Skeletal System

- Bone
- Cartilage
- Ligaments

Outline

- Osteology - Study of bone tissue
  - Functions
  - Cells, tissues
  - Growth, development
  - Osteopathology

- Organization of the Skeleton
  - Axial Division
  - Appendicular Division
  - Articulations

Functions of the Skeletal System

- Framework
- Protection
- Biochemical Storage
- Blood Cell Formation
Structure of Bone - Cells -

Organization of Bone Tissue

Biochemistry of Bone Tissue

Matrix

Cells (2%)
Collagen (33%)
Mineral salts (~60%)

\[ \text{Ca}_3(\text{PO}_4)_2 + \text{Ca(OH)}_2 = \text{hydroxyapatite} \]
Figure 7.15

Bone Calcium Regulation

- Calcium is consumed, blood calcium levels increase.
- Thyroid gland releases calcitonin.
- Osteoblasts deposit calcium in bones.
- Blood calcium levels are returned to normal (homeostasis).
- Osteoclasts break down bone to release calcium.
- Parathyroid gland releases parathyroid hormone.
- Blood calcium levels are low.
OSTEOGENESIS

Two methods

• Intramembranous (Skull, mandible, clavicle, patella)
  – originate within sheets of connective tissue

• Endochondral (longbones)
  – begin as models of hyaline cartilage that are replaced by bone
Nutrition and Bone Development

- Vitamin A
  - necessary for osteoblast and osteoclast activity
- Vitamin C
  - necessary for collagen synthesis

Hormones and Bone

- Growth Hormone (GH)
  - stimulates epiphyseal cartilage cell division
- Deficiency of GH
  - pituitary dwarfism
- Excess GH
  - pituitary gigantism in children
  - acromegaly in adults
Hormones and Bone

- Thyroid hormone
  - stimulates cartilage replacement in the epiphyseal disks
- Sex steroids
  - promote formation of bone tissue close the epiphyseal disk

Physical Factors Affecting Bone

- Physical stress (bending, twisting, compressing)
  - stimulates bone growth
- Weight bearing exercise
  - stimulates bone tissue to thicken and strengthen
  - hypertrophy
- Lack of exercise
  - leads to bone wasting
  - atrophy
Nutrition and Bone Development

- Vitamin D
  - necessary to absorb calcium in the small intestine
- Vitamin D deficiency
  - leads in rickets in children
  - osteomalacia in adults
Axial Skeleton

- head, neck, and trunk
- Skull
  - cranium and facial bones
- Hyoid bone
  - anchors the tongue
- Vertebral column: upright posture
  - Supports the head superior to trunk
- Thoracic cage
  - ribs and sternum

Appendicular Skeleton

- Pectoral girdles, upper extremities, pelvic girdle, lower extremities