

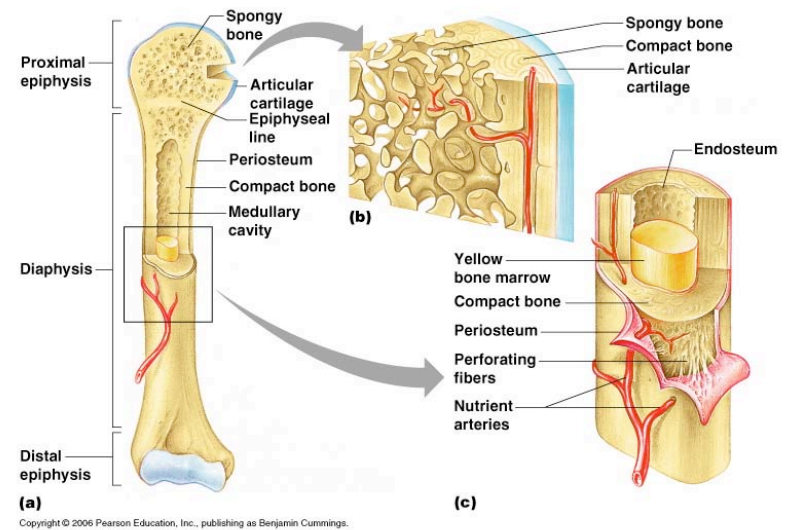
The skeletal system is made of many components

We have learned about the bones of the **axial** and **appendicular** skeletons, but the **skeletal system** includes **joints, cartilages and ligaments**

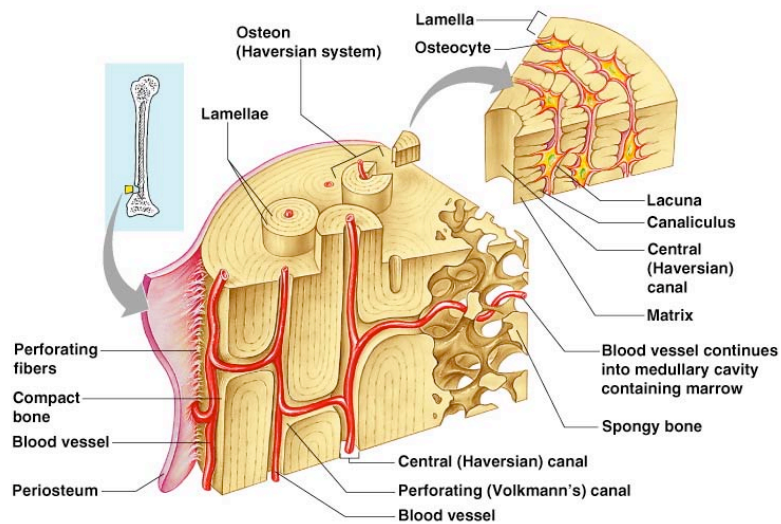
Our skeletal system serves many functions:

- Support
- Protection
- Movement (w/ help of skeletal muscles)
- Storage
- Blood cell formation

Long bone anatomy



Long bone anatomy



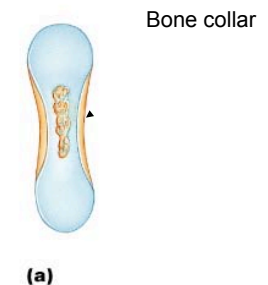
Bones form from a cartilage 'scaffolding'*

The embryonic skeleton is mostly cartilage, but has been replaced mostly by bone by the time we're born

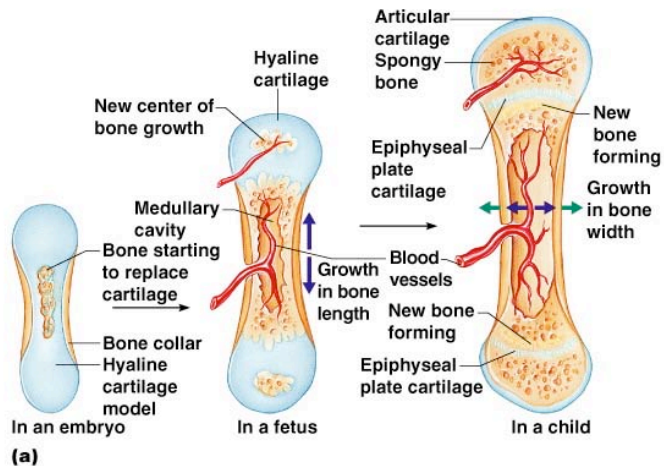
This process (= **ossification**) involves two major processes:

1. The hyaline cartilage cartilage model is covered with a bony matrix by **osteoblasts**

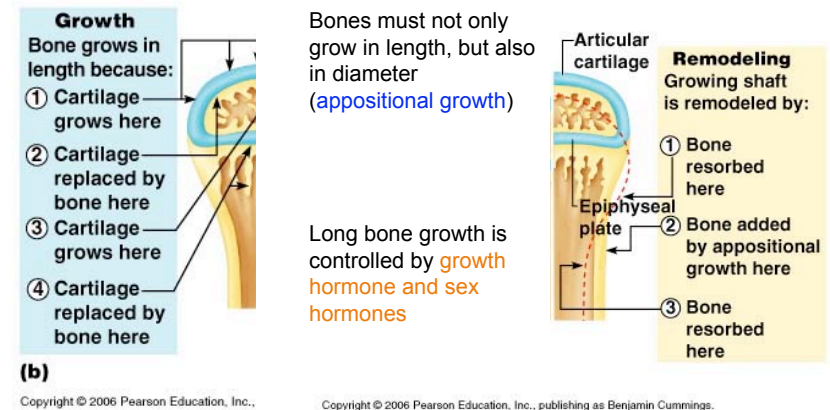
2. The enclosed cartilage model is digested away from the inside, *opening the medullary cavity*



Bone formation in young children



How does the epiphyseal plate work?



Bones are continuously remodeled

Two main factors dictate when bone is remodeled:

Blood **calcium** levels

Physical stress being put on the bone

When blood calcium levels drop, **parathyroid hormone** is released into the blood by the **parathyroid glands**. This stimulates **osteoclasts** to break down bone matrix, releasing calcium into the blood.

When calcium levels rise, calcium is deposited back into the bone matrix.

Bones are continuously remodeled

Two main factors dictate when bone is remodeled:

Blood **calcium** levels

Physical stress being put on the bone

As muscles pull on bone they stress it

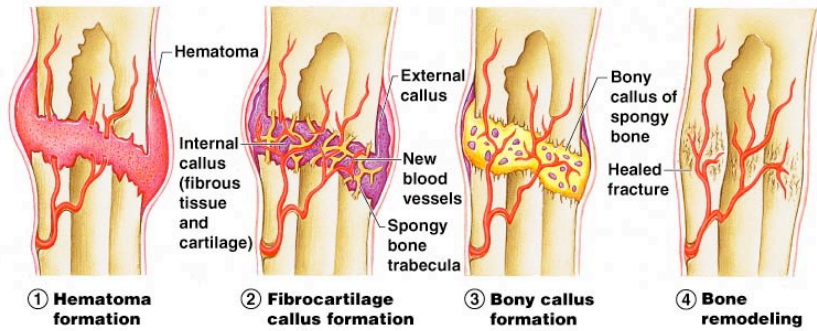
Because of this, more bone is added to the sites where it is stressed by osteoblasts (later osteocytes)

This is why we have large projections (which you have been learning in lab) on bones--to give muscles a large point of attachment!

PTH determines when bone is broken down; stress determines where it is broken down

Bone fractures heal relatively quickly

First, fractures undergo either *closed or open reduction*



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Joints have two functions: stability and mobility

Joints can be classified functionally.

What is a joints function? (hint: see above)

Joints can be:

- immovable (**synarthroses**)
- slightly movable (**amphiarthroses**)
- freely movable (**diarthroses**)

Diarthroses are found in the limbs, and **amphi-** and **synarthroses** tend to be found along the axial skeleton

Growing a new jaw bone in muscle

A 56-year-old German man who lost his lower jaw from cancer nine years ago can now enjoy a new life after surgeons grew a new jaw bone in his back muscle and transplanted it into his mouth.

Procedure

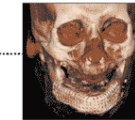
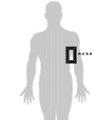


After tumor surgery, the patient's lower jaw was bridged with a titanium reconstruction plate.



Three-dimensional computer designs produced a virtual replacement and were used to create a titanium mesh cage filled with bone mineral blocks and a growth chemical.

The cage was then transplanted into his back and seven weeks later transplanted into the jaw.



In the news



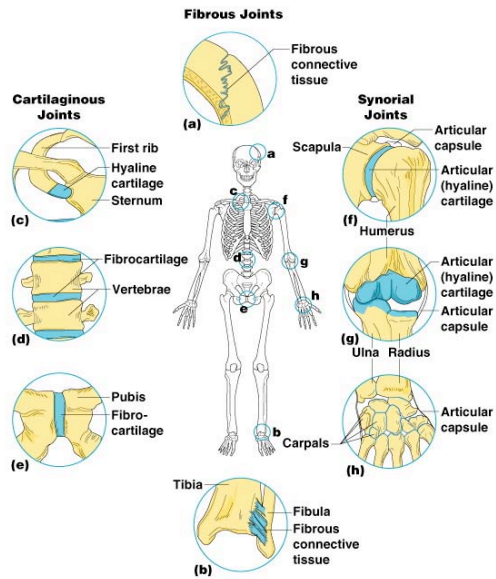
Joints have two functions: stability and mobility

Joints can be classified structurally as well:

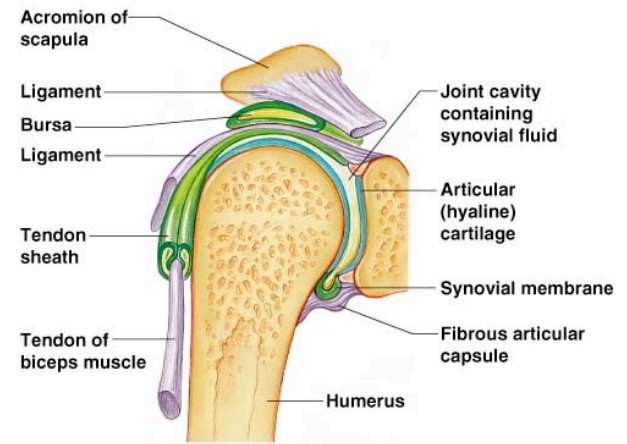
Fibrous joints are united by fibrous tissue (usually immovable, except for syndesmoses)

Cartilaginous joints

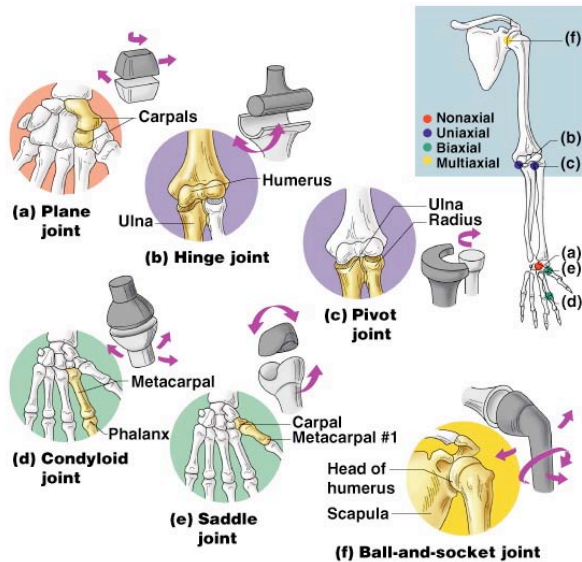
Synovial joints—all of the joints in the limbs



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Joint injuries

“Bursitis”: swelling or inflammation of the bursa or synovial membranes

Sprains: ligaments or tendons are damaged by excessive stretching, or can be completely torn away from the bone; very slow to heal because of low blood supply and can be very painful

Arthritis: describes over 100 types of very painful joint inflammation

Osteoarthritis

Common, and affects older people

Progressive softening, fraying and breakdown of articular cartilage

As new bone is exposed, *bone spurs* grow, causing popping and cracking of the joints (= *crepitus*)

Painful, but rarely crippling; aspirin, exercise and rest are usually enough to relieve the pain

Rheumatoid arthritis

Autoimmune inflammatory disease; usually symmetrical and mostly affects women

Begins with inflammation of synovial membranes; the fluid thickens (= *pannus*) and clings to existing cartilage

In extreme cases, this pannus ossifies and fuses the joint (= *ankylosis*)

Can be treated with many different drugs, exercise, ice packs, and possibly even joint replacement



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Gouty arthritis (= gout)

Uric acid is deposited as needle-shaped crystals in the soft tissues of joints

Tends to affect a single joint (usually the big toe) and is agonizingly painful

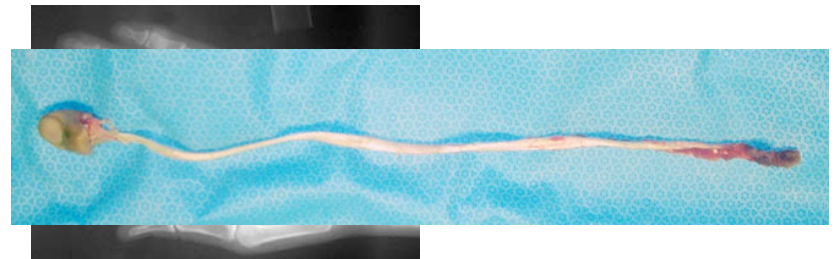
May be genetic

Can be treated with many drugs; if left untreated, can completely fuse the joint

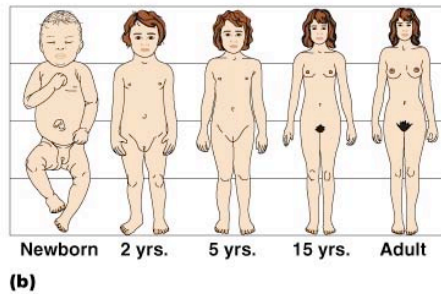
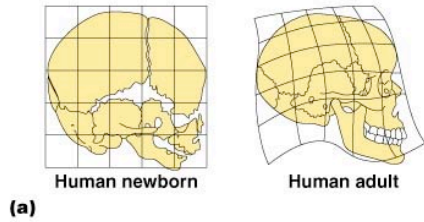
Other injuries

Trauma can cause joint/bone and connective tissue damage

Example: snowblower injury



Growth



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Bone health

Bones must be continually stressed and exercised in order to remain healthy

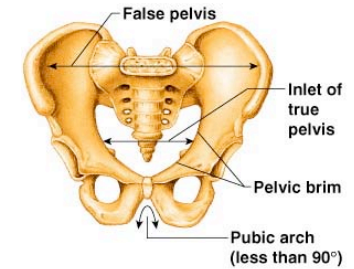
Osteoporosis is a bone-thinning disease caused by inactivity
 Causes bones to become brittle and break easily; often results in **vertebral collapse**

Estrogen and living a healthy life reduces your risk for osteoporosis

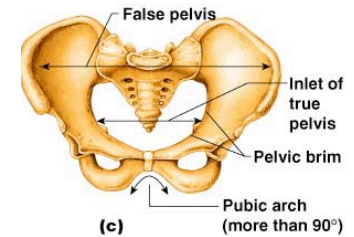
Gender differences



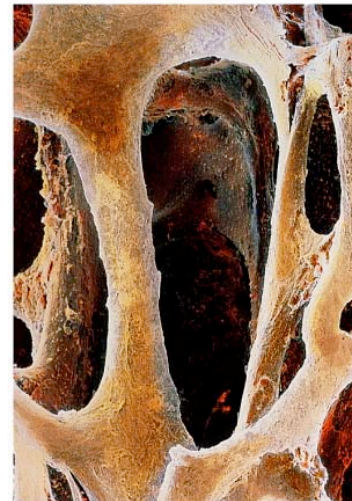
The male skeleton becomes more robust--preparing for a larger musculature



During puberty, the female pelvis flares out, preparing her to bear children.



Bone health



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