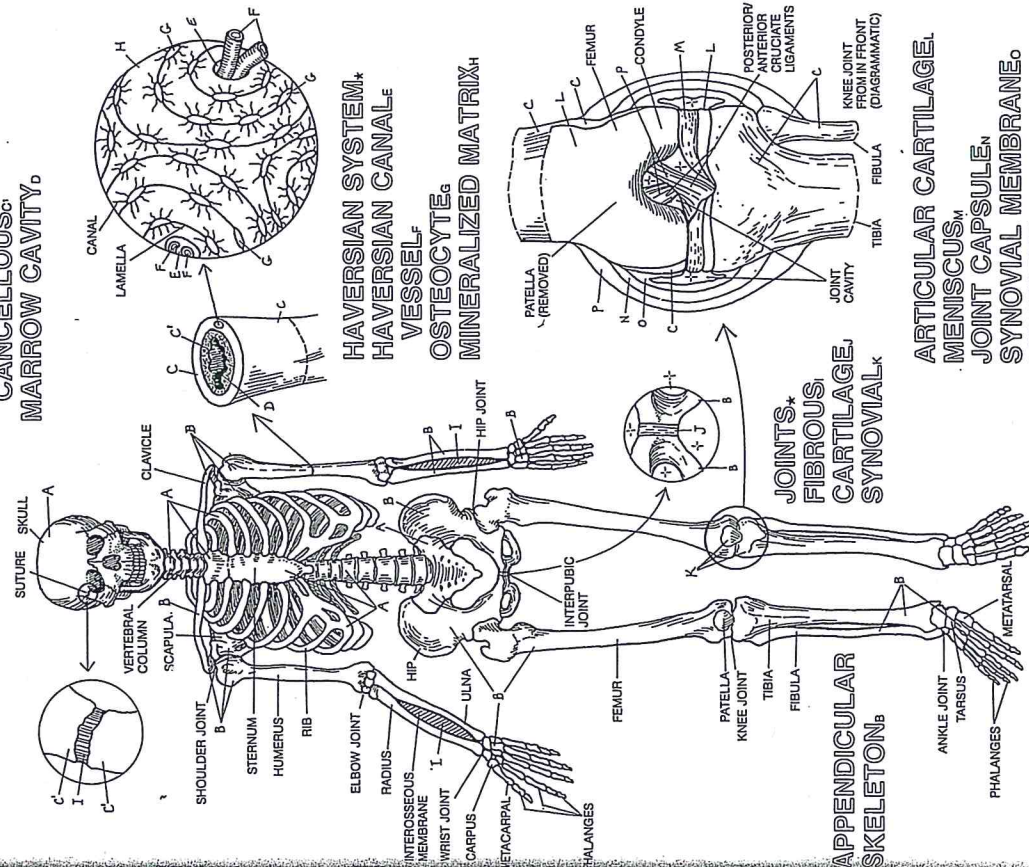


# SKELETAL SYSTEM.

## AXIAL SKELETON.

BONE\*  
COMPACT,  
CANCELOUS,  
MARROW CAVITY<sup>d</sup>



HAVERSIAN SYSTEM\*  
HAVERSIAN CANALE  
VESSEL  
OSTEOCYTE<sup>g</sup>  
MINERALIZED MATRIX

ARTICULAR CARTILAGE.  
MENISCUS<sup>m</sup>  
JOINT CAPSULE<sup>n</sup>  
SYNOVIAL MEMBRANE<sup>o</sup>  
LIGAMENT<sup>p</sup>

# 100 SKELETAL SYSTEM

The skeletal system consists of the bones, the articular (joint) cartilages at the ends of the bones, the costal cartilages of the rib cage, the ligaments (bands or sheets of fibrous connective tissue holding joints together), and the sheets of fibrous tissue called fasciae (see next plate). Only the bones are normally mineralized (hardened with deposits of a calcium phosphate complex). As important as the bones are in the framework of the body, rupture of a ligament or joint capsule may cause as severe a disability as a broken bone.

Color titles A through H, the associated headings, and the related structures in the main illustration and the illustrations at the upper right. Structure C can also be colored at the lower right. Color one vessel (F) red to represent an artery, the other one blue to represent a vein.

The bony skeleton has four basic functions: support of the body, attachment of muscles, formation of blood cells (in the marrow cavities), and storage of calcium for the blood.

The axial skeleton consists of the skull (22 bones), the vertebral column (26 bones), the sternum (2 bones), and 24 ribs. The cranium of the skull encloses the brain, and the facial part forms the framework of the face. The vertebrae have weight-bearing parts, arches to protect the spinal cord, and projections (processes) for muscle attachment. The upper 24 vertebrae (with one exception) are separated by intervertebral disks of fibrocartilage. The appendicular skeleton consists of bones of the upper and lower limbs. The lower-limb bones are larger than those of the upper limbs to bear the greater weight. The bones of the hands and feet are similar in structure, although the ankle bones are more adapted to weight bearing and locomotion.

By weight, bone is 65 percent mineral and 35 percent cells, fibers, and blood vessels. The weight-bearing part of bone is called compact bone, and it is arranged into distinctive patterns called haversian systems or osteons. Here bone cells called osteocytes are arranged in concentric circles (lamellae) surrounded by a mineralized matrix. In the center of each set of lamellae is a canal that carries small vessels. Nutrients and oxygen reach the isolated osteocytes by way of small canals that radiate away from the cells like legs from an insect. Between individual haversian systems, bone-destroying cells called osteoclasts (not shown) can be found breaking down existing patterns, freeing the cal-

cium phosphate complexes to enter the blood as ions. At the ends of bones and along the marrow cavities we find cancellous (spongy) bone, in which tiny beams of bone called trabeculae interlock to form a somewhat open network. Red (blood cell-producing) and yellow (fat-storing) marrow are located among the trabeculae. Spongy bone undergoes reorientation of its trabeculae in response to changes in the load placed on it.

Color the heading Joints, titles I through P, and the related structures. Consider coloring I, N, and P similar colors, as they are generally identical structurally and functionally.

Bones move at joints (articulations). Joints between two or more bones that employ bands of fibrous tissue as the connecting agent are called fibrous joints. These joints may be seen among the flat bones of the skull and between the bones of the forearm. In the first case (sutures), the joints are immovable. In the latter case, the joint is partly movable: the bones are joined by a ligament called the interosseous membrane. The same joint in the leg (between tibia and fibula) is immovable. Some bones are joined by cartilage or fibrocartilage; such is the case with the partly movable joints between the pubic bones at the front of the pelvis and the intervertebral disks of the vertebral column.

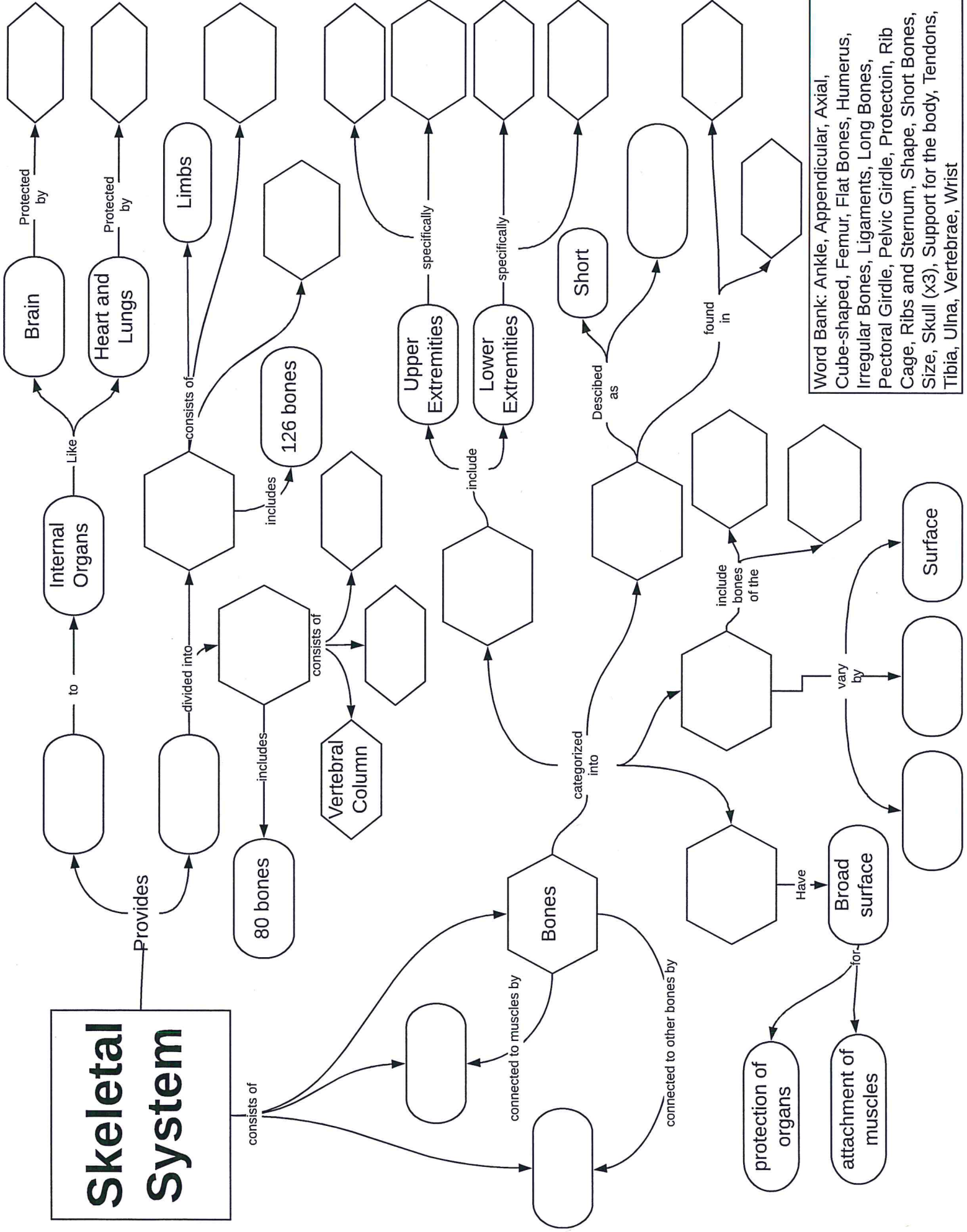
A third category of joint is termed synovial (Latin: *syn*, "together"; *ovium*, "egg," referring to the resemblance of synovial fluid to raw egg white). Synovial joints are freely movable and constitute the major movable joints of the body, including the shoulder, hip, knee, and ankle. The knee joint, a representative synovial joint, is illustrated. The opposing bony surfaces are capped with articular cartilage. The tibial "sockets" for the femoral condyles are enhanced by C-shaped cartilaginous pads called menisci (singular, meniscus). The joint is surrounded and held together by a fibrous joint capsule (essentially a ligament reinforced by an external ligament) lined with a synovial membrane, which secretes the lubricating synovial fluid. The movement of the joint is limited by the bony architecture at the joint, the ligaments, and the orientation of muscles crossing the joint.

Bones that develop in tendons crossing a joint are called sesamoid bones, of which the largest is the kneecap (patella). It serves to increase the leverage of the large muscle on the front of the thigh (quadriceps femoris) as it extends the knee joint.

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# Skeletal System



Word Bank: Ankle, Appendicular, Axial, Cube-shaped, Femur, Flat Bones, Humerus, Irregular Bones, Ligaments, Long Bones, Pectoral Girdle, Pelvic Girdle, Protectoin, Rib Cage, Ribs and Sternum, Shape, Short Bones, Size, Skull (x3), Support for the body, Tendons, Tibia, Ulna, Vertebrae, Wrist