

# III. SKELETAL SYSTEM

## ANATOMY OF A LONG BONE

CN: Use light blue for C, a "bone" color for D, very light colors for E and F, yellow for I, and red for J. The little red marrow (H) is not to be colored as the red marrow in this bone is not shown, having been replaced by yellow marrow during maturity. Only part of the yellow marrow in the medullary canal is shown.

Bone is a living, vascular structure, composed of organic tissue (cells, fibers, extra-cellular matrix, vessels, nerves—about 35% of a bone's weight), and mineral (calcium hydroxyapatite—about 65% of a bone's weight). Bone functions as a support structure, a site of attachment for skeletal muscle, ligaments, tendons, and joint capsules, a source of calcium, and a significant site of blood cell development (hematopoiesis) for the entire body. Here we show a long bone, specifically the femur, the bone of the thigh.

### EPIPHYSIS<sub>A</sub>

The *epiphysis* is the end of a long bone or any part of a bone separated from the main body of an immature bone by cartilage. It is formed from a secondary site of ossification. It is largely cancellous bone, and its articulating surface is lined with 3-5 mm of hyaline (articular) cartilage. The epiphysis is supplied by vessels from the joint capsule.

### DIAPHYSIS<sub>B</sub>

The *diaphysis* is the shaft or central part of a long bone. It has a marrow-filled cavity (*medullary cavity*) surrounded by compact bone which is lined externally by *periosteum* and internally by *endosteum* (not shown). The diaphysis is formed from one or more primary sites of ossification, and is supplied by one or more *nutrient arteries*.

### ARTICULAR CARTILAGE<sub>C</sub>

The only remaining evidence of an adult bone's cartilaginous past, *articular cartilage* is smooth, slippery, porous, malleable, insensitive, and bloodless. It is massaged by movement, permitting absorption of synovial fluid, oxygen and nutrition. Articular (hyaline) cartilage is also nourished by vessels from the subchondral bone. Bones of a synovial joint make physical contact at their cartilaginous ends. The degenerative process of arthritis involves the breakdown and fibrillation of articular cartilage.

### PERIOSTEUM<sub>D</sub>

*Periosteum* is a fibrous, cellular, vascular and highly sensitive life support sheath for bone, providing nutrient blood for bone cells and a source of osteoprogenitor cells throughout life. It does not cover articular cartilage.

### CANCELLOUS (SPONGY) BONE<sub>E</sub>

*Cancellous (spongy) bone* consists of interwoven beams (trabeculae) of bone in the epiphyses of long bones, the bodies of the vertebrae, and other bones without cavities. The spaces among the trabeculae are filled with red or yellow marrow and blood vessels. Cancellous bone forms a dynamic latticed truss capable of mechanical alteration (reorientation, construction, destruction) in response to the stresses of weight, postural change, and muscle tension.

### COMPACT BONE<sub>F</sub>

*Compact bone* is dense bone characterized in long bones by microscopic hollow cylinders of bone (haversian systems) interwoven with non-cylindrical lamellae of bone. It forms the stout walls of the diaphysis of long bones and the thinner outer surface of other bones where there is no articular cartilage, e.g., the flat bones of the skull. Blood vessels reach the bone cells by a system of integrated canals.

### MEDULLARY CAVITY<sub>G</sub>

The *medullary cavity* is the cavity of the diaphysis. It contains marrow: red in the young, turning to yellow in many long bones in maturity. It is lined by endosteal tissue (thin connective tissue with many osteoprogenitor cells).

### RED MARROW<sub>H</sub>

*Red marrow* is a red, gelatinous substance composed of a red and white blood cells in a variety of developmental forms (hematopoietic tissue) and specialized capillaries (sinusoids) enmeshed in reticular tissue. In adults, red marrow is generally limited to the sternum, vertebrae, ribs, hip bones, clavicles, and cranial bones.

### YELLOW MARROW<sub>I</sub>

*Yellow marrow* is fatty connective tissue and no longer productive of blood cells. It replaces red marrow in the epiphyses and medullary cavities of long bones, and cancellous bone of other bones.

### NUTRIENT ARTERY / BRANCHES<sub>J</sub>

The *nutrient artery* is the principal artery and major supplier of oxygen and nutrients to the shaft or body of a bone; its branches snake through the labyrinthine canals of the haversian systems and other tubular cavities of bones.

