Chapter 7

The Skeleton: Bones and Joints

The Skeleton

Skeletal system is made up of bones and joints and supporting connective tissue.

1. Bone Functions

1. To store calcium salts
2. To protect delicate structures such as the brain and spinal cord
3. To serve as levers to produce movement
4. To serve as a firm framework for the body
5. To produce blood cells

S-P-L-F-B

2. Bone Structure

A. There are 206 bones in the adult body
B. 2 basic groups
   - Axial skeleton (head and trunk); 80 bones
   - Appendicular skeleton (extremities); 126 bones

5. Bones of the Axial Skeleton

   - Axial skeleton—80 bones of the head and trunk
   - Head
   - Vertebræ & sacrum
   - ribs

6. Bones of the Appendicular Skeleton

   - Appendicular skeleton—126 bones of the extremities
   - 2 girdles:
     - Shoulder girdle: clavicle, scapula, arm & hand bones
     - Pelvic girdle: pelvis and leg and feet bones
c. Four basic bone shapes:

- 1. Flat (ribs, skull)
- 2. Short (carpals, tarsals)
- 3. Irregular (vertebrae, face)
- 4. Long (most common)

D. The Long Bone

- **Diaphysis** — the center shaft
- Outside: wrapped with membrane layer called (periosteum);
- Inside: lined by inner membrane called (endosteum) and filled with yellow marrow (mostly made of fat)

E. Bone Tissue — two types

- 1. **Compact bone**
  - Makes up the outer layer of long bone shaft
  - Cells are in rings of tissue called **haversian canals**
  - Each set of rings is called an osteon; osteocytes are found in areas called lacunae
2. Spongy (cancellous) bone
   • Found in the ends of long bones
   • Made of a meshwork of small bony plates
   • Contains red marrow that makes blood cells

3. Bone Growth and Repair
   • A. All bone starts as cartilage (hard connective tissue)
   • B. Ossification - the process of converting cartilage into bone, starts during 2-3rd month of embryonic development.

C. How ossification/bone growth works:
   1. Osteoblasts (bone building cells) manufacture the matrix, material between the cells made of collagen (gives strength and resilience).
   2. Calcium gets deposited in the matrix, causing it to harden. Vitamin D and calcitonin enable absorption of calcium.
   3. Osteocytes (mature osteoblasts) maintain and repair existing bone matrix throughout life but they do not manufacture new matrix.
   4. Animation video

D. How Long Bones Grow in Length
   • 1. Epiphyseal plates develop across bone ends
   • 2. Bones continue to lengthen at end plates
   • 3. Bones stop lengthening in early 20’s
   • 4. Bone resorption and formation continues throughout life, but it slows with age.

D. How Long Bones Grow in Length
   5. Resorption – process of fixing bones that needs repair; osteoclasts are special bone cells that breakdown old bone tissue, then osteoblasts fill in with new bone.
   • Animation of

4. Bone Markings
   • A. Projections – allow for muscle attachments
     • Head – rounded knob-like end
     • Process – large projection of a bone
     • Crest – distinct border or edge
     • Spine – a sharp projection
   • B. Depressions or holes – allow for passage of nerves and blood vessels
     • Foramen – a hole for nerves or vessels to pass
     • Sinus – an air space in skull
     • Fossa – a depression on a surface
     • Meatus – a short channel or passageway
A. VERTEBRAE
Cervical – 7 neck bones
Thoracic – 12 chest bones; 24 ribs attach here
Lumbar – 5 bones, thick to withstand pressure
Sacrum – 5 bones fuse by adulthood
Coccyx – 4-5 fused
Foramen – hole for spinal cord to go through
Process – projection for muscle attachment

B. RIBS
12 pairs attach to T1-12 vertebrae
#1-7 are true ribs; attach directly to sternum
#8-10 are “false ribs” attaching indirectly to sternum (#11-12 are ‘floating ribs.’)

B. Structural problems:
3 irregular spinal curvatures
Kyphosis – exaggerated thoracic curve
Lordosis – exaggerated lumbar curve
Scoliosis – spine curves laterally rather than straight

C. Cleft palate - the hard palate (mouth roof) does not fuse before birth

D. Flat feet - tendons and ligaments are weak, causing arch to fall

7. Disorders of Bone
A. Osteoporosis – lack of calcium in matrix
B. Animation: Osteoporosis

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E. Fractures – break in the bone usually caused by trauma

F. Skeletal Changes in the Aging

Bones undergo significant changes:
1. Loss of calcium salts causes bone brittleness
2. Decrease in protein being formed
3. Reduction in collagen causes stiffness in joints
4. Loss of height as discs get thinner
5. Decrease in chest diameter as cartilage calcifies

Part 2 - The Joints – a connection of 2 or more bones

Classified by material between adjoining bones and by degree of movement permitted:
1. Fibrous (immovable)
2. Cartilaginous (slightly movable)
3. Synovial (freely movable)

Movement at Synovial Joints
- Flexion/Extension
- Abduction/Adduction
- Circumduction
- Rotation

Movements characteristic of forearm and ankle:
- Supination/Pronation
- Inversion/Eversion

Types of Synovial Joints

Classified by types of movement they allow:
A. Gliding – wrist, feet
B. Hinge – elbow, knee
C. Pivot – head on neck; radius/ulna
D. Condyloid – finger and metacarpal joint
E. Saddle – carpals and thumb
F. Ball-and-socket – shoulder, hip