

Anatomy and Physiology

7. The Skeletal System



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The Skeletal System

Tour of the System

The early skeleton forms during gestation and continues to develop for several years after birth through a process called endochondral ossification.

A baby has more than 300 bones, whereas an adult only has 206. This is because several bones fuse together during growth.

There are different cells involved in producing bone and these cells are located in the matrix of the bone. This matrix also contains a variety of substances and collagen. As this matrix hardens, bone forms. Formation, re-formation and repair of bones takes place over a long period of time.

Muscles, tendons, ligaments and cartilage support the skeleton and together these are the musculoskeletal system. There are several differences between male and female skeletons, including the pelvis, which has to allow for childbirth.

Functions

The skeleton has several key functions:

It supports the body and maintains the shape of the body.

The joints between the bones allow movement.

It protects organs, such as the skull protecting the brain, eyes and inner ears.

It produces cells in its bone marrow (hematopoiesis).

The skeleton stores a variety of substances including calcium and iron.

It is also involved in regulation of blood sugar levels and fat deposits through release of a hormone called osteocalcin.

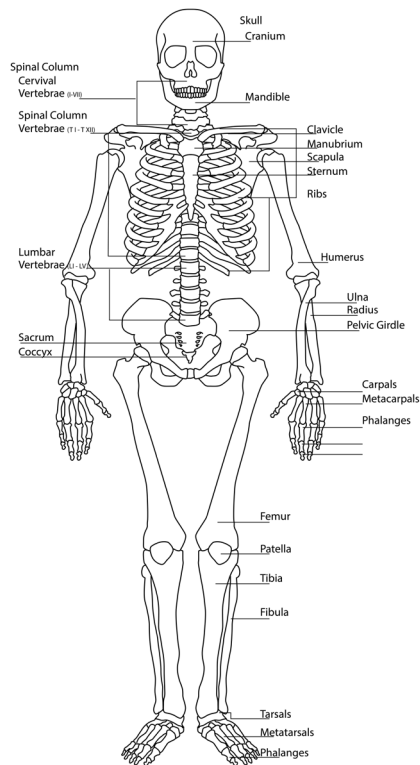
Components

Skeleton

The skeleton consists of the axial skeleton and the appendicular skeleton:

The axial skeleton is central bones including the skull, vertebrae and rib cage.

The appendicular skeleton consists of the pelvis, upper and lower limbs.



Bone

Two types of bone structure make up the skeleton:

Compact or dense bone is most of the adult skeleton. This has a smooth, white appearance.

Cancellous or *trabecular bone* is the spongy bone tissue found inside compact bone. This contains room for blood vessels and marrow.

As well as the two types of bone structure, there are also five types of bone in the human body:

Type	Description	Example
Long bones	The shaft (or diaphysis) is longer than its width	Femur, tibia, radius
Short bones	Cube shaped	Wrist bones, ankle bones
Flat bones	Thin and curved	Skull, sternum

Irregular bones	Irregular and complicated shape	Hip, spinal bones
Sesamoid bones	Found embedded in tendon	Patella (kneecap)

Joints

Joints or *articulations* are:

- where bone meets bone
- bone meets cartilage
- bone meets teeth

Joints are key components of the skeletal system. Diseases of the joints constitute the single greatest cause of disability in the civilized world.

How joints move can categorize them:

- **Synarthrosis:** An immovable joint
- **Amphiarthrosis:** A slightly moveable joint
- **Diarthrosis:** Freely moveable joint

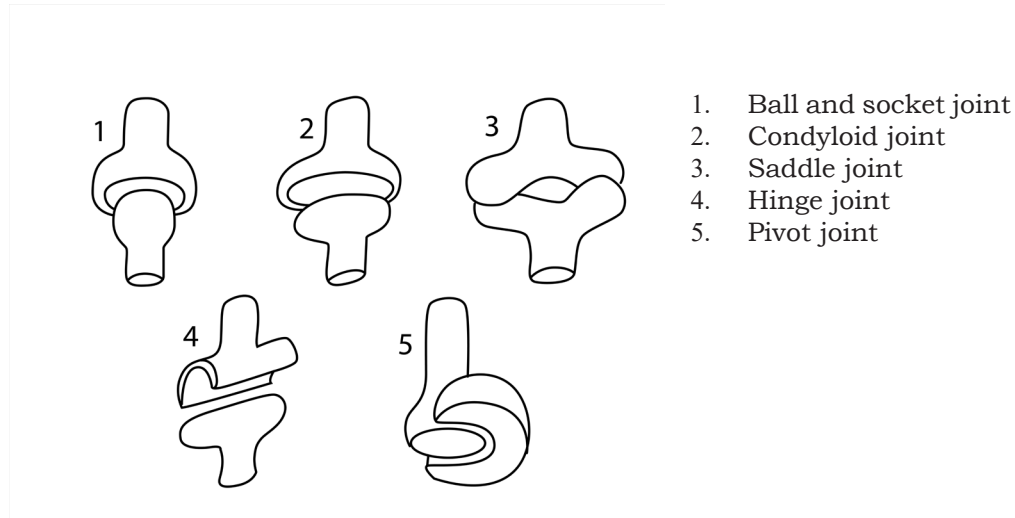
The group known as synarthroses (immovable joints) contain three joints:

1. **Suture:** This is a connective tissue joint, joining the bones of the skull. Some sutures are also present in the skeletons of children until replaced with bone. This type of temporary suture is a synostosis.
2. **Gomphosis:** A peg fits into a socket. These joints are the roots of teeth and their connection with the skull and jawbone.
3. **Synchondrosis:** This is a cartilage joint found where a bone joins to another bone with cartilage. An example is the sternocostal joints, where costal cartilage attached the ribs to the sternum (breastbone). These joints also occur in the epiphyseal (growth) plate of long bones during development. This joint eventually becomes bone.

Amphiarthroses (slightly moveable joints) contain only two sub types of joint:

1. **Syndesmosis:** Is a fibrous joint that contains more connective tissue than a suture. An example of this joint is between the tibia and fibula.
2. **Symphysis:** This joint contains a flat disc of cartilage. The main examples are the spine and hipbones.

Diarthroses or freely moveable joints (also called synovial joints) all contain a space called a synovial cavity. This cavity contains synovial fluid that lubricates and prevents friction in joints. These joints also contain cartilage that covers the ends of the bones.



1. A ball and socket joint consists of the ball shaped end of one bone, fitting into the depression of another bone. These joints allow a variety of movement. The shoulder and hip joints are the only two ball and socket joints.
2. A condylloid joint allows side-to-side and backward and forwards movement. The joint at the wrist is a condylloid joint.
3. A saddle joint is similar to a condylloid joint, but allows more movement. The thumb is a saddle joint.
4. A hinge joint allows flexion and extension because a convex surface of one bone fits into the concave surface of another. Examples include the knee, elbow and ankle.
5. A pivot joint allows rotation of a bone. The pivot joint found at the end of the radius and ulna allows the hand to turn upwards and downwards.
6. A gliding joint allows side-to-side and backwards and forwards movement. An example is the clavicle (collarbone) gliding on the sternum (breastbone) and scapula (shoulder blade).

Muscles

Muscles help the skeleton with movement and this skeletal muscle attaches to the bones with tendons.

Tendons

Tendons are fibrous connective tissues that connect bone to muscle. These work with muscles for movement.

Ligaments

Ligaments connect bone to bone, such as the cruciate ligaments in the knee.

Cartilage

There are different types of cartilage in the body, some of which is at the joints of moveable bones, helping joints to move freely. Cartilage can also act as a shock absorber for the skeleton.

Common Diseases and Disorders

Dislocation: A dislocation or luxation occurs when bones displace at the joint. Sudden trauma, such as a fall can cause a dislocation.

Fractures: These occur when there is a break in the bone. A closed (or simple fracture) means that the skin is unbroken, whereas an open fracture has a wound at the fracture site.

Osteoporosis: This is a condition where there is a reduction in bone density, increasing the chance of fractures. This is more common in post-menopausal women, due to hormone changes.

Osteoarthritis: This is degeneration of the joints. Eventually cartilage at the end of the bones is lost

Osteomyelitis: This is infection of either the bone or its marrow.

Spur: Spurs or osteophytes form on bone as it ages, often caused with the onset of arthritis.

Medical Terminology

Collagen: This is part of connective tissue. There are many different types of collagen, found in scar tissue, skin, hair, cartilage, ligaments, bone and many other body tissues.

Connective tissue: This is a fibrous tissue with many structural roles, found in tendons, bone, cartilage and ligaments.

Endochondral ossification: Is the name for the development of the skeleton after birth.

Greenstick fracture: This fracture only occurs in children when the bones are still soft.

Haematopoiesis: The name given to the process by which different components of the blood develop in bone marrow. This includes erythrocytes, white blood cells and platelets. These all develop from stem cells.

Orthopedic: Branch of surgery concerned with the musculoskeletal system.

Strain: This occurs when a muscle is torn. It can also affect tendons.

Sprain: Similar to a strain, but occurs when a ligament has been over-stretched

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