
- Attach to hip bones

e. Coccyx

- 3 small fused vertebrae
- “tailbone”



C. Bony Thorax: three general structures

1. Sternum

a. Three flat bones

- Manubrium
- Body
- Xiphoid process

b. Attached to first 7 ribs

c. Much blood production in its marrow

2. Ribs

- a. 12 pairs
- b. All attached to vertebral column
- c. True ribs (superior 7 pairs) directly attached to sternum
- d. False ribs (inferior 5 pairs) attached indirectly or not at all to sternum.
**last 2 pair called "floating ribs" b/c lack all sternal attachment.*

3. Thoracic Vertebrae

- Form posterior axis of thoracic cage.

D. Axial Skeleton Pathophysiology

1. Abnormal Curvatures

a. Scoliosis – spine curved laterally



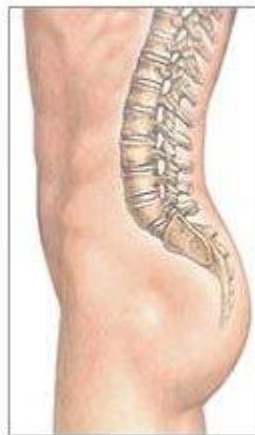
b. Kyphosis – exaggerated thoracic curvature
-- “hunchbacked”



c. Lordosis – exaggerated lumbar curvature
-- belly & butt stick out



Normal spine



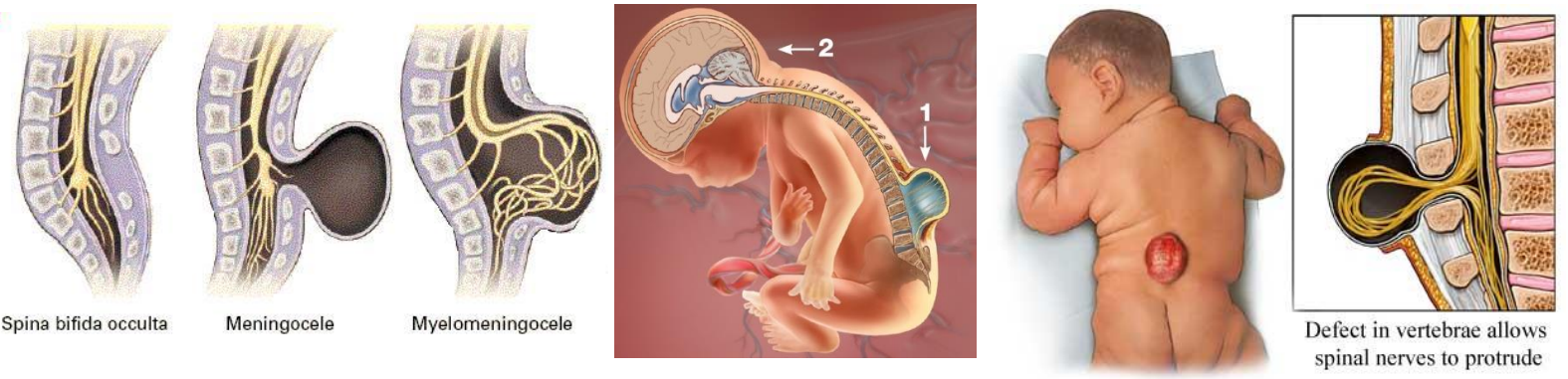
Lordosis of the spine



Exaggerated lumbar curve

2. Spinal Diseases

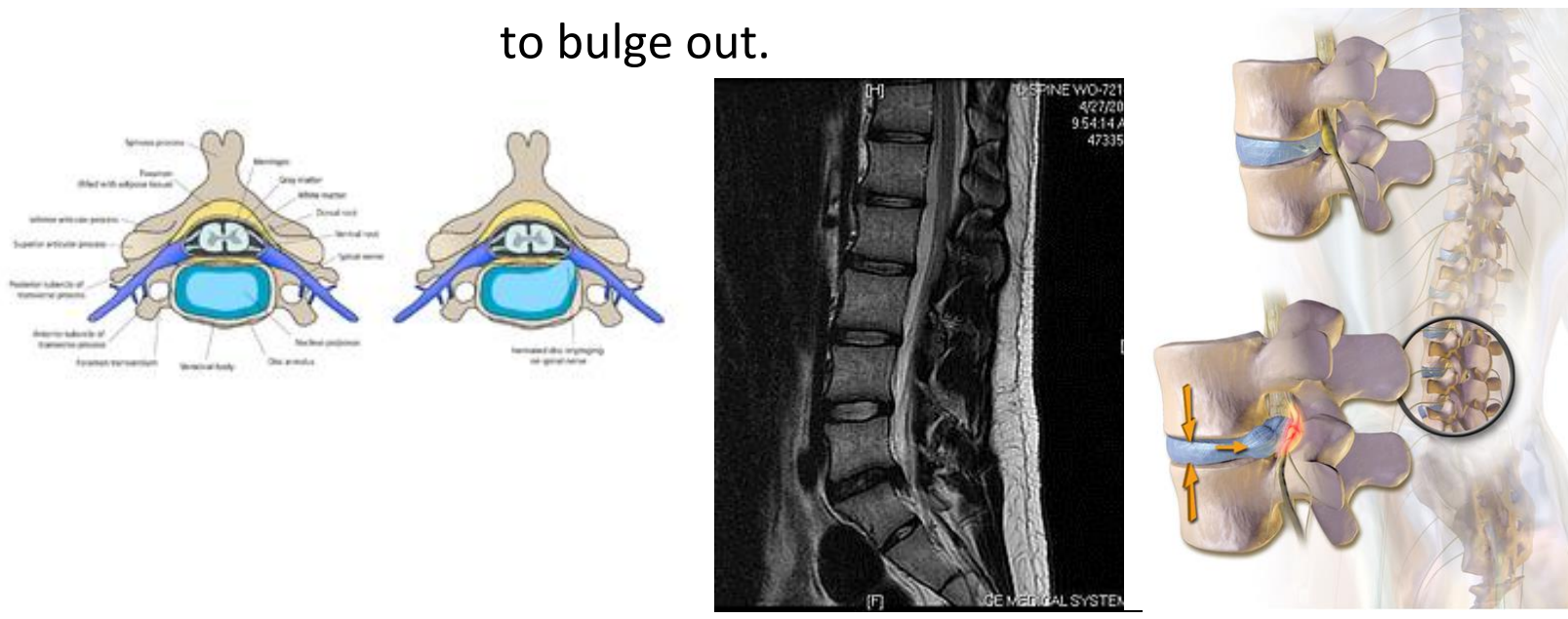
a. Spina bifida – vertebrae do not close around spinal cord during embryonic development.



3. Spinal Injuries & Repair

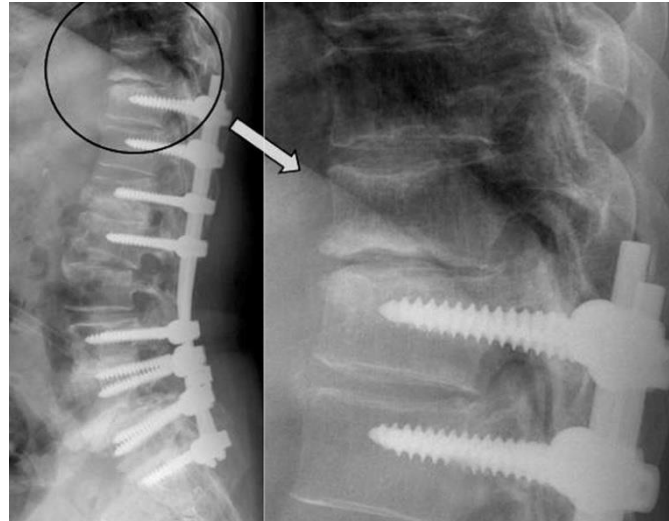
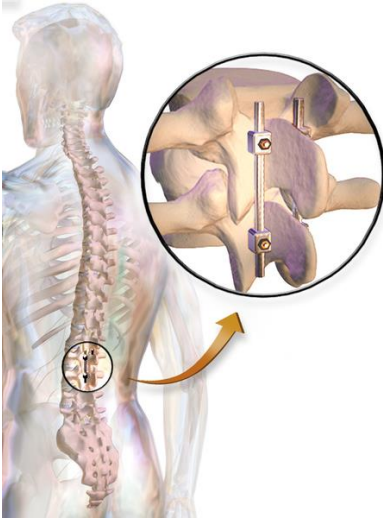
a. Disc Herniation (“slipped disc”)

- Outer cartilage tears allowing soft interior to bulge out.



b. Spinal Fusion

- Surgery to join vertebrae



VII. The Appendicular Skeleton

- Girdles (Pelvic & Pectoral)
- Limbs (Arms & Legs)
- 126 total bones

A. Superior A.S.

1. Pectoral Girdle (Shoulder)

- Clavicle – braces arms out
- Scapula – slides freely / much muscle attachment

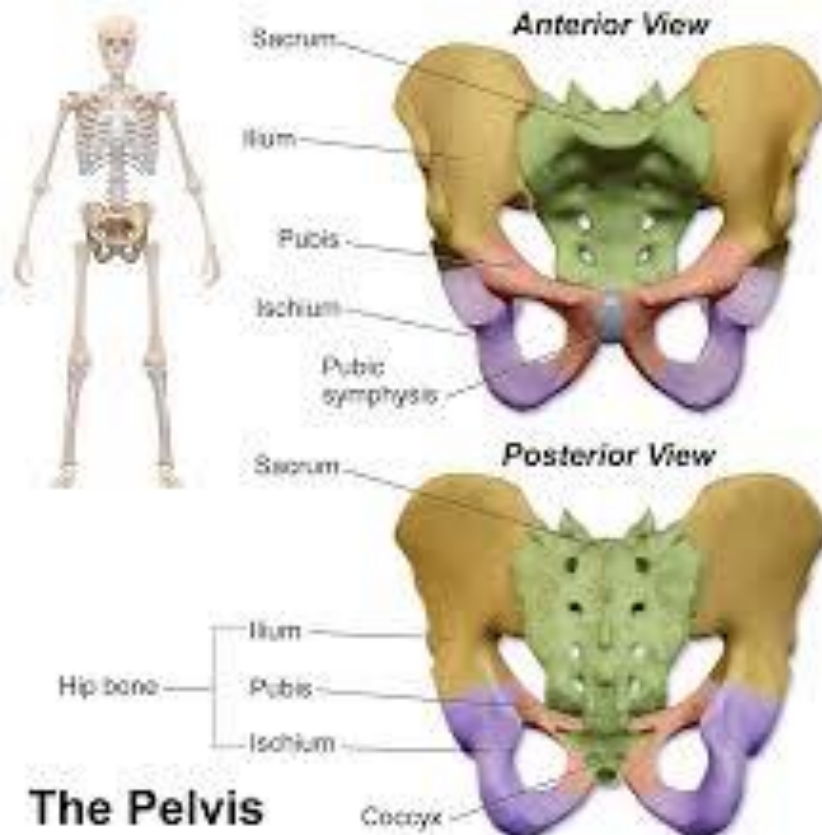
2. Upper Limb Bones

- Humerus
- Radius & Ulna
- Carpals, Metacarpals, Phalanges

B. Inferior A.S.

1. Pelvic Girdle (Hip)

- Pelvis made of 3 bones:
Ilium, Ischium, Pubis
- Male v. Female: pubic arch (90°)



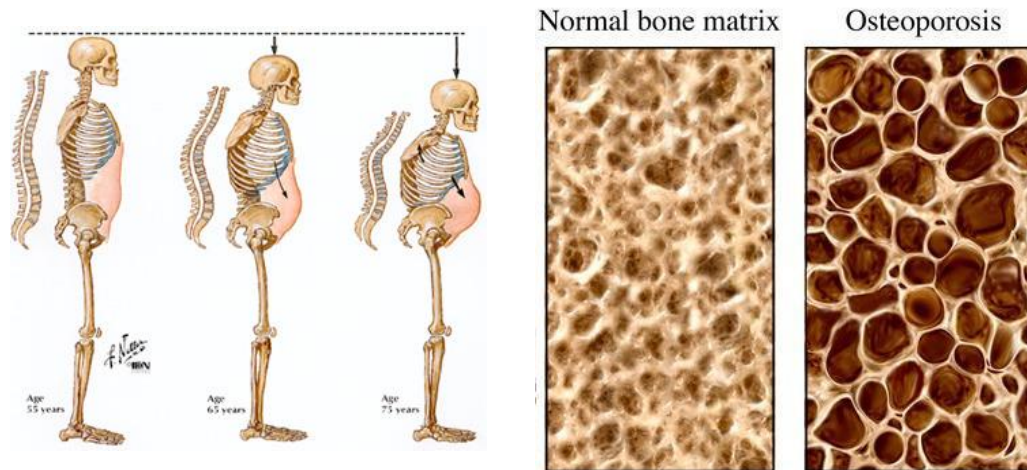
2. Lower Limb Bones

- Femur
- Patella
- Tibia & Fibula
- Tarsals, Metatarsals, Phalanges

VIII. Disorders of the Skeletal System

A. Osteoporosis

- Bones become full of holes and brittle
- Lack of Ca^+ uptake



B. Rickets

- Growing bones in children do not calcify.
- Lack of vit D which helps bones absorb Ca^+ .
- Crooked, bowed legs.



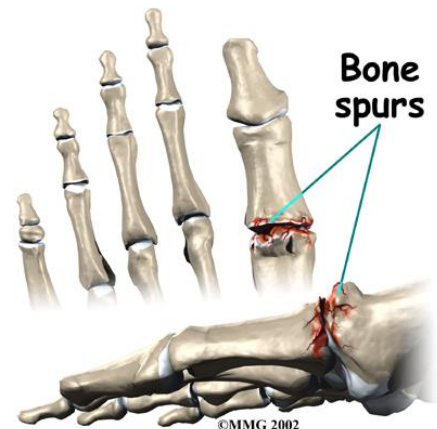
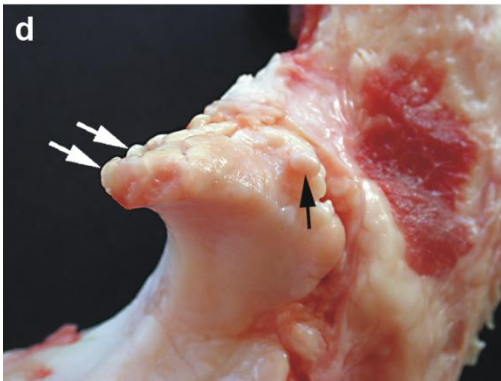
C. Osteogenesis Imperfecta

- “brittle bone disease”
- Strengthen bones through supplements and steel rods



D. Bone Spurs

- Bony projections along bones
- Age, injury, or disease



IX. Joints

A. Functions

1. Hold bones together.
2. Make skeleton flexible.

B. Classified by **structure** and/or **function**:

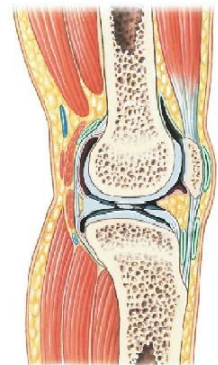
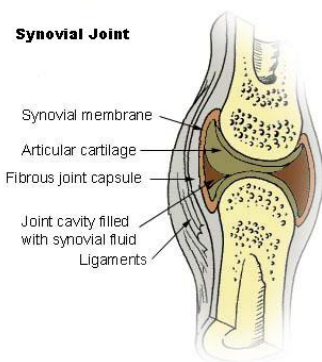
Classification by STRUCTURE	Classification by FUNCTION
Fibrous -Connective tissue -No movement	
Cartilaginous -cartilage -little movement	
Synovial -fluid-filled cavity -much movement	

Classification by STRUCTURE	Classification by FUNCTION
Fibrous -Connective tissue -No movement	Immoveable -mainly in axial skeleton -skull sutures
Cartilaginous -cartilage -little movement	Slightly Moveable -mainly in axial skeleton -vertebrae
Synovial -fluid-filled cavity -much movement	Freely Moveable -mainly in appendicular skeleton -elbows, ankles, knees, fingers, etc.

C. Most freely moveable joints are synovial.

1. Four characteristics of f.m. / synovial joints

- a. Articular cartilage at bone ends
- b. Fibrous capsule
- c. Joint cavity with fluid
- d. Reinforcing ligament



*[why do synovial joints “crack”?](#)

~~2. Six types of synovial joints~~

~~a. Plane — slight slipping (carpals)~~

~~b. Hinge — one plane of movement (elbow)~~

~~c. Pivot — twisting (radius & ulna)~~

~~d. Condylloid — two planes of mvmt.~~

~~—— flat surfaces~~

~~(knuckles)~~

~~e. Saddle — two planes of movement~~

~~—— curved surfaces~~

~~(base of thumb)~~

~~f. Ball & Socket — many planes of mvmt~~

~~(shoulder)~~

D. Joint Disorders

1. Arthritis

a. Inflammation or degrading of a joint.

b. Pain, stiffness, swelling

c. Basic types:

- Osteoarthritis

- cartilage between bones wears out.

- typical in older or overweight people.

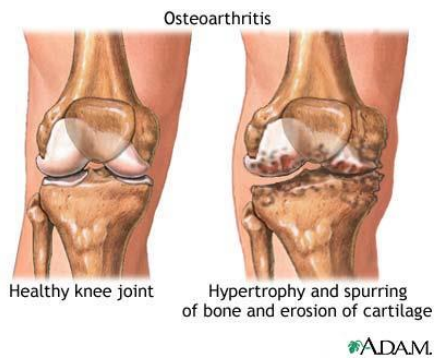


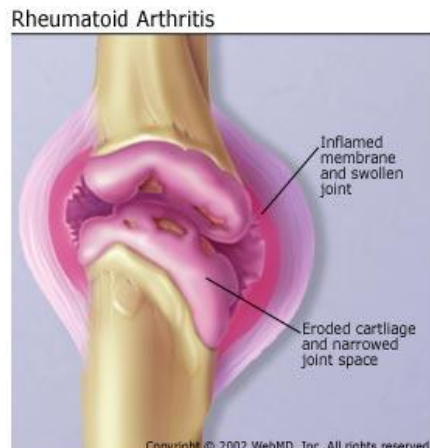
Figure 1



Figure 2

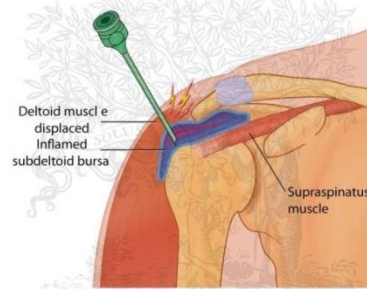
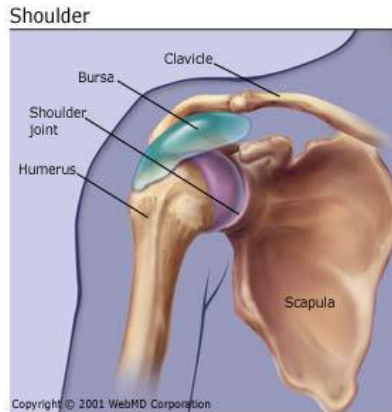
- Rheumatoid arthritis

- autoimmune cause (immune system attacks own synovial membrane)



2. Bursitis

- a. Bursae (synovial membrane) damaged
- b. Aka. “water on the knee”
- c. Cortisone may be injected in to the bursae.

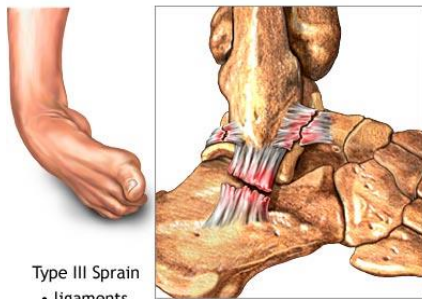


Proper needle placement for injection of the subdeltoid bursa.
(From Waldman SD: Atlas of Pain Management Injection Techniques. Philadelphia, Saunders, 2000.)

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3. Sprains

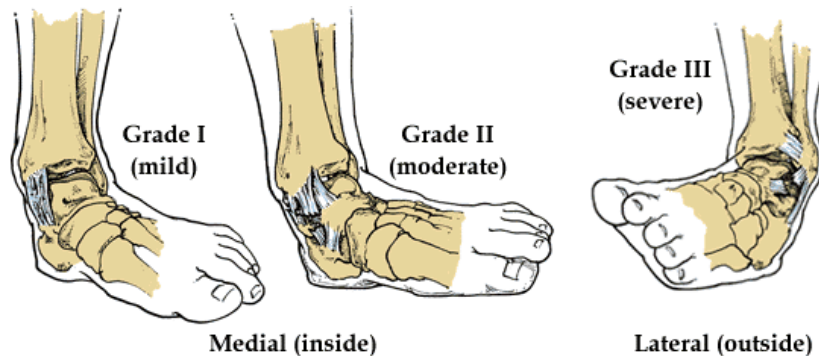
- a. Supporting ligaments in a joint are stretched or torn.
- b. Little blood supply to dense connective tissue results in slow healing.



ADAM



ADAM



X. Bone Fractures & Healing



A. Types of Fractures

1. Each of the following types can be either simple (closed) or compound (open)

Clean break that does NOT penetrate skin.

Aka: "closed" fracture



Simple



Compound

Broken bone ends penetrate skin.

Aka: "open" fracture

2. Common Fracture Patterns



Greenstick (incomplete)

Incomplete break.

Common in children.



Transverse

Complete single, clean break across bone.



Comminuted

Bone shatters into many small pieces.

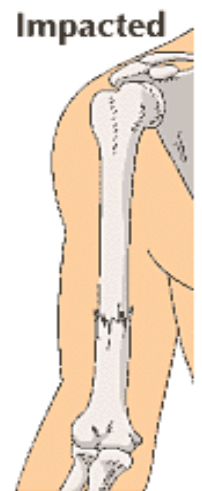
Common in elderly



Spiral

Ragged break from twisting.

Common sports injury.



Impacted

Broken ends forced into each other.

Common hip fracture.

C. Medical Treatment through Reduction

1. Closed Reduction – bone ends are put back into place by hand without surgery.
2. Open Reduction – bone ends are realigned with surgery and fixed in place with screws, pins and/or plates.

D. Steps in the Bone Healing Process:

