SKELETAL SYSTEM

Notes # 1
Functions and main structures of the skeletal system
STRUCTURES:

- BONES!!!
- LIGAMENTS
- JOINTS
Main functions of skeletal system

1. Support
   - stand upright

2. Protection
   - Soft organs
     - Skull – brain
     - Thorax – heart
     - Pelvis/hips – reproductive organs
FUNCTIONS CONTINUED

3. Movement

4. Blood cell formation
   - Red marrow – red and white blood cells

5. Storage
   - Yellow marrow – fat and ion storage
SKELETAL SYSTEM

- Two parts
  - Axial skeleton
    - Protection
  - Appendicular skeleton
    - Support/movement
- 206 bones in your body
Axial skeleton

Very protective

3 main parts

Skull
Vertebral column
Thorax
APPENDICULAR SKELETON

- MORE INVOLVED IN MOVEMENT/support

- Girdles
  - Shoulder
  - Pelvic

- Limbs
  - Arms
  - Legs
  - Hands
  - Feet
What are the two main components of bone?

- **MINERALS**
  - Calcium and phosphorous
  - Provide strength

- **ORGANIC MATERIAL**
  - Made from Carbon!
  - Main protein – collagen
  - Provides flexibility

- **MATRIX**
  - The minerals and organic material together
HOW DOES MATRIX FORM BONES?

- Central (Haversian) Canals
  - Matrix on the outside
  - Hole with blood vessels in the middle
NOTES 2

WHAT EXACTLY IS HAPPENING INSIDE YOUR BONES?
Bones by shape

+ Long bone
short bone
irregular bone
flat bone
BONES BY SHAPE

- Long Bones
  - Exterior compact bone for strength
  - Spongy bones at head
  - Open space in middle for marrow (Yellow Marrow)
  - “classic” bone shape
BONES BY SHAPE

- **Short Bones**
  - Mostly spongy bone
  - Thin wall of compact bone
Bones by Shape

- Flat Bones
  - Sandwich of compact and spongy
Bones by Shape

- Irregular Bones
  - Depends...
Bone Tissue

- Compact and spongy bone
  - Compact bone is dense and smooth looking
  - Spongy has holes and internal open space
MORE ON MARROW

RED MARROW
- Birth place of blood cells
- RBC born & mature here
- WBC start here, mature elsewhere

Located in flat bones, short bones, and ends of long bones

YELLOW MARROW
- Fat storage/reserve
- Deposit of Ca 2+, Mg2+ and PO4-

- Only in long bones
A FEW OTHER STRUCTURAL FEATURES

- **Ligament**
  - Connective tissue
  - Connects bone to bone

- **Tendon**
  - Connective tissue
  - Connects Muscle to bone

- **Tubercles or tuberosity**
  - Where the muscle/tendon connects to the bone
Achilles Tendon

Lateral view of proximal humerus

Tubercle
LONG BONE ACTIVITY

- Go to a long bone
- Sketch it
- Label the following in your sketch
  1. Epiphysis
  2. Shaft
  3. Arterial hole
  4. Spongy bone
  5. Compact bone
  6. Tubercle
  7. Where the red marrow is
  8. Where the yellow marrow is
DAY 3

- Joints and ligaments
  - Connecting one bone to another
BODY JOINTS

Hip Joint

- Synovial Fluid
- Articular Cartilage
- Ligament and Joint Capsule
- Synovial Membrane
- Femoral Head
- Femur
- Ligament and Joint Capsule
BODY JOINTS

- Body joint – where 2 bones come together

- All bones (except the hyoid bone) form at least one joint

FUNCTION:
  - To bring two bones together
Hyoid Bone
TYPE AND STRUCTURE OF JOINTS

1. Fibrous – does not move

2. Cartilaginous (made of cartilage) – some movement

3. Synovial (cartilage and fluids) – lots of movement
EXAMPLES

- Fibrous joints - fixed
  - Sutures of the skull
  - Allows for very little movement
EXAMPLES

- Cartilaginous or slightly movable
  - Bone ends connected by cartilage
  - Allow small movements such as hip, spinal column, ribs
EXAMPLES

- Synovial or freely moving joints
  - Bone ends connected with a membrane bound cavity with synovial fluid in it
  - All your free moving limbs have this
BONES, VITAMINS AND HORMONES

VITAMIN D
  • Necessary to absorb Ca++ from the intestines into the blood.
  • Ca++ is essential for bone strength

GROWTH HORMONE
  • Causes your bones to grow
  • Stop producing it in teen years.
HOMEOSTASIS

1. **Stimulus**: Produces change in variable

2. **Change detected by receptor**

3. **Input**: Information sent along afferent pathway to **Control center**

4. **Output**: Information sent along efferent pathway to **Effector**

5. **Response of effector feeds back to influence magnitude of stimulus and returns variable to homeostasis**

**Variable (in homeostasis)**
Day 4

- Lab write up
- Bone ID activity
BONE IDENTIFICATION

- On your paper write the letters A –
- Go around to the lab benches and identify each bone.
- For the following bones identify what type of joint it makes and with what other bone

- Draw a vertebrae
  - Label with anterior (front), posterior (Back), inferior (toward the feet), superior (toward the head)
  - Where does the rib attach?
  - What goes through the hole?
Day 5

- Bone growth, regrowth and cellular structures
Bone growth and regrowth

First time around
- Bone starts as cartilage
- Surrounded by osteoblasts (cells that make bone)
- Ossification begins – cartilage gets eaten away and replaced by bone
REGROWTH

Simple fracture
skin not broken

Compound fracture
skin is broken by bone

Repair
1. Blood rushes to area
2. Cartilage is laid down
3. Osteoblasts come in and form new spongy bone
4. Osteocytes slowly strengthen over months with additional mineral deposits
SYSTEM OUT OF BALANCE

- Rickets
- Spinal curvatures
- Fractures
Dislocations
OSTEOARTHRITIS

Normal and Arthritic Joints

- Normal Joint: Muscle, Bone, Bursa, Synovial membrane, Synovial fluid, Joint capsule, Cartilage, Tendon
- Osteoarthritis: Bone erosion, Thinned cartilage, Swollen inflamed Synovial membrane
- Rheumatoid Arthritis: Bone ends rub together

Arthritic hip joint:
- Decreased joint space
- Worn cartilage
- Rough bone

Normal hip joint
RHEUMATOID ARTHRITIS

Osteoarthritis
(late stage)

Fusiform
swelling
of joints

Heberden’s nodes

Rheumatoid arthritis
(late stage)

Boutonniere
deformity
of thumb

Ulnar deviation of
metacarpophalangeal
joints

Swan-neck deformity
of fingers
GOUT & OSTEOPOROSIS

**Gout**
- Bone erosions
- Urate crystals in a tophus
- Synovium

**Osteoporosis**

(normal bone) vs (osteoporosis bone)

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AND NOW FOR SOMETHING COMPLETELY DIFFERENT
SKULL

- Cranium
  - 8 flat bones
  - Connected by sutures
  - Note: sinus cavities

- Mandible
  - Jaw

- Hyoid
  - Only bone in the body that doesn’t have a joint
VERTEBRAL COLUMN

- 3 sections
  - Cervical
    - Neck area
    - Unique movement of nodding and shaking
  - Thoracic
    - Mid area
  - Lumbar
    - Base of spine
    - Fused portions at very end – sacrum and coccyx

Cartilage between each vertebra
BONY THORAX  THORACIC CAGE OR RIB CAGE

- 2 parts – sternum and ribs
- 12 pairs of ribs
  - “true Ribs” first seven - they attach to sternum
  - “False Ribs” next 5 do not directly attach to sternum
- Floating ribs – final 2 false ribs so not attach at all
BONES TO KNOW – YOU HAVE THIS LIST

- Clavicle
- Humerus
- Radius/Ulna
- Phalanges
- Femus
- Patella
- Tibia/Fibula

- A few others:
  - Carpals
  - Metacarpals
  - Tarsals
  - Metatarsals
  - Hyoid

Axial – skull, vertebrae, ribs, sternum