

CC-102: Anatomy and Physiology

1.4 Skeletal System

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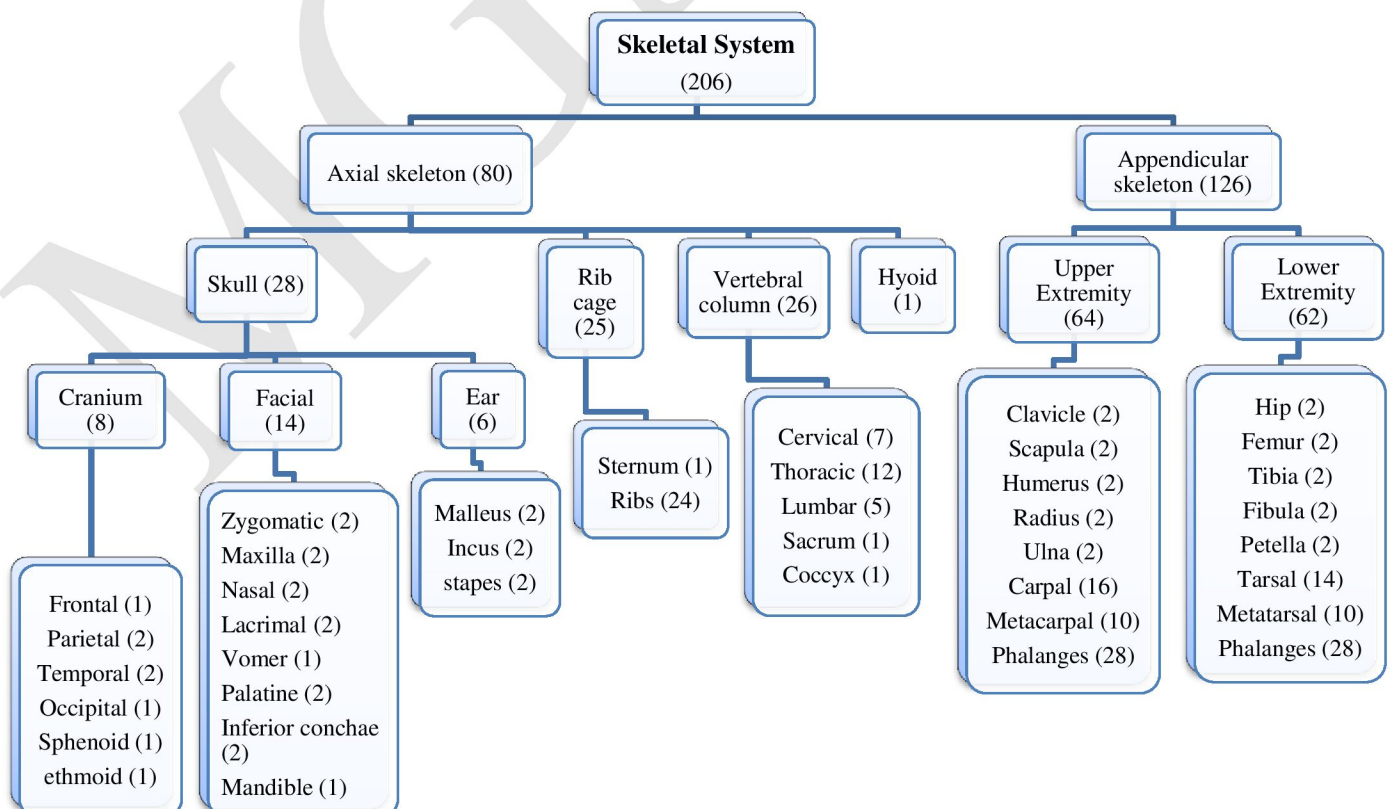
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1.4 Skeletal System - Bones of the human body - axial and appendicular skeleton. Classification and functions of bone. Anatomical sex difference. Brief description of Joints.

- **Skeletal System:** The skeletal system includes all of the bones and joints in the body. Each bone is a complex living organ that is made up of many cells, protein, fibers, and minerals. The skeleton acts as a scaffold by providing support and protection for the soft tissues that make up the rest of the body.
- **Bone:** Bone is the hard, rigid form of connective tissue constituting most of the skeleton of vertebrates, composed chiefly of calcium salts.
- The skeletal system in an adult body is made up of **206** individual bones. These bones are arranged into two major divisions: **the axial skeleton** and **the appendicular skeleton**.
- **Axial skeleton:** The axial skeleton runs along the body's midline axis and is made up of 80 bones in the following regions: Skull, Hyoid, Auditory ossicles, Ribs, Sternum and Vertebral column.
- **Appendicular skeleton:** The appendicular skeleton is made up of 126 bones in the following regions: Upper limbs, Lower limbs, Pelvic girdle and Pectoral (shoulder) girdle.



- **Classification of Bone:** All of the bones of the body can be broken down into five types: long, short, flat, irregular, and sesamoid.
 1. **Long Bone.** Long bones are longer than they are wide and are the major bones of the limbs. Examples - femur, tibia, fibula, metatarsals, and phalanges.
 2. **Short Bone:** Short bones are about as long as they are wide and are often cubed or round in shape. The carpal bones of the wrist and the tarsal bones of the foot are examples of short bones.
 3. **Flat Bone:** Flat bones vary greatly in size and shape, but have the common feature of being very thin in one direction. Because they are thin, the frontal, parietal, and occipital bones of the cranium along with the ribs and hip bones are all examples of flat bones.
 4. **Irregular Bone:** Irregular bones have a shape that does not fit the pattern of the long, short, or flat bones. The vertebrae, sacrum, and coccyx of the spine as well as the sphenoid, ethmoid, and zygomatic bones of the skull are all irregular bones.
 5. **Sesamoid Bone:** The sesamoid bones are formed after birth inside of tendons that run across joints. The patella and the pisiform bone of the carpals are the only sesamoid bones.

- **Functions of bone:** The skeleton serves six major functions; support, movement, protection, production of blood cells, storage of minerals and endocrine regulation.
 - **Support:** The skeleton provides the framework which supports the body and maintains its shape.
 - **Movement:** The joints between bones allow movement.
 - **Protection:** The skeleton helps protect our many vital internal organs from being damaged. The skull protects the brain, the eyes, and the middle and inner ears. The vertebrae protect the spinal cord. The rib cage, spine, and sternum protect the lungs, heart and major blood vessels.
 - **Blood cell production:** The skeleton is the site of haematopoiesis, the development of blood cells that takes place in the bone marrow. In children, haematopoiesis occurs primarily in the marrow of the long bones such as the femur and tibia. In adults, it occurs mainly in the pelvis, cranium, vertebrae, and sternum.
 - **Storage of minerals:** The bone matrix can store calcium and is involved in calcium metabolism, and bone marrow can store iron in ferritin and is involved in iron metabolism.
 - **Endocrine regulation:** Bone cells release a hormone called osteocalcin, which contributes to the regulation of blood sugar (glucose) and fat deposition. **Osteocalcin** increases both the insulin secretion and sensitivity, in addition to boosting the number of insulin-producing cells and reducing stores of fat.

- **Anatomical sex difference:**

Anatomical differences between human males and females are highly pronounced in some soft tissue areas, but tend to be limited in the skeleton. The human skeleton is not as sexually dimorphic as that of many other primate species, but subtle differences between sexes in the morphology of the skull, dentition, long bones, and pelvis are exhibited across human populations. In general, female skeletal elements tend to be smaller and less robust than corresponding male elements within a given population.

- **Skull:** A variety of gross morphological traits of the human skull demonstrate sexual dimorphism, such as the nuchal crest, mastoid processes, supraorbital margin, supraorbital ridge, and mental eminence.
 - **Long bones:** Long bones are generally larger in males than in females within a given population.
 - **Shoulder Girdle:** Shoulder Girdle is generally wider in males than in females.
 - **Thoracic cavity:** Thoracic cavity is generally wider in males than in females.
 - **Pelvis:** Human pelvis exhibit greater sexual dimorphism than other bones, specifically in the size and shape of the pelvic cavity, ilia, greater sciatic notches, and the sub-pubic angle.
- **Joints:** Joint is a point of connection between two bones. Strands of connective tissue, ligaments, hold the bones together and ensure the stability of joints.
 - **Classification of Joints:**
 - **The functional classification of joints are -**
 1. **Immovable or fixed joints (Synarthrosis or Fibrous):** These joints are held together by tough tissue which develops during childhood. Examples include: the Cranium, pelvis,
 2. **Slightly moveable joints (Amphiarthrosis or Cartilaginous):** Here, movement is needed but only to a certain point e.g the vertebral column Individual vertebrae are separated by cartilage.
 3. **Freely moveable joints (Diarthrosis or Synovial):** These joints are also called synovial and allow movement to take place.
 - **The structural classification of joints are -**
 1. **Fibrous joints (Immovable or fixed joints or Synarthrosis):** Lack a synovial cavity, The articulating bones are held very closely together by dense irregular connective tissue Fibrous joints permit little or no movement. Three types of fibrous joints – Sutures, Syndesmoses, Gomphoses.
 2. **Cartilaginous joints (Slightly moveable joints or Amphiarthrosis):** Lacks a synovial cavity, Allows little movement, Joint is tightly connected by cartilage, Two types of cartilaginous joints – Synchondroses & Symphyses.
 3. **Synovial joints (Freely moveable joints or Diarthrosis):** Synovial joints are highly moveable and all have a synovial capsule (collagenous structure) surrounding the entire joint, a synovial membrane (the inner layer of the capsule) which secretes synovial fluid (a lubricating liquid) and cartilage known as hyaline cartilage which pads the ends of the articulating bones.
- There are 6 types of freely moveable or synovial joints -**
1. **Ball and Socket Joint:** Shoulder Joints
 2. **Hinge Joint:** Elbow Joints
 3. **Pivot Joint:** Atlanto-occipital joints
 4. **Gliding Joint:** Intra-carpal joints
 5. **Saddle Joint:** Joints of 1st Metacarpal and Thumb
 6. **Condyloid Joint:** Wrist Joint