Objectives

1. Explain the role of bone salts and the organic matrix in making bone both hard and flexible.
2. Identify structures and functions of the microscopic structure of compact and spongy bone.
3. Describe the process of bone formation and bone remodeling from fetus through adulthood.

MICROSCOPIC ANATOMY OF BONE
FIGURE 5.3 PAGE 116

COMPACT BONE

- Dense bone
- Contains systems of canals that allow blood vessels to nourish bone cells (osteocytes)
- Osteon or Haversian System – entire complex unit

STRUCTURE

- Lamellae – “little layers”; concentric rings formed by lacunae
- Lacunae – “little lakes”; cavity containing osteocyte
- Canaliculi – “little channels”; outward canals that lead to all lacunae ensuring all osteocytes are nourished
• Haversian Canal – run longitudinally through the center of the osteon
• Volkmann's Canal – run horizontally connecting each osteon
• Both contain blood vessels which nourish the bone cells

SPONGY BONE (CANCELLOUS BONE)
• Porous
• Most abundant in short, flat & irregular bones
• Consists of interconnecting rods called trabeculae
• Support bone & store marrow
• Cavities that contain osteoblasts – immature bone cells

http://health.howstuffworks.com/adam-200125.htm
CHEMICAL COMPOSITION OF BONE
- Matrix consists of solid materials rich in minerals and salts
- 67% inorganic material; provides strength & hardness
- Hydroxapatite \( \text{Ca}_3(\text{PO}_4)_2 \cdot \text{Ca(OH)}_2 \)
- 33% organic; collagenous proteins that provide reinforcement & flexibility

OSSIFICATION
- Formation of new bone from hyaline cartilage
- Cartilage model is covered with bone matrix by the osseoblast
- Hyaline model is digested away opening up the medullary canal
- Digesting occurs in all areas except on ends of bone & growth plates

Embryonic Development
- Embryo – skeleton is mostly hyaline cartilage
- By birth – most converted to bone except:
  - Articular cartilage (for life)
  - Epiphyseal plates (growth)
- Bone growth is controlled by growth hormone and the sex hormones
- Adolescence – epiphyseal plates converted to bone

BONE REMODELING
- Formation of new bone material
- Controlled by
  1. Ca levels in blood
  2. Pull of gravity and muscles (stress) on skeleton
Ca Levels

- Ca drops in blood – known as hypocalcemia
- Parathyroids secrete PTH to blood
- PTH activates osteoclasts to break down bone matrix and release Ca into blood
- Hypercalcemia is the reverse condition which deposits high levels of Ca in the blood into the bone

Gravity

- The constant pull of muscles on bone causes bony matrix to breakdown
- Osteoblast lay down new bony material
- Osteoblast becomes trapped within the bony matrix
- Osteoblast then develops into an osteocyte.