Systems in the Human Body

Life function	Human body system responsible
Movement	**Muscular skeletal system**
Respiration	**Respiratory system**
Sensitivity	Nervous system
Circulation	**Circulatory system**
Growth	Numerous systems
Reproduction	Reproductive system
Excretion	Excretory system
Nutrition	**Digestive system**

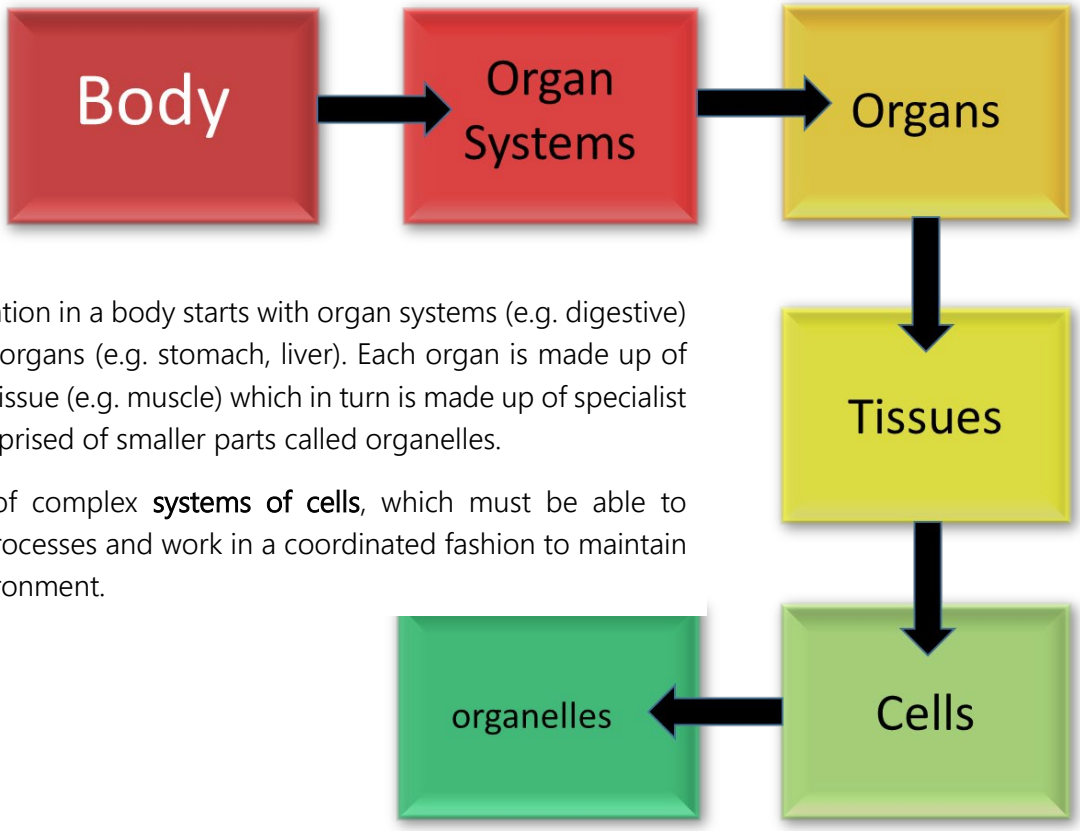
The structure and functions of the human (as an animal) systems: skeletal, digestive, circulatory, respiratory.

All vertebrates share the same basic body plan, with tissues and organs functioning in a similar manner. We focus on the human body, studying structure (**anatomy**) and function (**physiology**).

Different tissues functioning together for a common purpose are called **organs** (eg, stomach, kidney, lung, heart).

Organ systems are composed of individual organs working together to accomplish a coordinated activity. For example, the heart, veins and arteries all play a role in circulation.

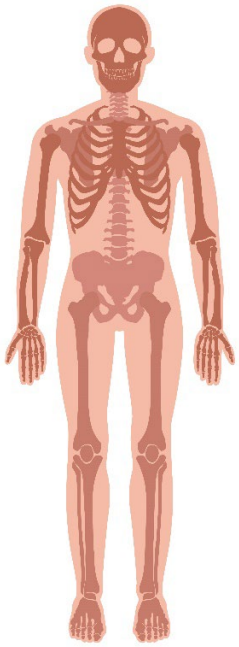
Organisation in the human body



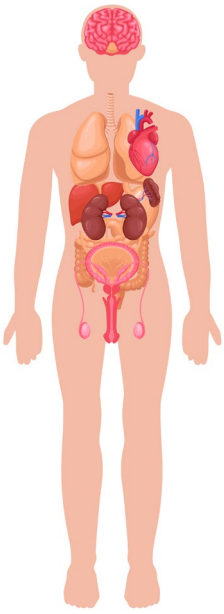
The order of organisation in a body starts with organ systems (e.g. digestive) that are made up of organs (e.g. stomach, liver). Each organ is made up of one or more type of tissue (e.g. muscle) which in turn is made up of specialist cells. Each cell is comprised of smaller parts called organelles.

Humans are made of complex **systems of cells**, which must be able to perform all of life's processes and work in a coordinated fashion to maintain a stable internal environment.

The Human Organ Systems



The Human Organ Systems that will be covered in detail include the **Circulatory** (**Cardiovascular)** system: including the Heart and associated blood vessels, the **Muscular Skeletal** system: Including the skeleton, muscles of the arms and legs and supporting connective tissue, the **Respiratory** system: including breathing, gas exchange and respiration, and the **Digestive** system: allowing us to break down and then absorb food into our blood to deliver energy and nutrients to our cells.



Other Human Organ Systems

The **Nervous system** controls our body and sends messages from the brain to all parts of the body. It consists of the brain and connected nerves.

The **Excretory system** removes waste products from our bodies by filtering the blood through kidneys.

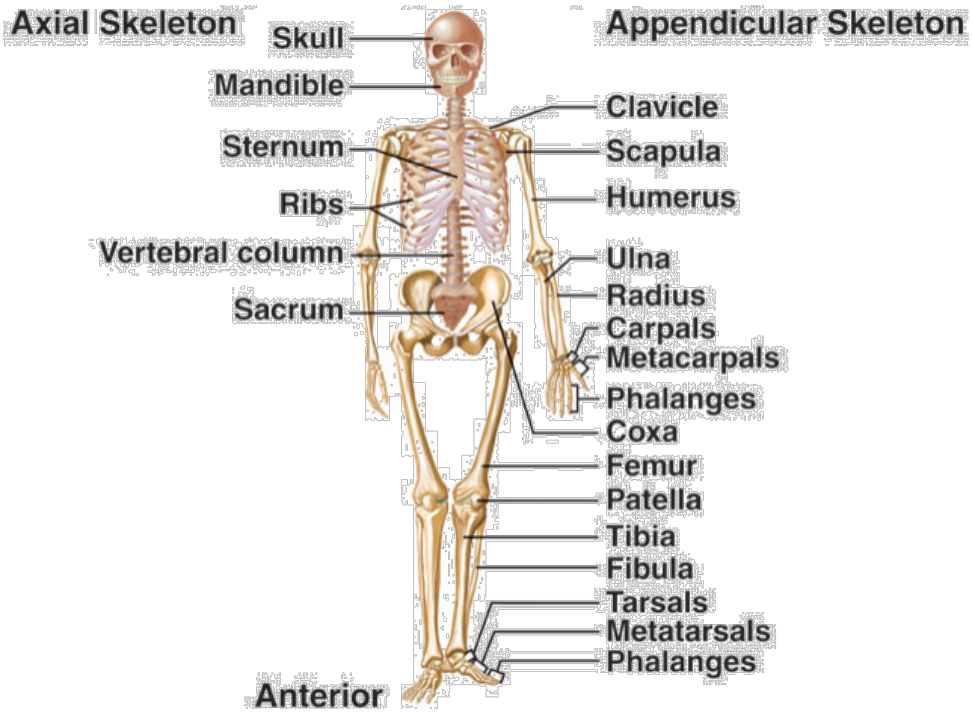
The Human skeletal system.

The human skeletal system is an **internal skeleton** that serves as a framework for the body. This framework consists of many individual **bones** and **cartilages**. This also includes l**igaments** and the **tendons** which hold bones to each other and to muscles that contract and cause the bones to move.

The adult human skeleton contains more than 200 bones.

The skeleton also provides **mechanical protection** for many of the body's internal organs, reducing risk of injury to them, **storage of minerals** and **production of blood cells**.

The main bones in the Human skeletal system.

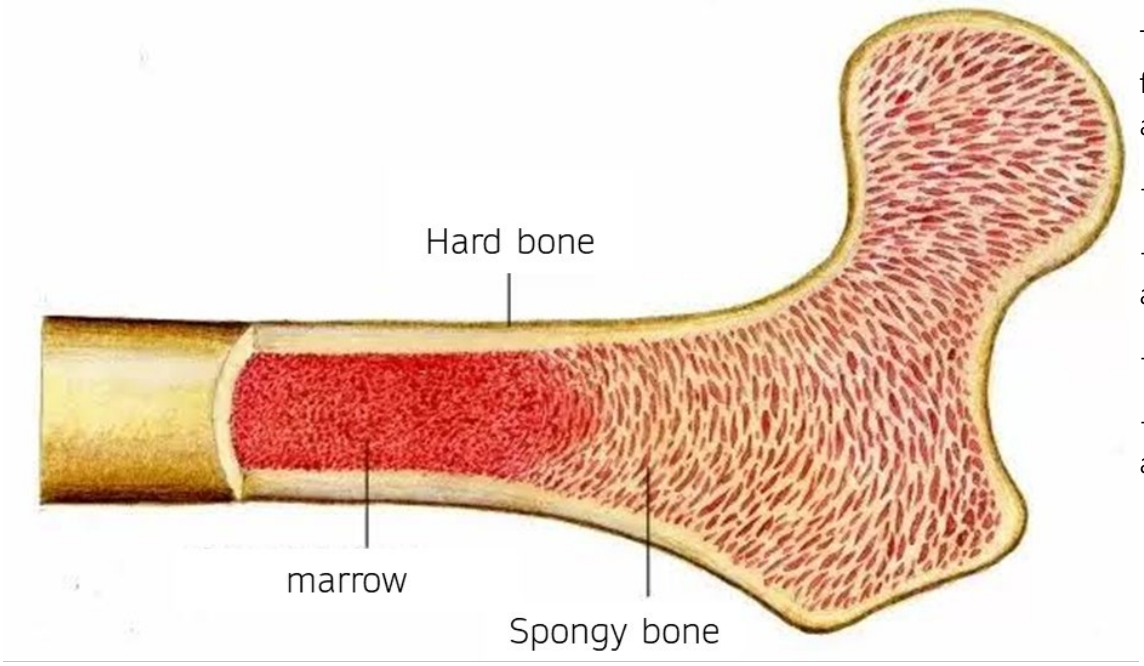


The main bones of the human skeleton are divided into two groups.
The **axial skeleton** is the central group of bones based around the spinal (vertebral) column.
The **appendicular skeleton** consists of bones or groups of bones which "hang" off the axial skeleton.

The main bones of the human skeleton are:

The **Skull**
Arm - humerus, radius and ulna
Chest - Sternum and Ribs
Pelvic girdle - Ilium, Pubis and Ischium.
Foot - Tarsals, Metatarsals and Phalanges
Shoulder girdle - clavicle and scapula
Hand - Carpals, Metacarpals and Phalanges
Leg - Femur, Tibia and Fibula
Ankle - Talus and calcaneus
Spine - vertebrae, Sacrum (5 fused or stuck together bones) and Coccyx (the tiny bit at the bottom of the spine).

The structure and functions of Hard and Spongy Bone

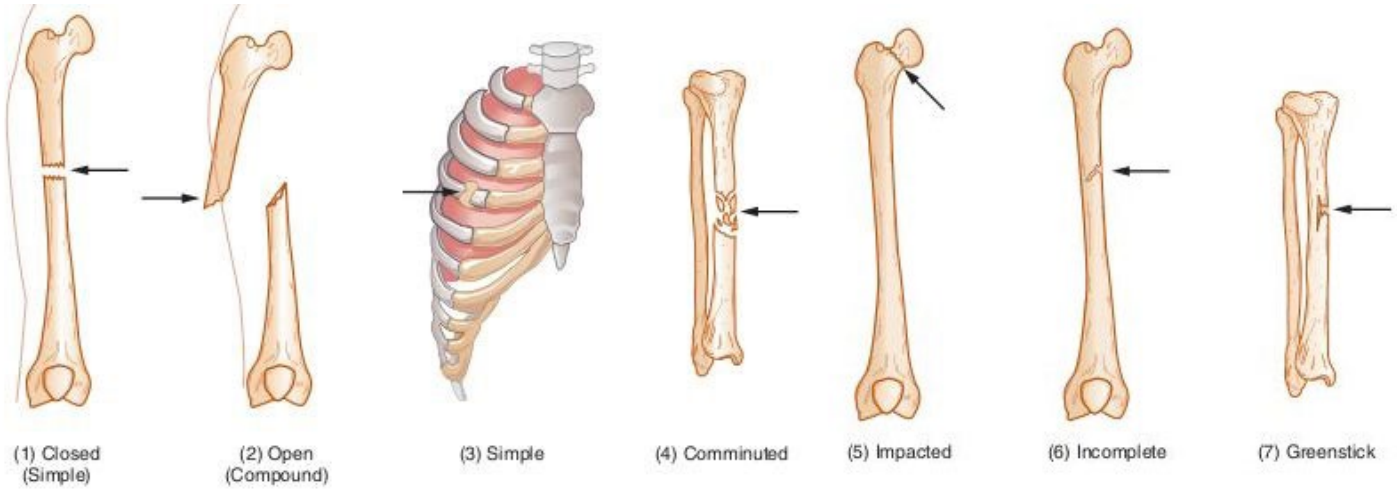


The four main functions of bones are to

- protect organs
- store minerals such as calcium and PO_4
- produce blood
- provide support and allow movement.

Hard (cortical) bone - on the end and sides aid strength. Storing and releasing calcium, and the site of growth for bone cells.
Spongy bone – is a mesh of bone filaments, providing more internal strength, while reducing weight. Stores nutrients needed for cell production. Provides flexibility and shock absorption to the skeletal system.
Marrow – helps produce blood cells, at about the rate of 2 million per second. Also breaks down old red blood cells
Blood vessels – spread to each cell to supply with oxygen and remove waste products

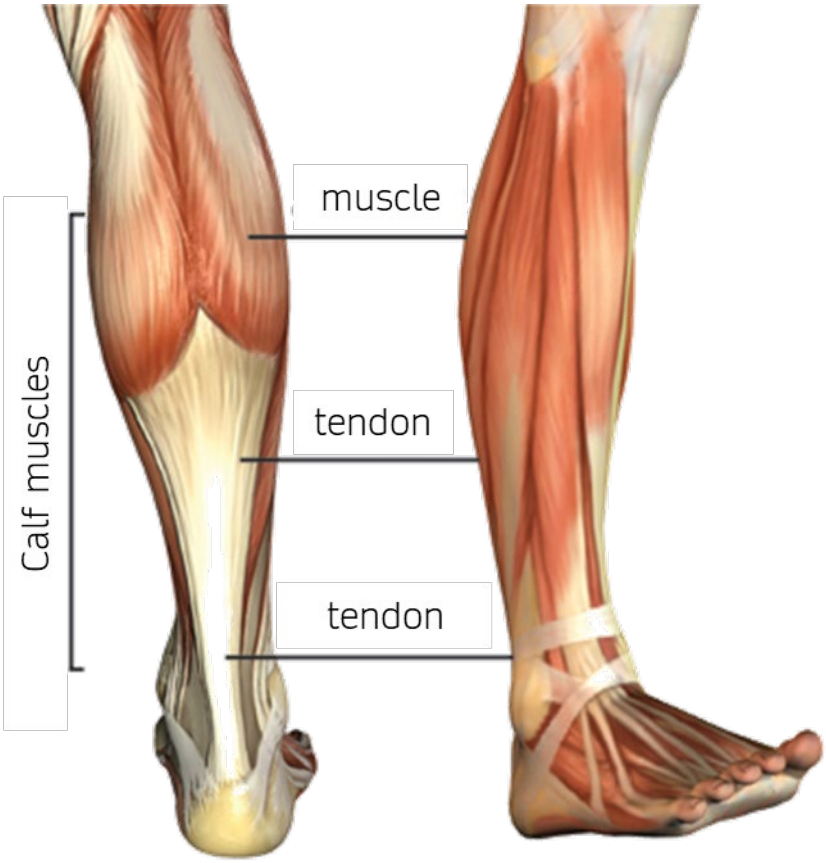
Fractured Bones



Bones are very strong and designed to handle a fair amount of impact and weight. Occasionally when the force is sudden and strong such as in a car accident or falling the bones will fracture.

The type of fracture depends on how much damage is done, whether there is a crack (greenstick) or the bone is broken all the way through, as well as if it remains inside the body (closed)or breaks through the skin (open)

How muscles help our bones move

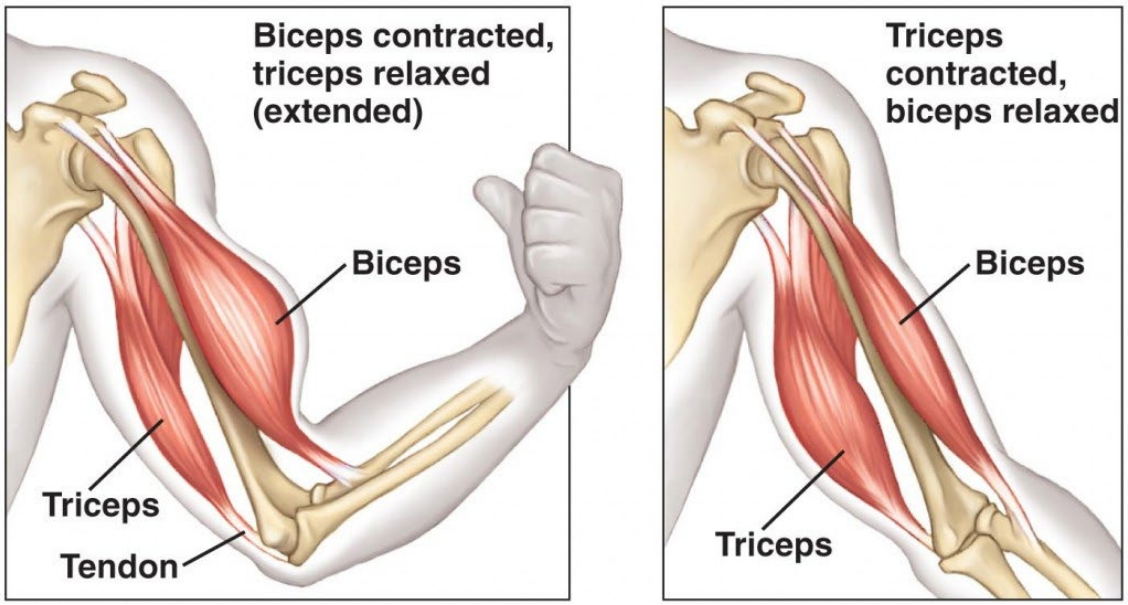


Bones in the body create a rigid frame that the muscles can pull against to provide movement. The thigh muscles attach across the knee joint etc.

The muscles are attached to the bones by **tendons**. Bones are held together with **ligaments**. When the muscles contract, they shorten and move the bones at the **joints**.

All the bones in the skeleton require muscles in order to move them. The muscles are attached by the nervous system to the brain which controls their movement – either voluntary or automatically when required.

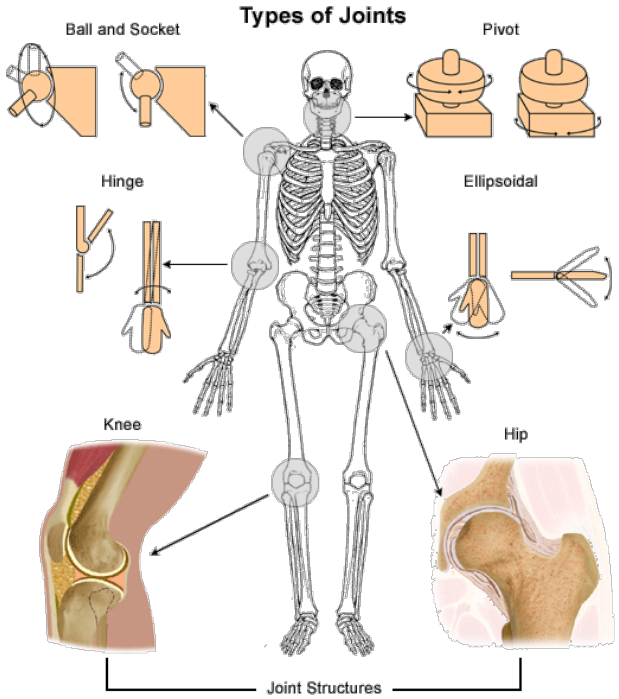
The structure of the skeleton and muscles of the human arm



Whenever a set of bones needs to move in both directions then a pair of muscles are required. In the arm the pair of muscles are the biceps muscle and the triceps muscle.

The antagonistic muscles and bones act together to flex or extend the arm. Muscles can contract, but are not designed to actively lengthen, so they are arranged as opposing antagonistic pairs. As one muscle shortens, another is stretched and vice versa. The contacting muscles move the bones they are attached to.

A joint occurs where two bones meet.



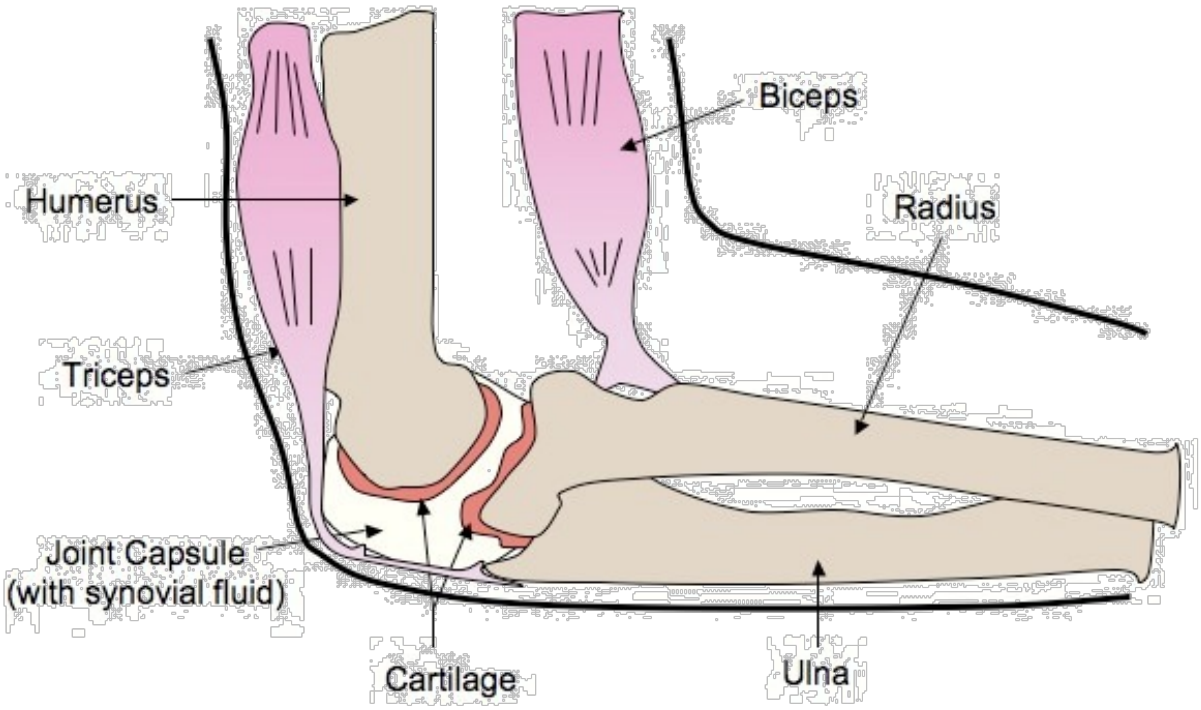
Movement of the skeleton occurs at the joints where two or more bones meet. There are different categories of joints. Freely movable, or synovial, joints allow a range of movement determined by the structure of the joint. Examples of movable joints are the **ball and socket** (shoulder), **hinge** (elbow), **pivot** (between the skull and neck) and **ellipsoidal** joint (hand and arm). **Ligaments** are inelastic connective tissues which hold bones together in a joint.

The two other groups of joints include the non-movable **Fibrous joints** and the moveable **Cartilaginous joints**.

Fibrous joints are fixed in which no movement between the bones is possible. These joints do not allow movement because the bones are held firmly together by bundles of strong collagen fibres. Fibrous joints include the sutures of the skull bones and the peg and socket joints of the teeth in the jaw bone.

Cartilaginous joints allow only slight movement. Often a pad of cartilage unites the two bones. An example of this is the joints between vertebral bones in the spine with cartilage discs between.

The synovial joint



Cartilage is a tough, rubbery surface that allows movement between bones, replaced by wear, it lubricates the joint under pressure. The joint capsule is filled with a fluid to assist free movement of the joint. Ligaments hold the bones together and tendons hold the muscles to the bone.

Other types of joint

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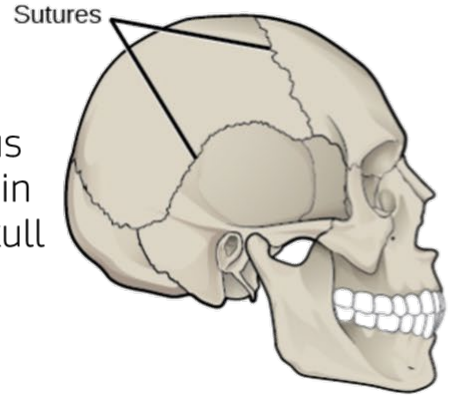
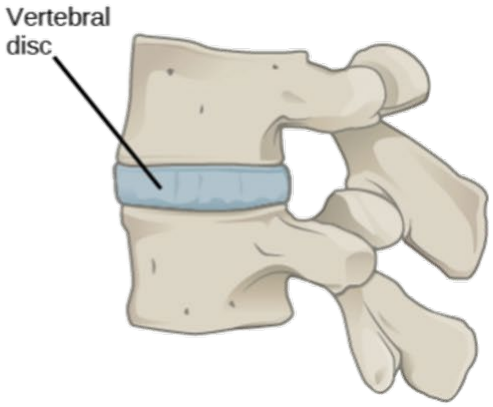
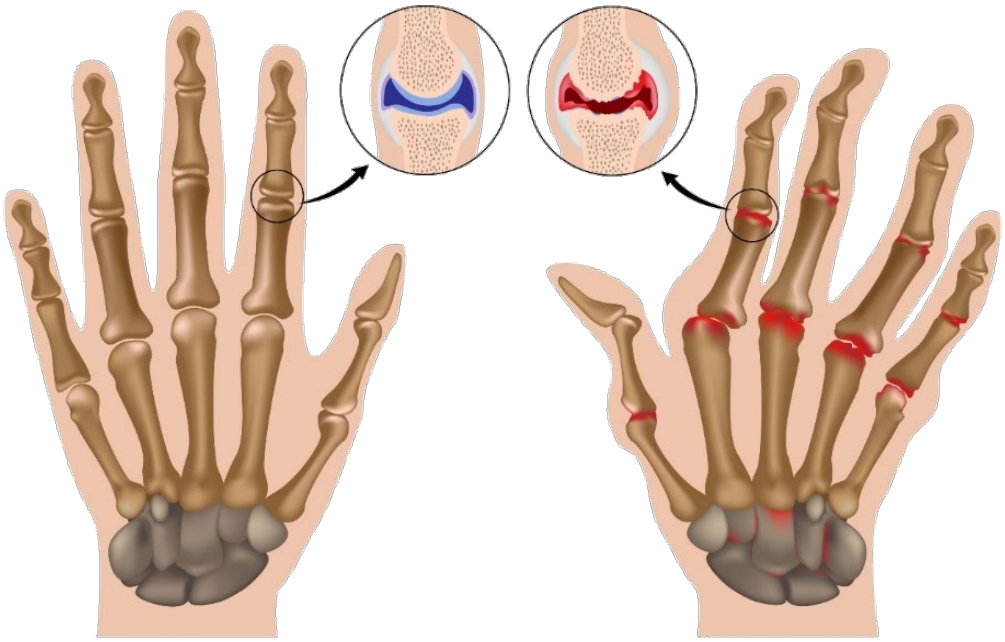
Fibrous joints in the skull





Cartilaginous joints in the vertebra

Rheumatoid Arthritis – A case study



Normal

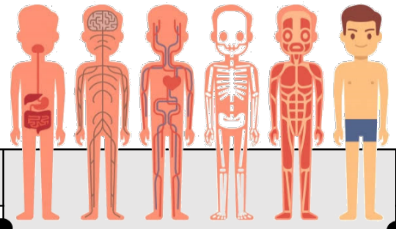
Rheumatoid Arthritis

Arthritis is inflammation of the joints (the points where bones meet) in one or more areas of the body.
There are many different types of arthritis including Rheumatoid arthritis.

Rheumatoid arthritis is a disease of the immune system, which normally protects us from infection by attacking viruses and bacteria. RA causes the immune system to mistakenly attack healthy cells such as the thin membrane that lines the joints. This causes fluid to build up in the joints, causing pain and inflammation. Over time this can wear away the cartilage and erode bone, causing a lack of function and mobility

1. Place the following terms, relating to the organisation of the human body, **in order,** from smallest to largest, then match the terms to their definitions by drawing a line.

tissues	organs	body	organelles	organ systems	cells

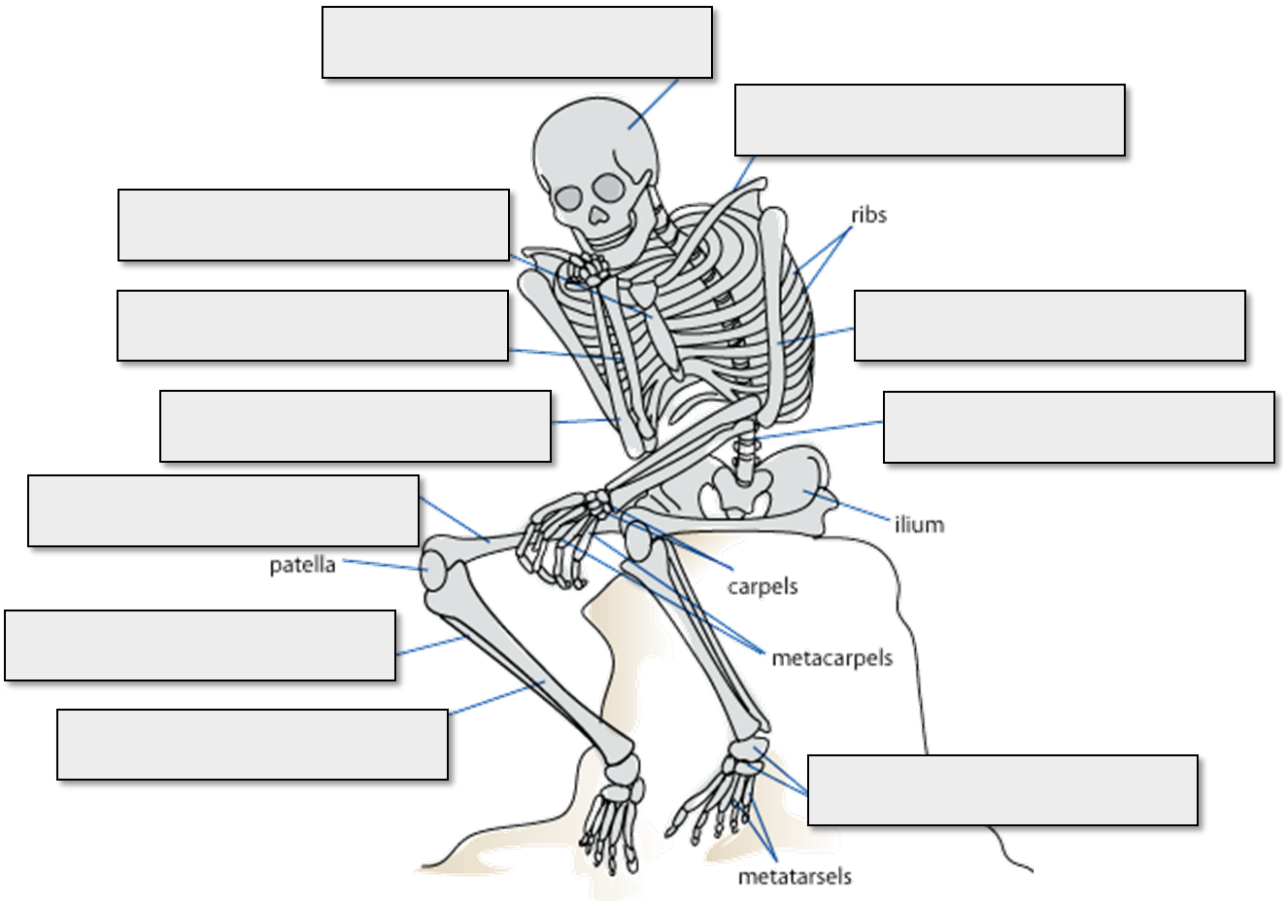


smallest

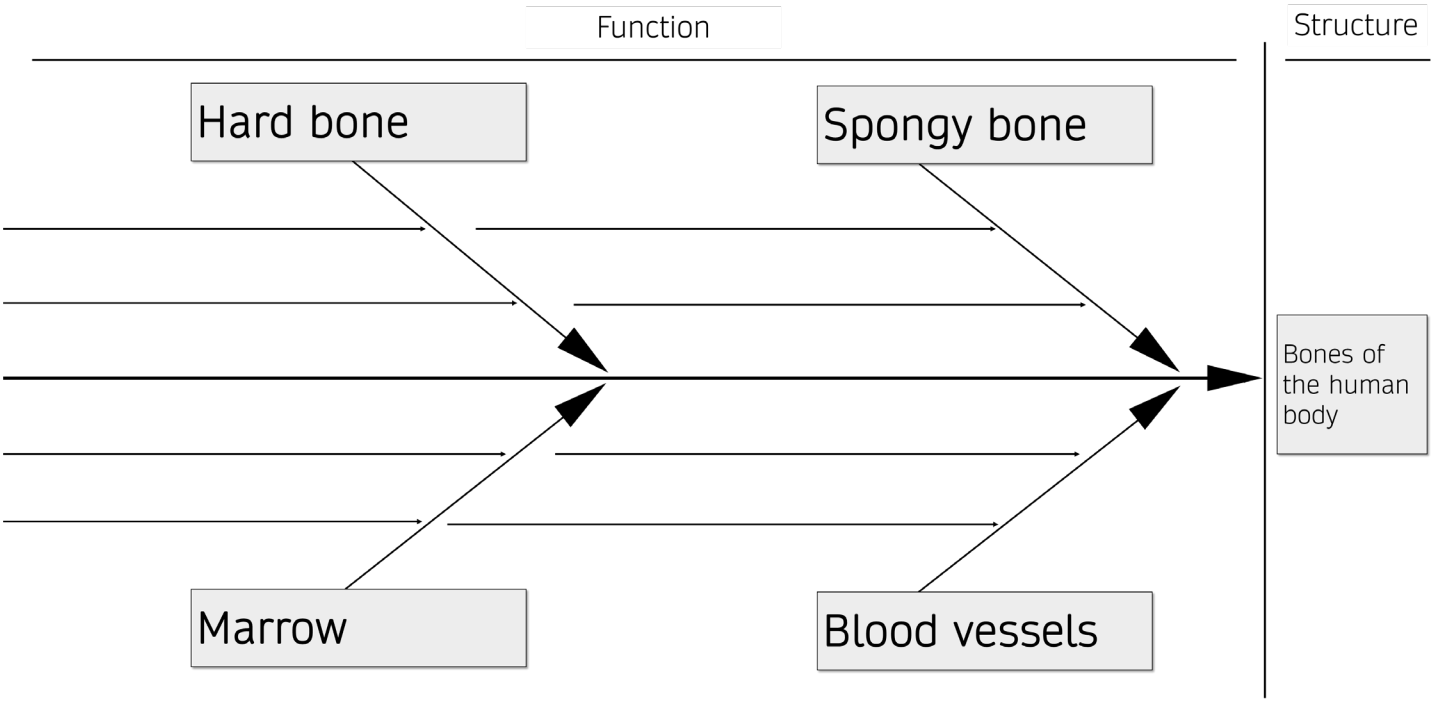
Term	Definition
	Co-ordinating groups of structures that work together to carry out a life function
	The individual 'parts' of a body that have their own specific function
	The specialised components within a larger living unit
	These share a similar structure and function
	The complete organism that carries out all life functions together
	The 'building blocks' of the body, and the smallest living unit

2. Sort the correct terms for the **missing labels** on the human skeleton.

tarsels	radius	tibia	skull	ulna	vertebra	femur	clavicle	fibula	humerus	sternum

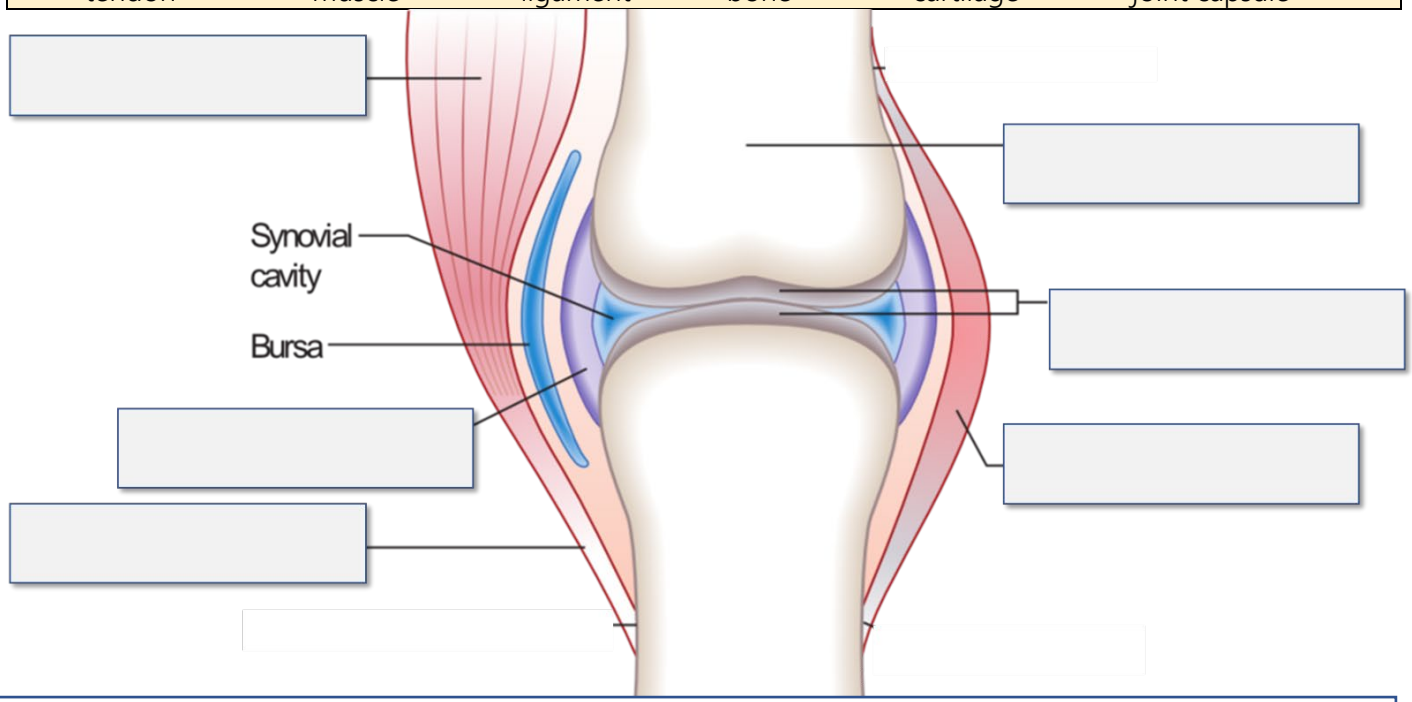


3. Summarise the function of the components found within a human bone.



4. Many components work together to allow free movement between bones in a synovial joint. Label these components in the diagram below.

tendon | muscle | ligament | bone | cartilage | joint capsule



5. Explain how the **muscle, tendon and ligament** work together to allow the joint to move