37 - The Skeleton and Muscles

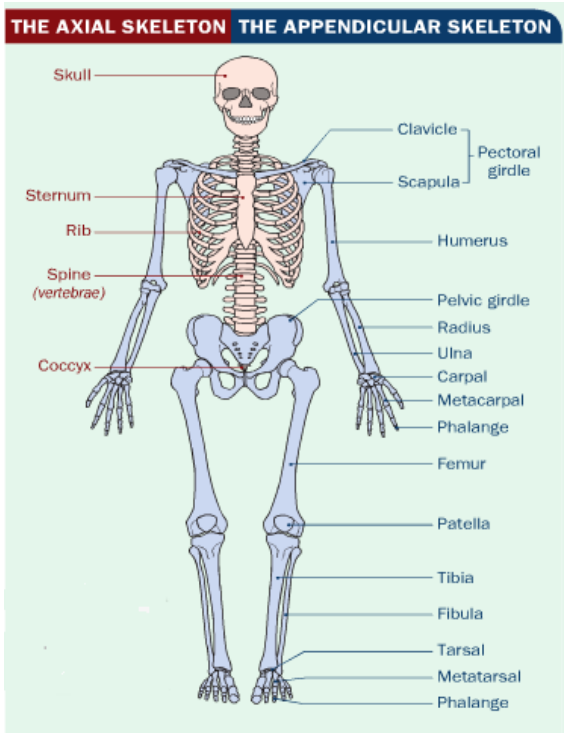
The skeleton and muscles form the **musculoskeletal** system.
This system is controlled by the nervous system.
Muscle can be skeletal, cardiac or smooth.

Functions of the skeleton

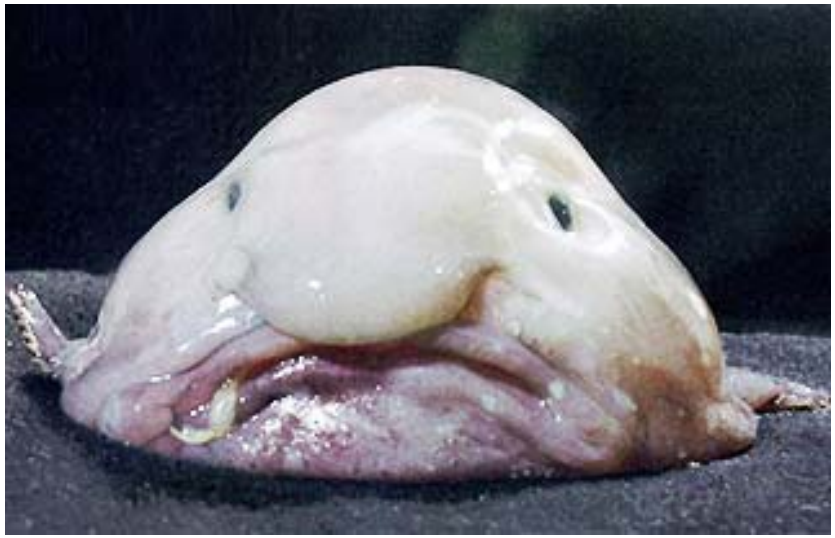
Support - a rigid frame,
Protection - protect the organs,
Movement - Levers for muscles,
Shape - height, etc.
Making blood - red, white and platelets.

Structure of the skeleton

The skeleton is divided into 2 main parts,
1. Axial skeleton
2. Appendicular skeleton

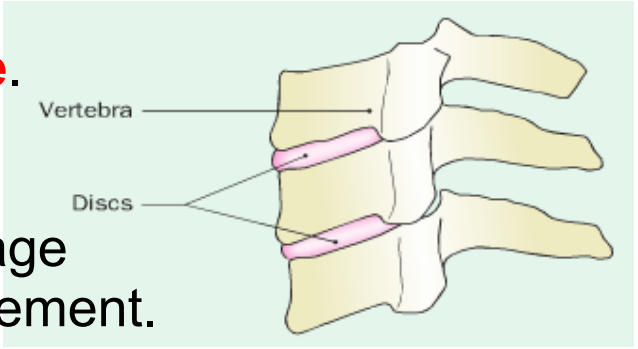


If you didn't have a skeleton you would just be a blob.

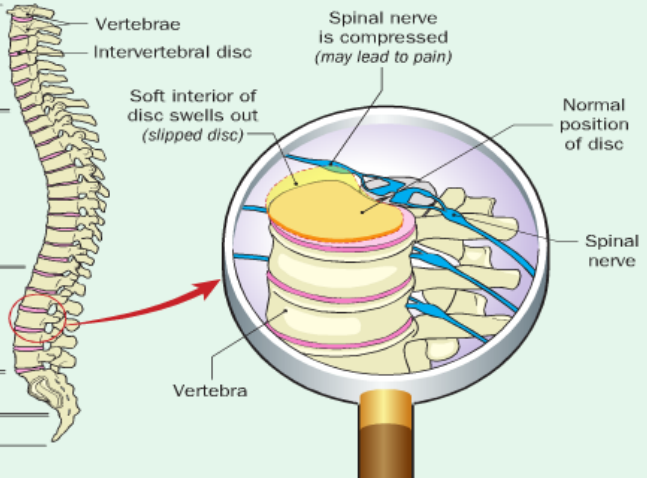


Axial skeleton

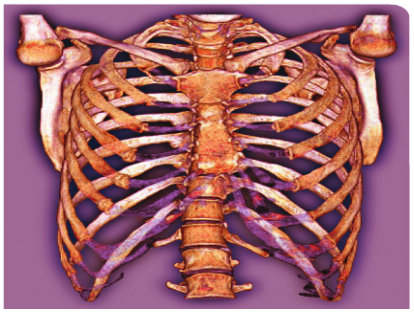
This consists of the **skull, spine and ribcage**.
The skull is made of 20 fused bones and the spine has 33 vertebrae.
Many of these vertebrae have a disc of cartilage between them to absorb shock and help movement.



Number of vertebrae	Region
7	Cervical *(neck)*
12	Thoracic *(chest)*
5	Lumbar *(back)*
5	Sacrum *(hip)*
4	Coccyx *(tail)*



We have 12 ribs.
7 are true ribs,
3 are false and
2 are floating.



Appendicular skeleton

Pectoral girdle

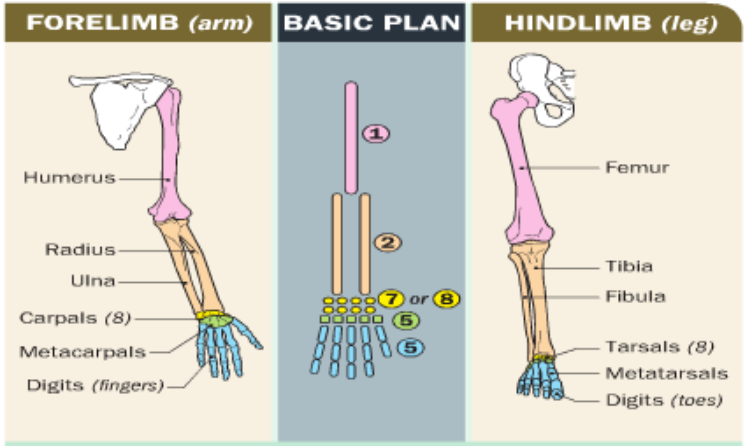
The pectoral girdle is made up of collar bone and shoulder blade and connects with the spine and with the arms.

Pelvic girdle

The pelvic girdle is made of 2 halves joined by flexible cartilage.
It is fused to the spine.

Limbs

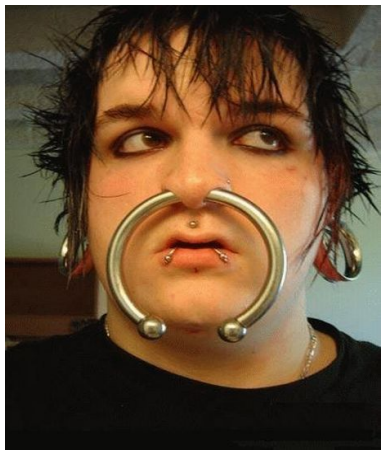
The limbs are pentadactyl - end with 5 pieces.
They take on the general shape of 1 main bone, 2 smaller bones and then lots of bones.



Which animal?

Cartilage

Made up of a firm flexible protein called **collagen**.
Cartilage has no blood vessels or nerves.
It is found in ear lobes (pinna) at the end of your nose, and in **discs** between your vertebrae.
Cartilage also covers the **ends of your bones** and acts as a shock absorber to avoid injuries.

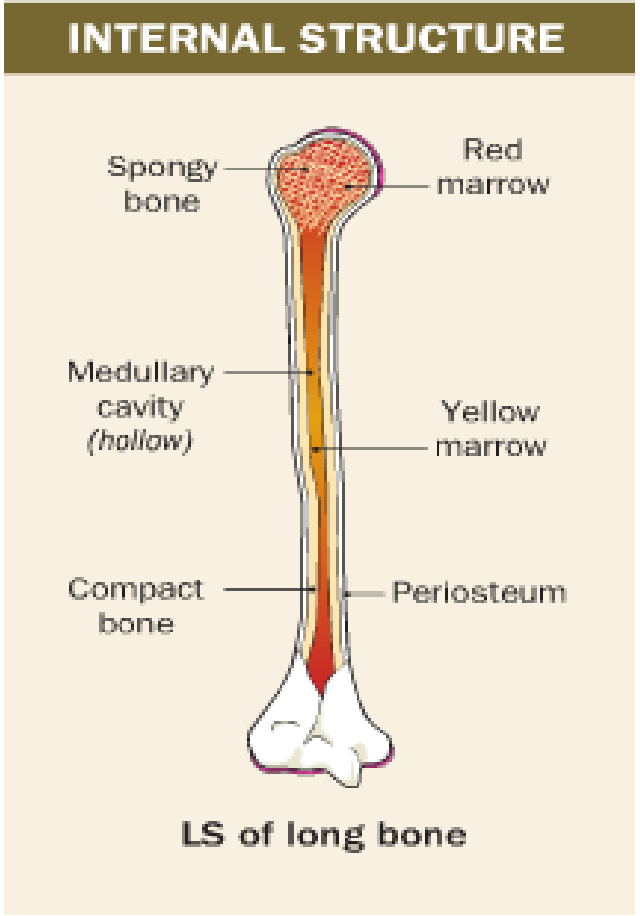


Bones

There are 3 main types of bones,
1. Compact 2. Spongy 3. Bone Marrow

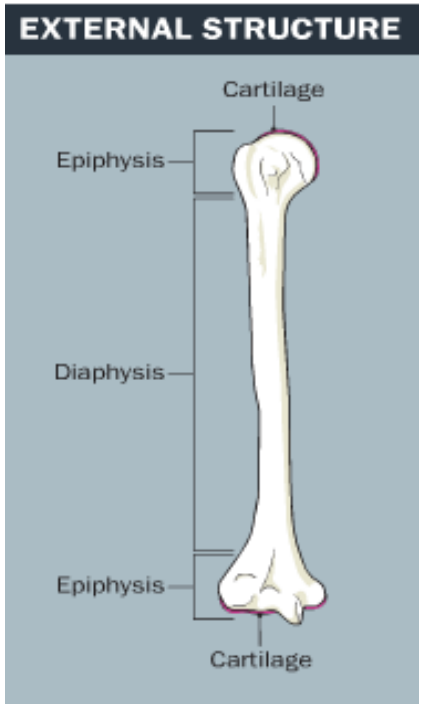
Compact bone
Is made of bone cells called **Osteoblasts**. These are stuck in a matrix (mix) of 70% **calcium phosphate** (strength) and 30% **collagen** protein (flexibility).

The bone also has blood vessels and nerves running through it.



Spongy bone

Is similar to compact bone but has many 'aero-like' bubbles. These **bubbles** are filled with red bone marrow and give **strength**. The spongy bone is mostly found at the ends **(epiphysis)** of the bones.

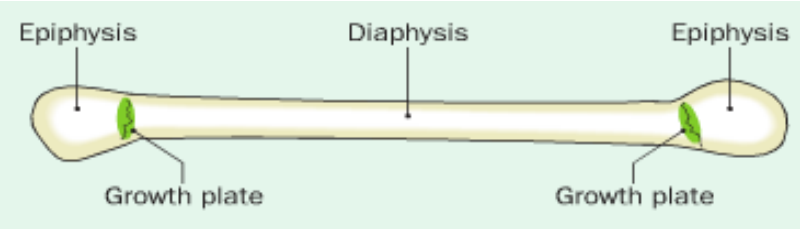


Bone Marrow

Is soft, fatty and found in the medullary cavity and spongy bone. When **active** it is **red** and makes blood cells. When **inactive** it stops and becomes **yellow**.

Bone Growth

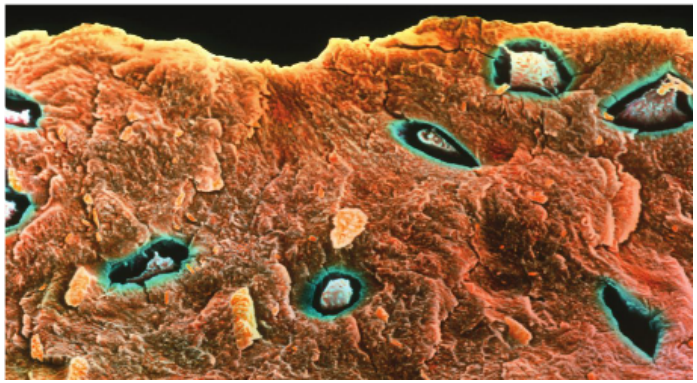
At 8 weeks in the womb the cartilage skeleton starts to become bone. Osteoblasts produce collagen. Calcium phosphate forms around the collagen and the **osteoblasts** become trapped and dormant.



A growth plate allows a bone to grow longer. The growth plate is made of cartilage.
Cartilage is constantly produced and turned into bone (**ossified**). This stops when a person reaches adulthood and determines your height.

Bone Development

Bone is constantly replaced in the human body.
A bone is replaced every 7 years or so.
Bones are digested (by **osteoclasts**) on the inside and replaced (by **osteoblasts**) on the outside.
This stops the bones from getting too heavy.



Exercise strengthens bones and causes them to thicken.
Hormones also cause bones to be thickened or thinned.
Parathormone - takes Calcium out of the bones and into the blood for muscles and nerves.

Joints

A joint is where two or more bones meet.

Immovable Joints

Fused or fixed joint - e.g. in the skull

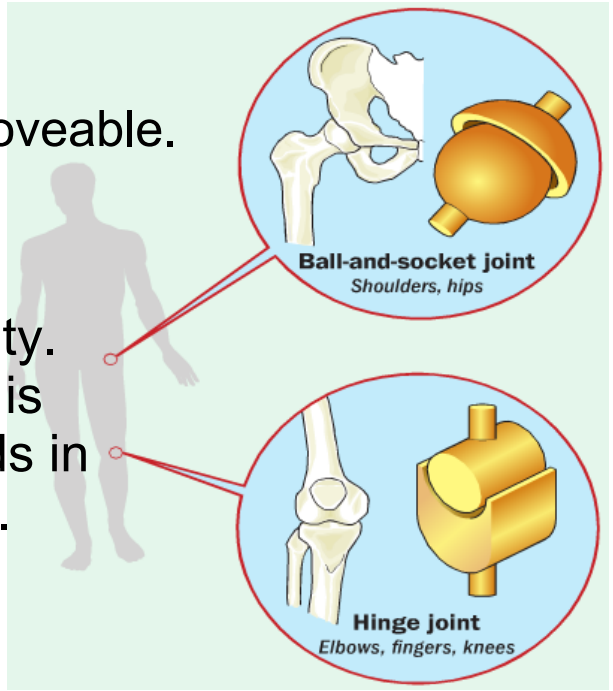
Slightly Moveable Joints

The joints between the **vertebrae** are slightly moveable.

Freely Moveable Joints

Also called **Synovial Joints**.
They are covered by cartilage and have a cavity.
The bones are held by ligaments and the joint is surrounded by a synovial **membrane** that holds in synovial **fluid**. This helps the joint move freely.

E.g. **Ball and Socket, Hinge joint**



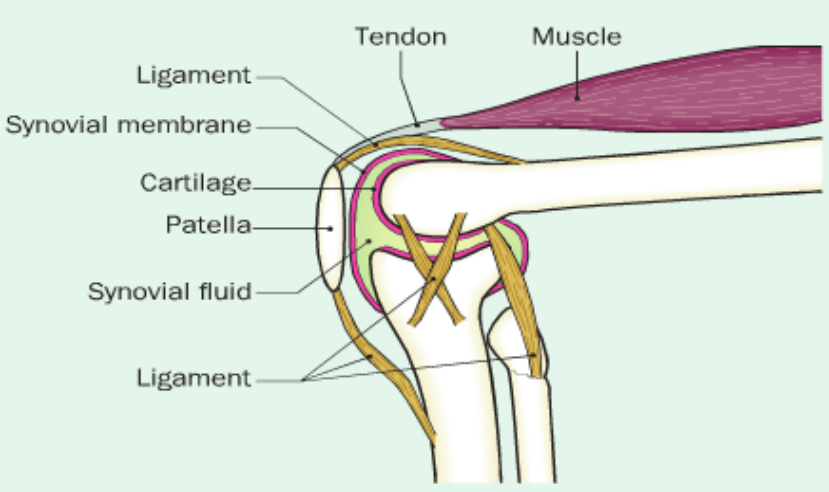
Ligaments and Tendons

Ligaments are strong, fibrous, slightly elastic tissues that connect bone to bone.

These must be warmed up and stretched before exercise.

Tendons are strong, flexible, inelastic fibres that connect muscle to bone.

These are made of collagen and have some blood vessels.



Arthritis

Osteoarthritis - from 50 years onwards.
Joints swell and cause pain due to wear and tear.
The cartilage wears down in synovial joints.
500,000 people have it in Ireland.

Rheumatoid Arthritis - is a genetic disorder.
The body attacks it's own joints and causes swelling which deforms the bones and joints.
3% or Irish people have this and 75% are women.

Prevention

As osteoarthritis is caused by wear and tear on the cartilage in joints, it may be prevented by reducing damage to joints. This may involve using proper footwear when running, avoiding running on hard surfaces (especially roads) and perhaps exercising by walking or swimming instead of running.

Treatment

There is no cure for either form of arthritis. Treatments include rest, exercises to maintain mobility and strength, weight loss, anti-inflammatory medications, steroids, drugs to reduce the immune response and possibly surgery to replace the joint.

Antagonistic Muscles

An **antagonistic pair** is two muscles that have opposite effects to each other.

When the **Biceps** contract the arm is raised and when the **Triceps** contract the arm is lowered.