



Skeletal System



It's all about the bones!!!

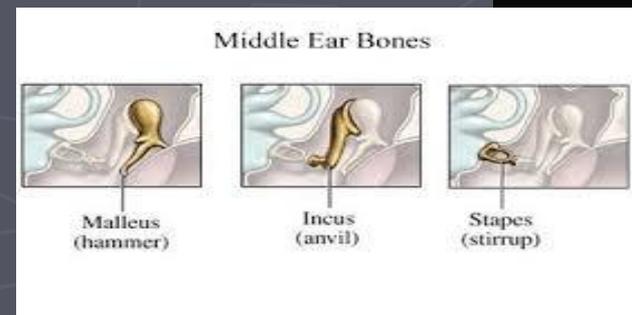


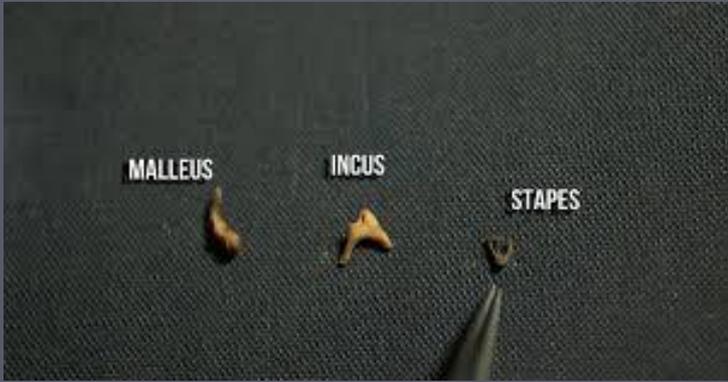
The Skeletal System in Action !!

- ▶ The Skeletal System in Action!
- ▶ <https://www.youtube.com/watch?v=ICwLlrQKVcg&list=PLZile25upgEBVRu0JnePPCABH0fhkTgTQ>

1. FYI 5 Cool Facts about the Skeletal System

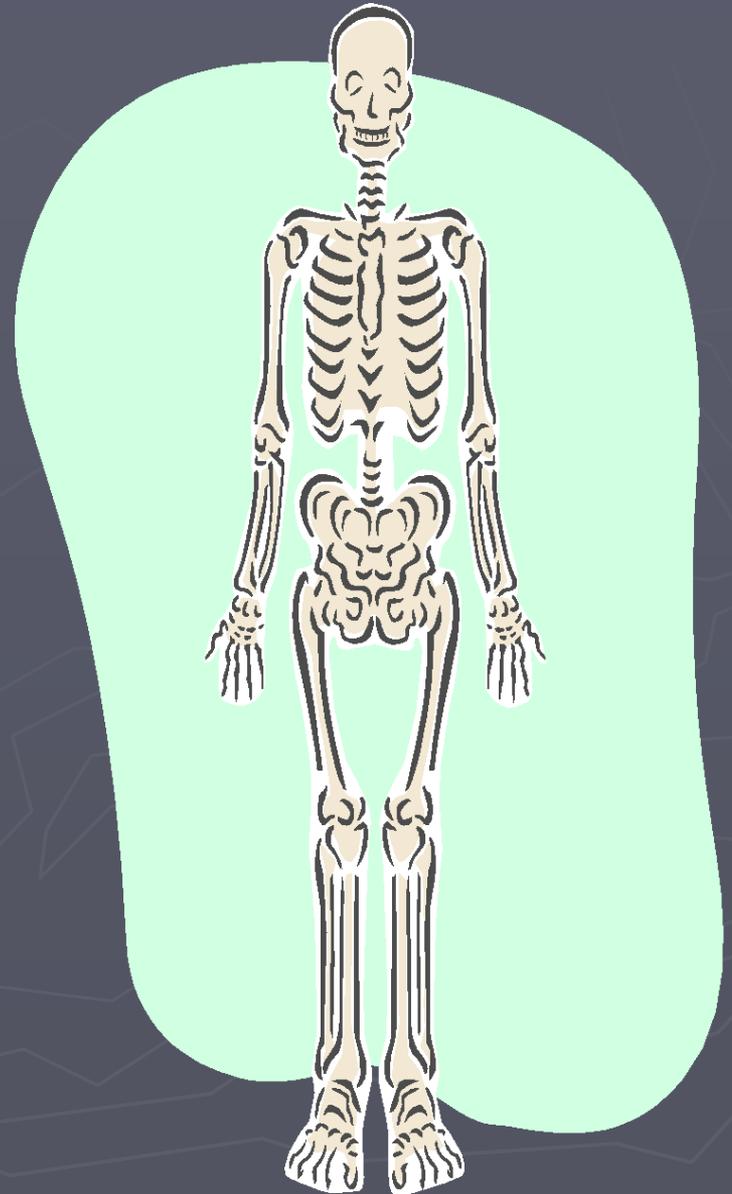
1. 20% of your body weight is bone
 - Do the math
 - (Your body weight) X .20= the weight of your bones
2. There are 30 bones in your skull
3. You have 206 bones
 - More than $\frac{1}{2}$ of these are in your hands and feet
4. Your largest bone is your femur and your smallest bone is in your Ear!





2. Functions of the Skeletal System

- Provides shape and support
- Enables you to move (works with muscles)
- Protects internal organs
- Produces blood cells
- Stores materials for future use
(HOMEOSTASIS ALERT!)

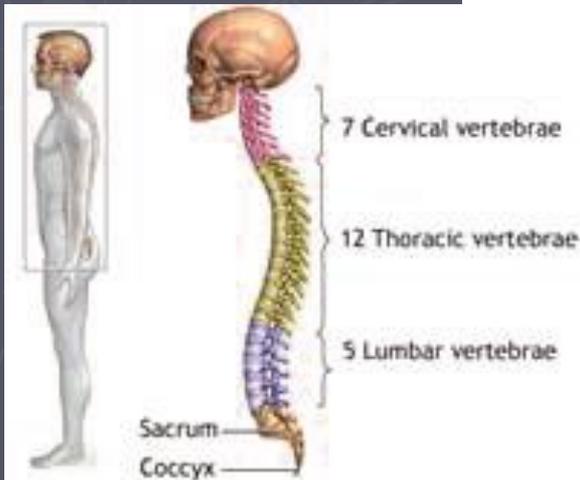


3. Shape and Support



Provides Shape and Support for Body

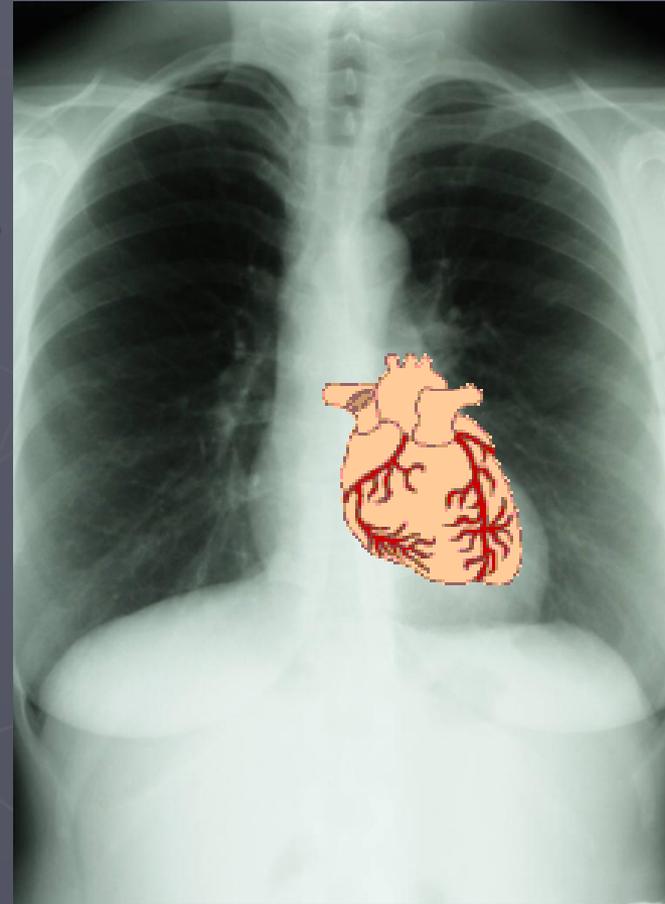
- Shape depends on the organ/organ system it needs to protect
- Example:
 - Skull thick and round to cover brain!
 - The backbone is the main support center for the upper body. **It holds your head up and protects your spinal cord.**



4. Protects Internal Organs

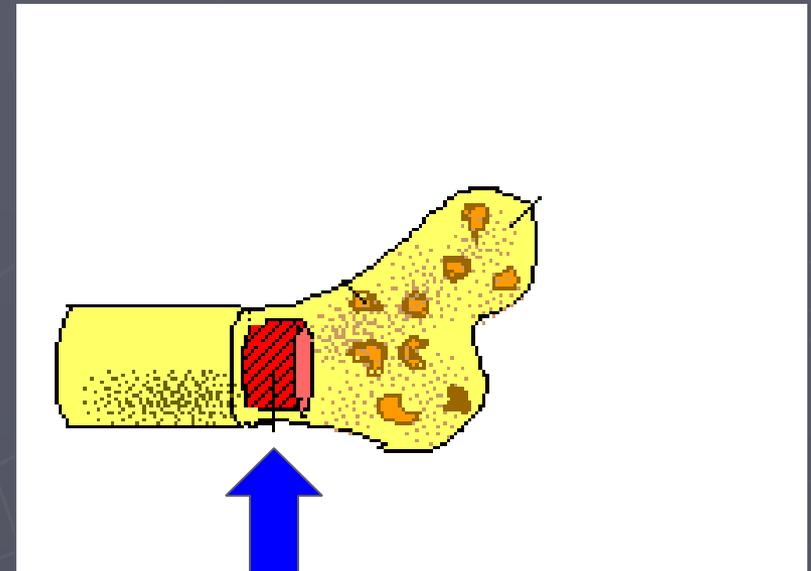
Protect your internal organs

- Organs can be easily squished
- Example:
 - Heart and breastbone
 - Lungs and rib cage
 - Spinal cord and spine



5. Produces Blood Cells

1. Produces substances our body needs
 - Blood cells (white and red) made in the marrow which is the center of the bone



Bone Marrow

6. Stores Materials for Future Use

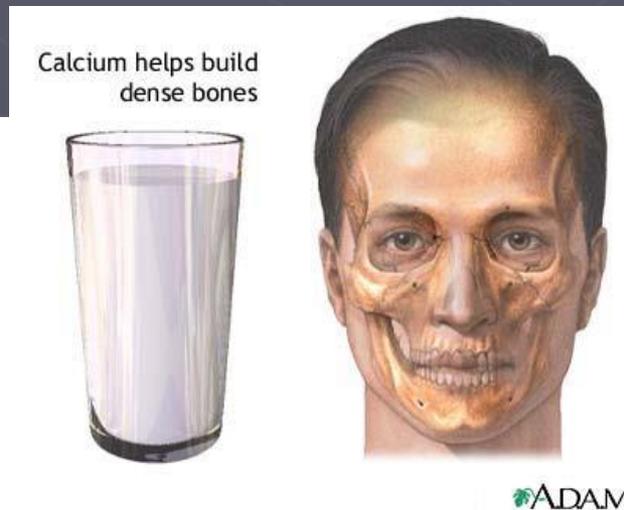
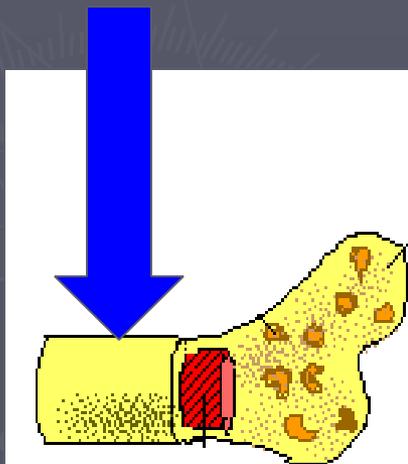
Compact bone -
where blood vessels
are and minerals
are stored

1. Stores substances
until your body
needs them

- Stores calcium and phosphorus

- **Homeostasis alert!**

- Bones release small amounts of Calcium and phosphorus into body when body is running low!

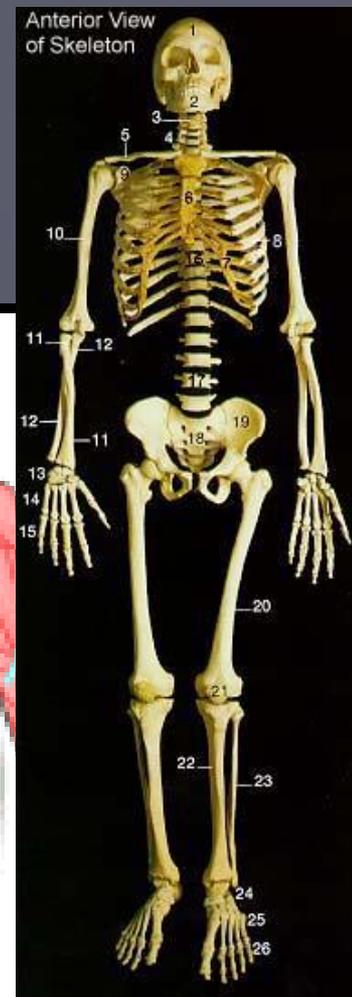


7. Enables you to move

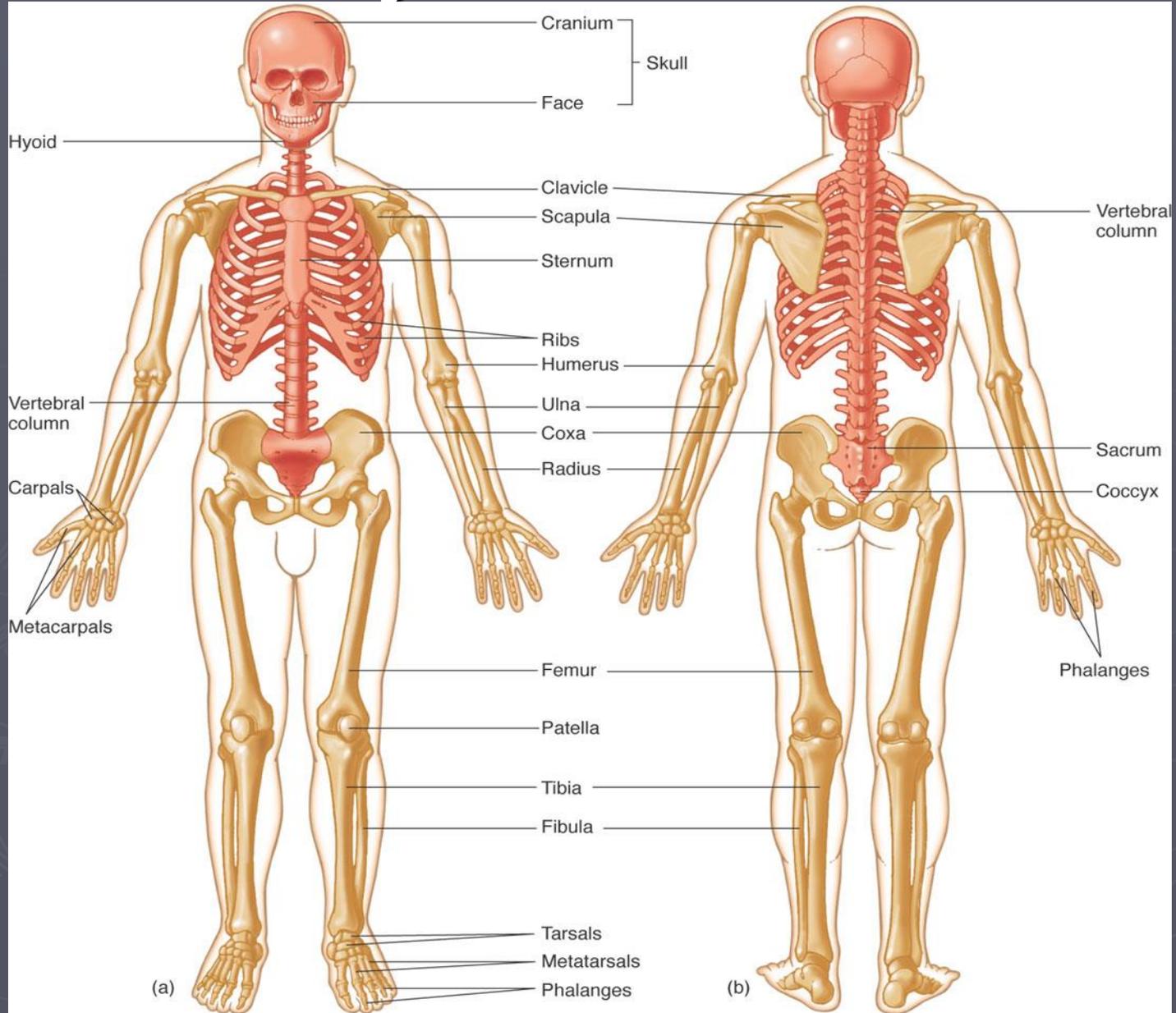
Muscles work with bones to make you move

Skeletal system provides points of attachment for muscles.

Your legs and arms move when the muscles pull on the bones.



The Skeletal System



Two Major Skeletal System Parts

- ▶ Axial Skeleton: The axial skeleton includes the skull, spine, ribs and sternum.
- ▶ Appendicular Skeleton: The appendicular skeleton includes the appendages of the body, which are the shoulders, arms, hips, and legs.



Classification of Bones

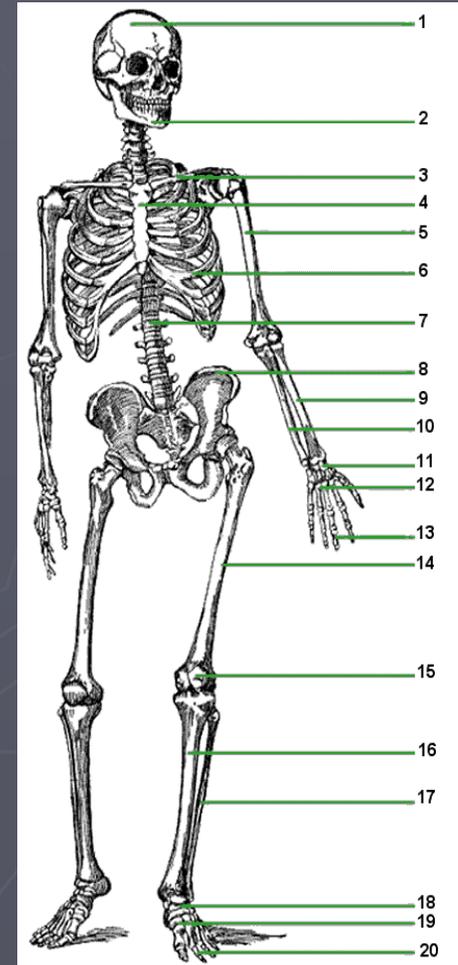
4 Basic Bone shapes

Long bones - located primarily in the arms and legs - **femur** (thigh bone) & **humerus** (upper arm bone)

Short bones - small bones are located in the wrists and ankles - **carpals** (wrist bones) & **tarsals** (ankle bones)

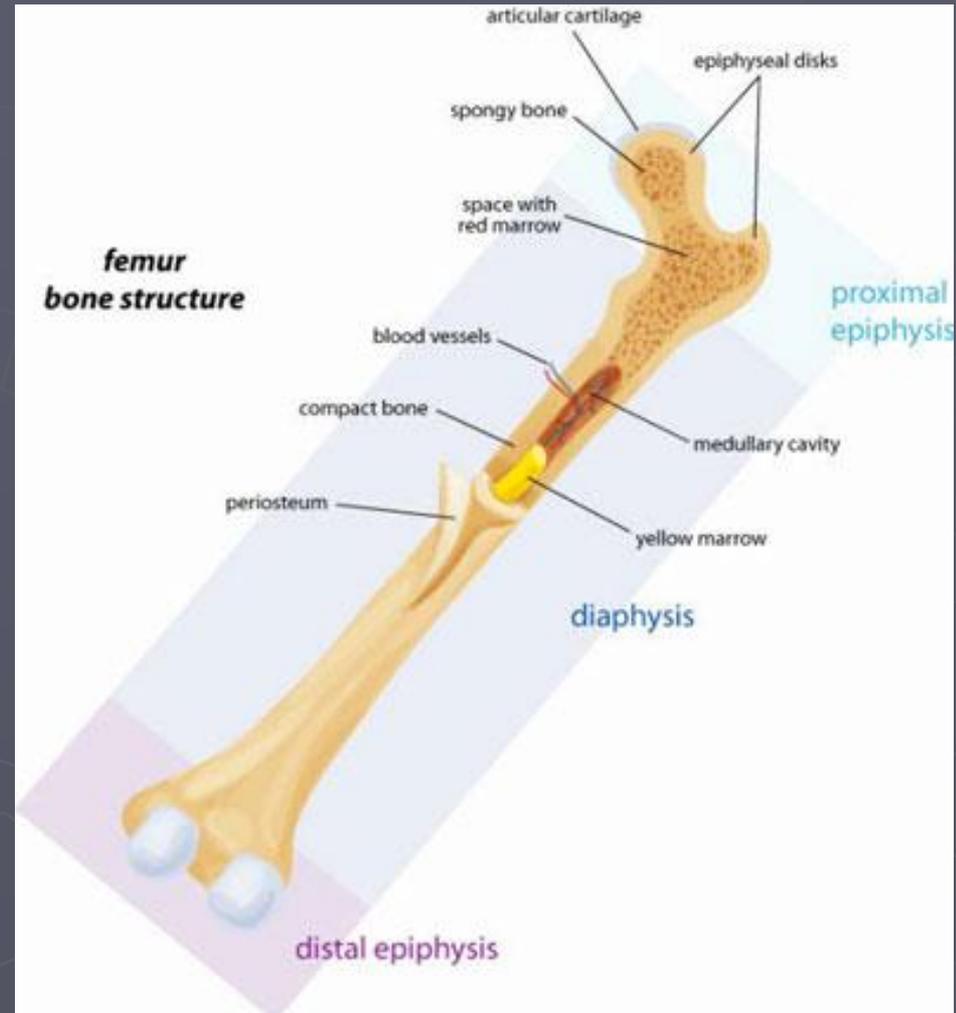
Flat bones - located in the skull and rib cage - **ribs** and **frontal bone**

Irregular bones - **vertebrae** and the bones of the **pelvic girdle**.



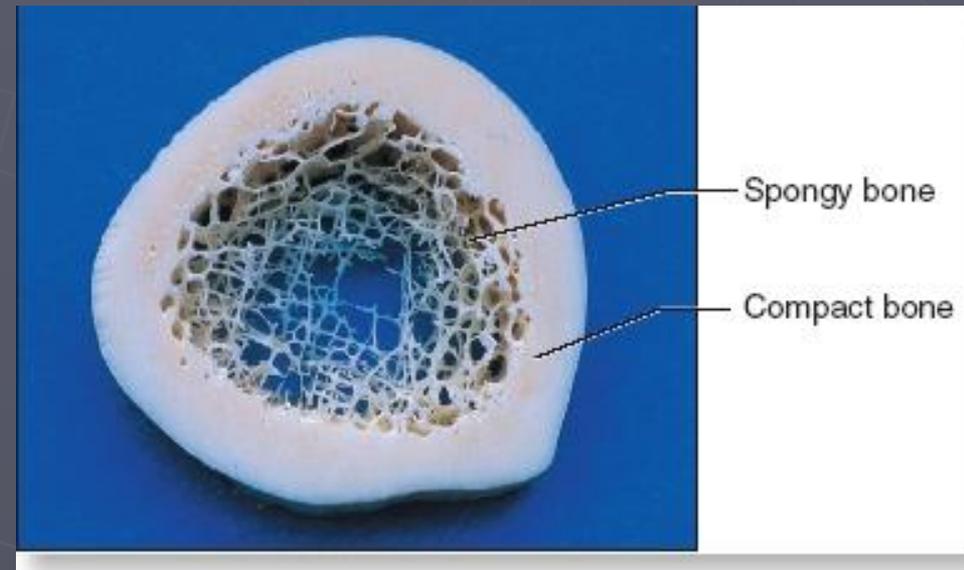
Bone Structure

- ▶ Typical Four Layers:
 - Periosteum: **Covers Bones**
 - Compact Bone: **Lies beneath the periosteum**
 - Spongy Bone: **Lies beneath the compact bone**
 - Bone Marrow: **Fills the gaps between the spongy bone**



Bone Structure

- ❑ Bones contain various kinds of tissues, including osseous tissue, blood vessels, and nerves.
- ❑ Osseous tissue can appear compact or spongy
- ❑ All bones are composed of both compact and spongy bone



Bone Structure (cont.)

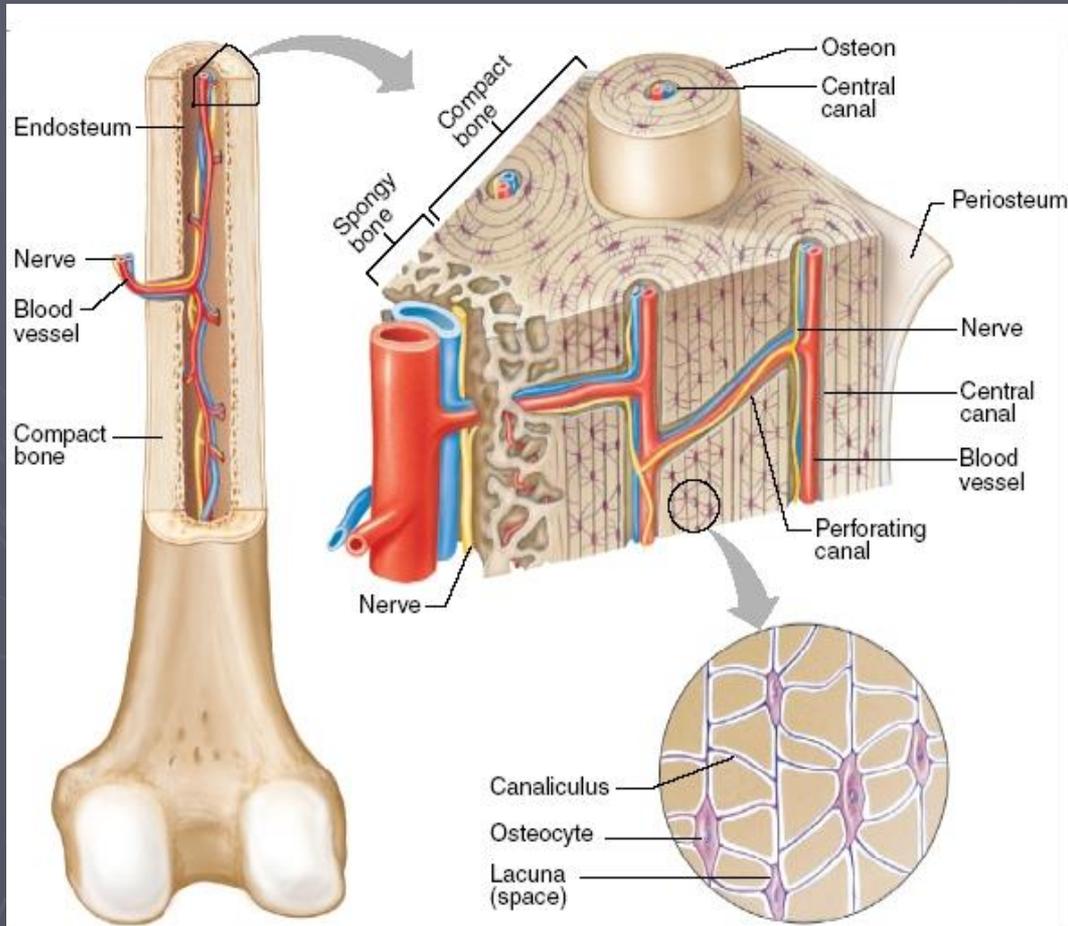


Figure 25-3. Compact bone at the microscopic level.

- ❑ **Compact bone looks solid; Compact bone is composed of many rod-shaped units called known as either osteons or Haversian systems. This type of bone tissue stores calcium, which gives the bone tissue its hardness.**

Bone Structure (cont.)

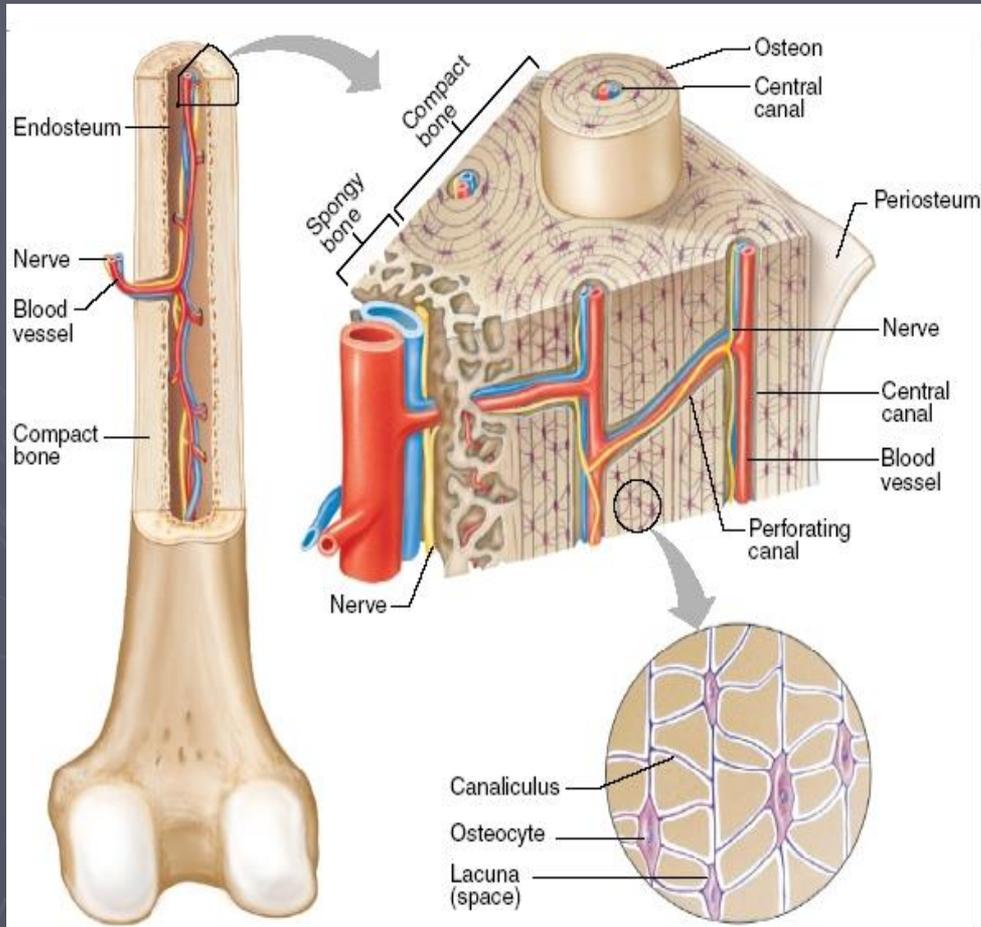


Figure 25-3. Compact bone at the microscopic level.

❑ Spongy bone is the porous inner bone tissue that lies underneath compact bone. This inner bone tissue is also known as cancellous bone. Spongy bone is composed of a network of thread-like thin bones called trabeculae. The arrangement of the trabeculae is affected by stress or trauma to the bone.

❑ The porosity of spongy bone allows it to develop and harbor bone marrow. This is also the more vulnerable bone tissue and the area that is affected by diseases such as osteoporosis. If spongy bone does not receive an adequate supply of calcium it weakens and breaks more easily.

Functions of Bones

- ❑ Shape to body parts
- ❑ Support and protect soft structures in the body
- ❑ Body movement since skeletal muscles attach to them
- ❑ Red bone marrow of bone produces new blood cells
- ❑ Store calcium for the body

Bone Growth

- ❑ **Ossification** – process of bone growth

Intramembranous ossification –

- ❑ bones begin as tough, fibrous membrane
- ❑ bone-forming cells called **osteoblasts** turn the membrane to bone (located in skull)

Endochondral ossification

- ❑ bones containing some cartilage between an epiphysis and the diaphysis will continue to grow
- ❑ cells that form holes in bone are called **osteoclasts**

Apply Your Knowledge

Why is it important for the bones to store calcium?

Every cell in the body needs calcium so the body must have a large supply readily available

Bones of the Cranium

- ▶ Some are thicker than others!!!



Bones of the Skull/face

Two types:

- ❑ **Cranial**-form the top, sides, and back of the skull
- ❑ **Facial bones**-form the face

“**Soft spots**” felt on an infant's skull are actually fontanelles.

- Tough membranes that connect the incompletely developed bones.



Bones of the Skull/Face (cont.)

Parietal - form most of the top and sides of the skull.

Occipital - forms the back of the skull

Temporal - form the lower sides of the skull

Frontal - the bone that forms the front part of the skull and the upper part of the eye sockets.

Sphenoid bone - part of the floor of the cranium

Ear ossicles are the smallest bones of the body

- Malleus
- Incus
- Stapes

Lacrimal - small bone forming the eye socket

Bones of the Skull/face

(cont.)



Mandible - the lower jaw bone

Maxillae - form the upper jawbone

Zygomatic - form the prominence of the cheeks

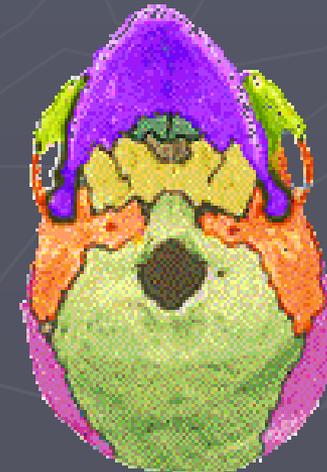
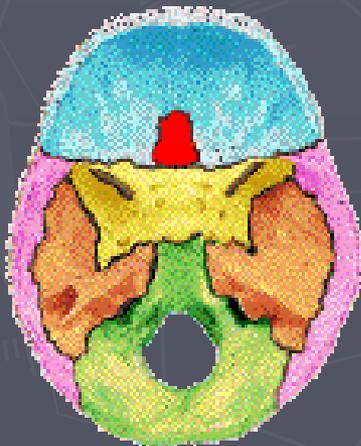
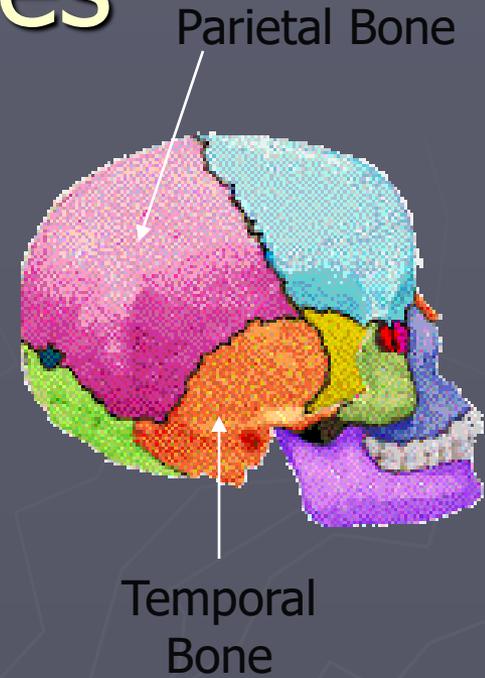
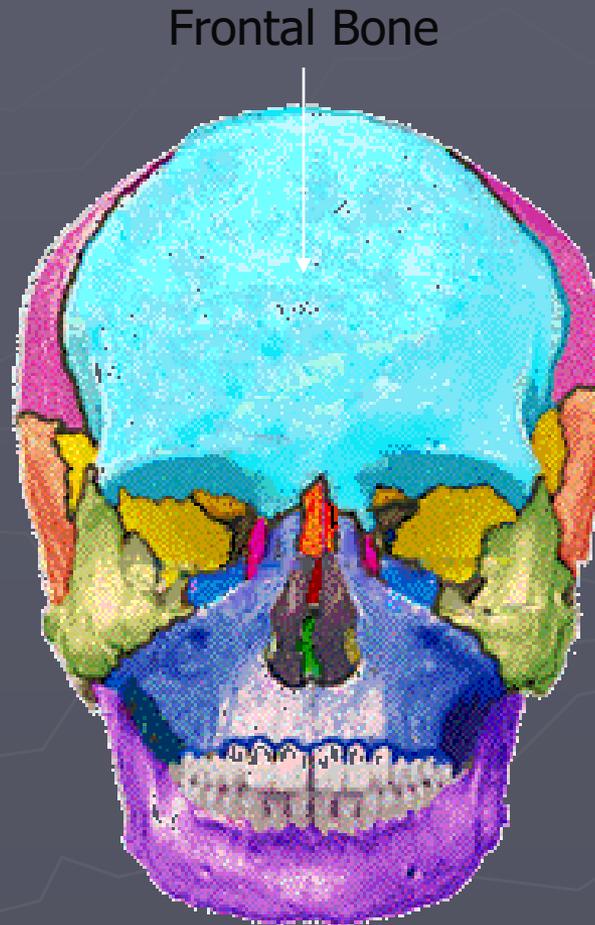
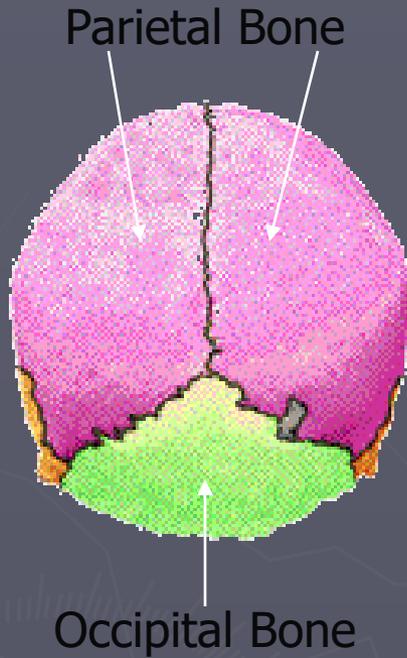
Nasal bones - fuse together to form the bridge of the nose

Palatine - form the anterior portion of the palate

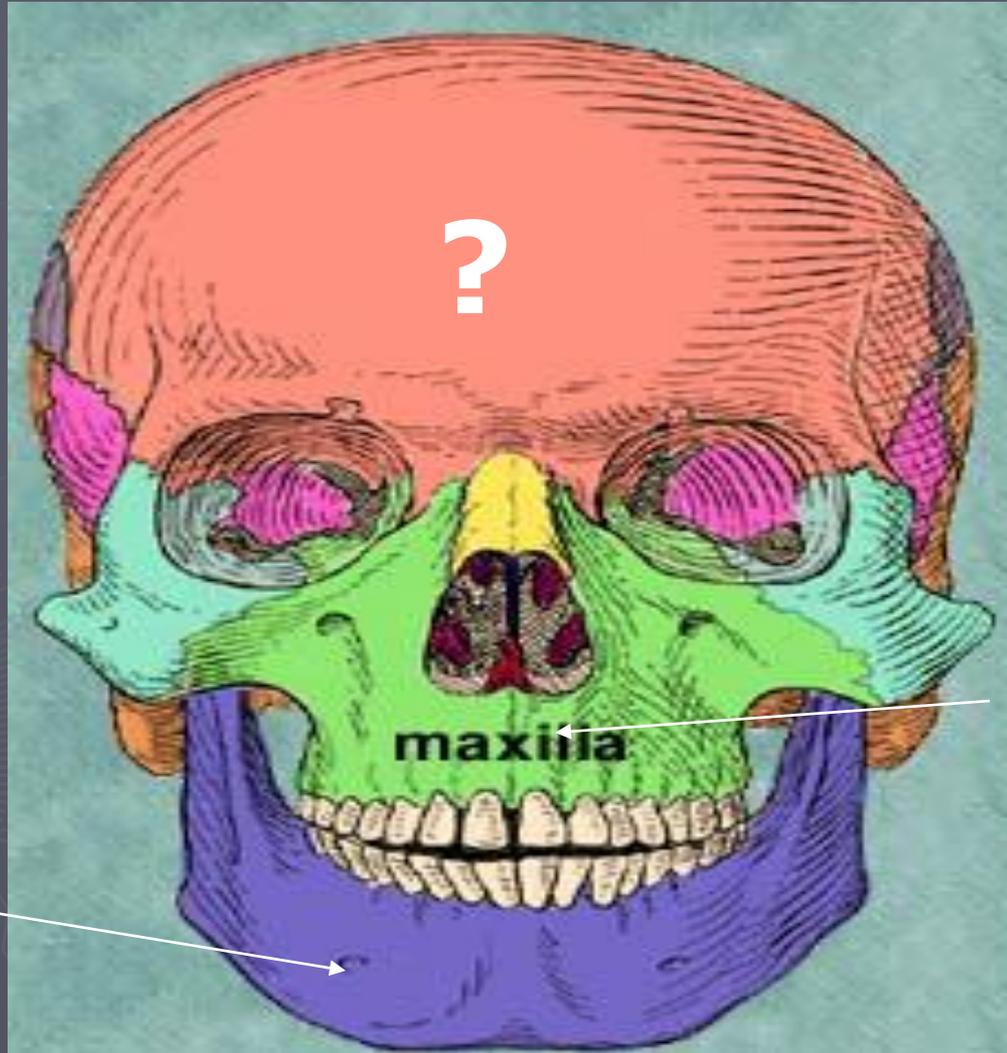
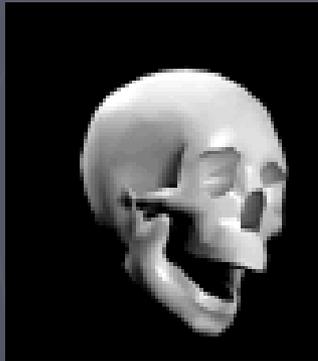
Vomer - a thin bone that divides the nasal cavity.

Ethmoid- a square bone at the root of the nose, forming part of the cranium, and having many perforations through which the olfactory nerves pass to the nose.

Cranium Bones



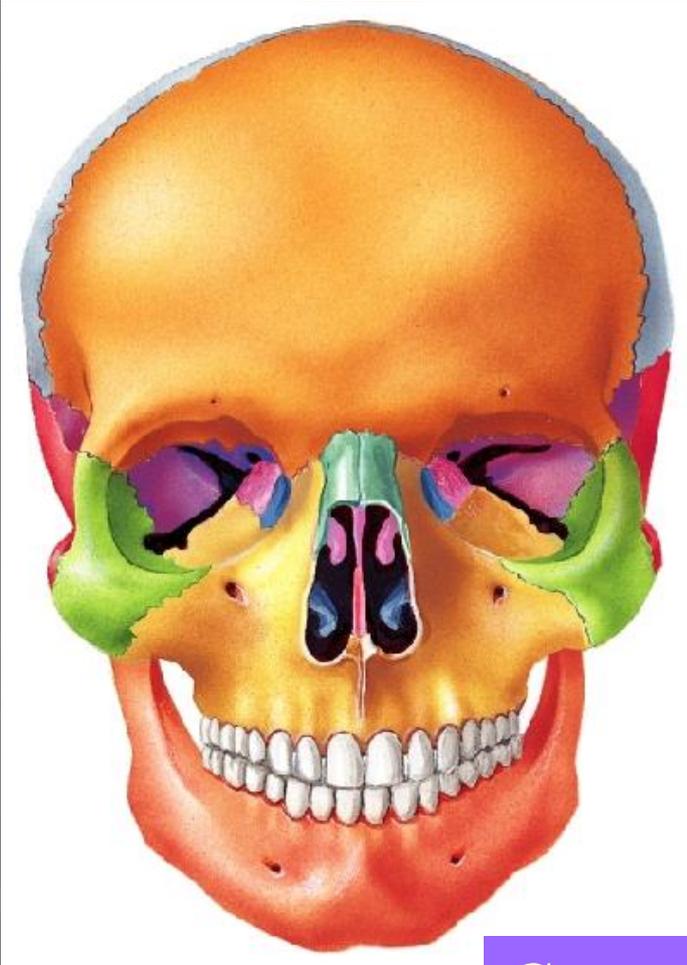
Maxilla and Mandible



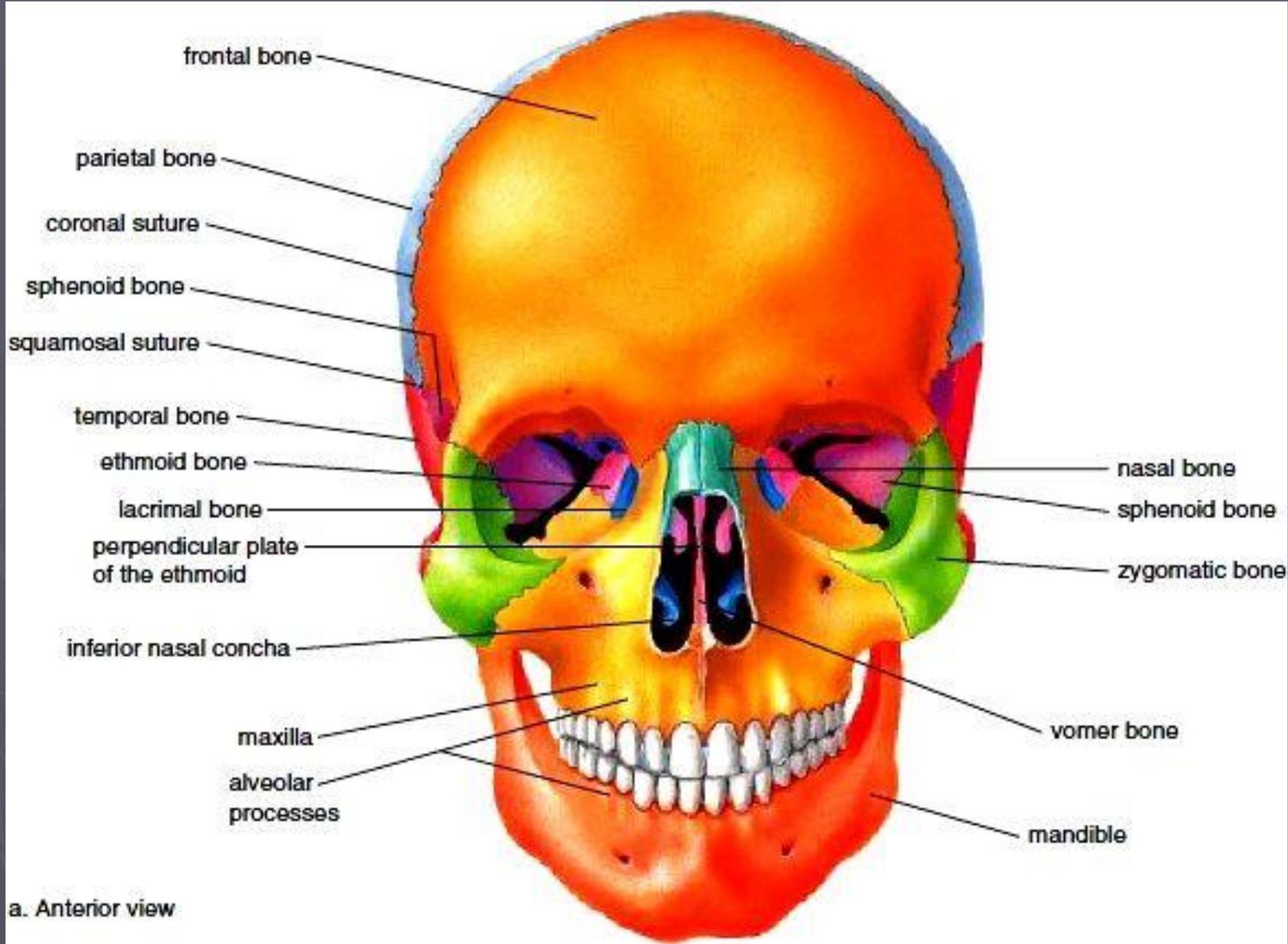
Maxilla

Mandible

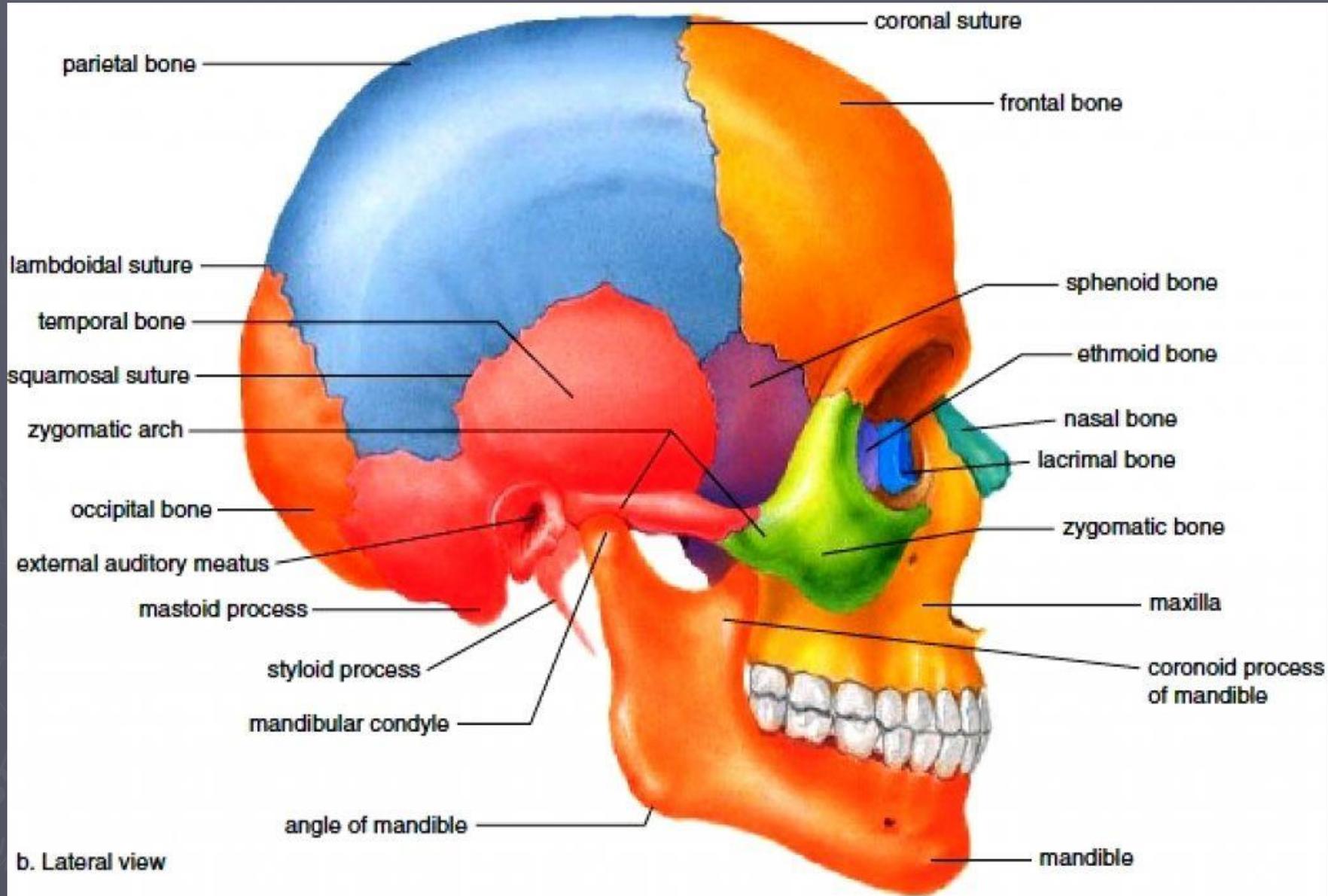
Bones of the Skull (cont.)



Can you name these bones of the skull?



a. Anterior view



Vertebral Column or Spinal Cord

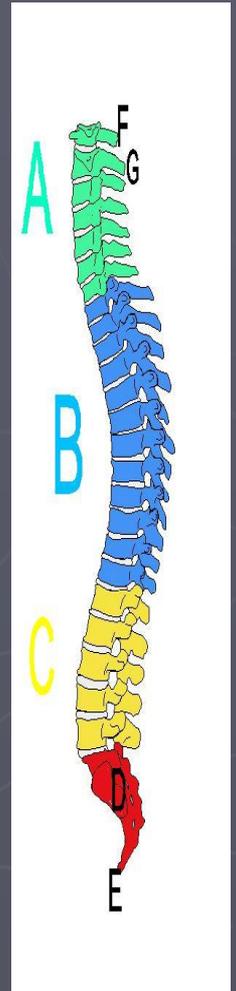
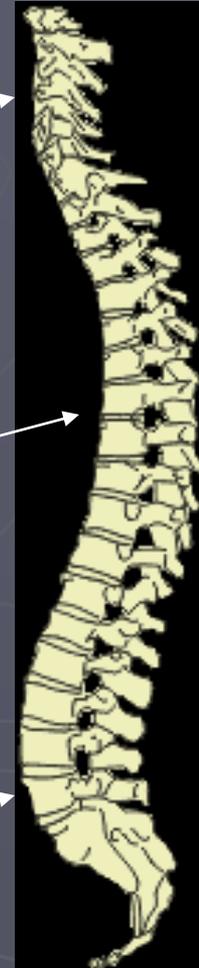
1) The **cervical region** (neck bones)



2) The **thoracic region** (what the ribs attach to)



3) The **lumbar region** (the lower part of the back)



Bones of the Spinal Column

Spinal column

- ❑ 7 Cervical vertebrae
- ❑ 12 thoracic vertebrae
- ❑ 5 lumbar vertebrae
- ❑ A sacrum
- ❑ A coccyx

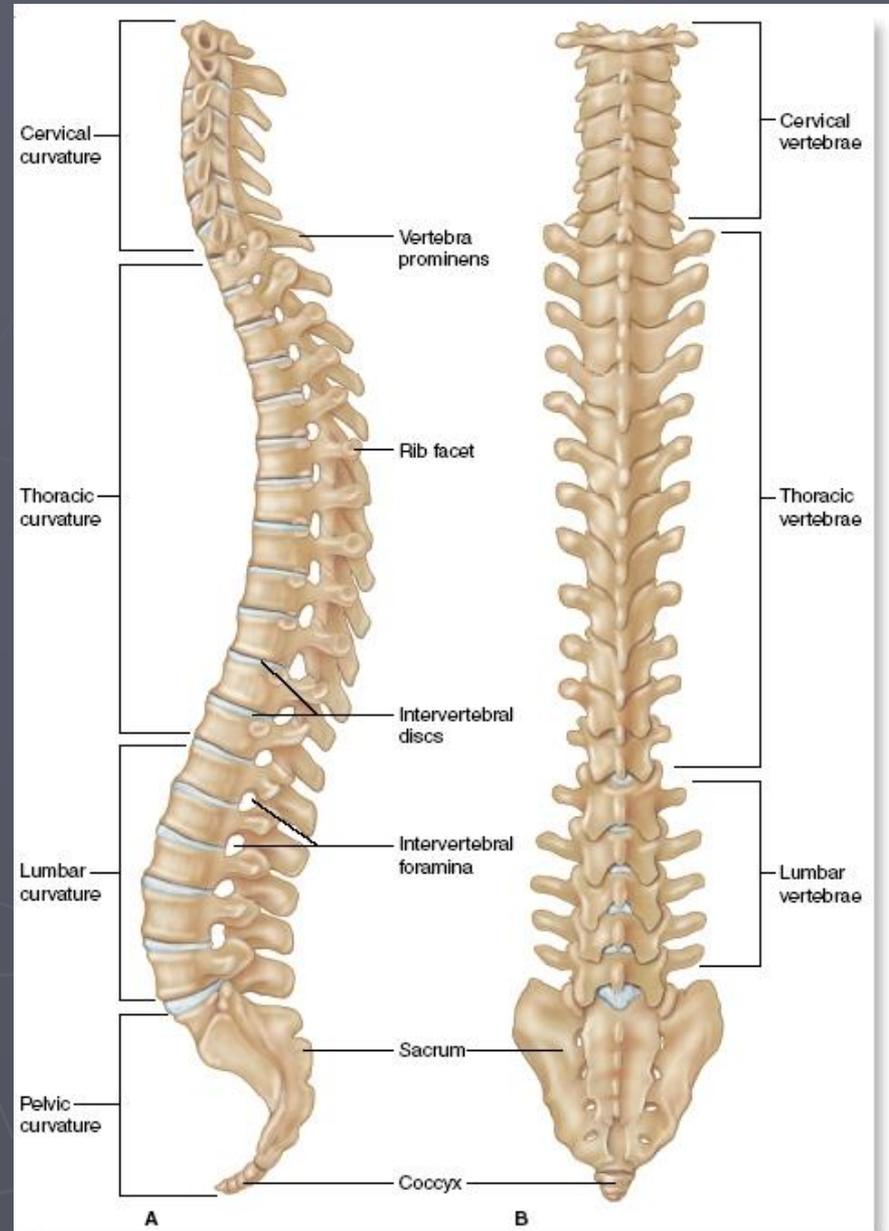


Figure 25-7. Vertebral column: (a) lateral view and (b) posterior view.

Bones of the Spinal Column

(cont.)

Cervical vertebrae (c1-c7)

- § Smallest and lightest
- § Located in the neck region
- § First one is atlas
- § Second one is axis

Thoracic vertebrae (t1-t12)

- § Join the 12 pairs of ribs

Lumbar vertebrae (l1-l5)

- § Have very sturdy structures

Sacrum

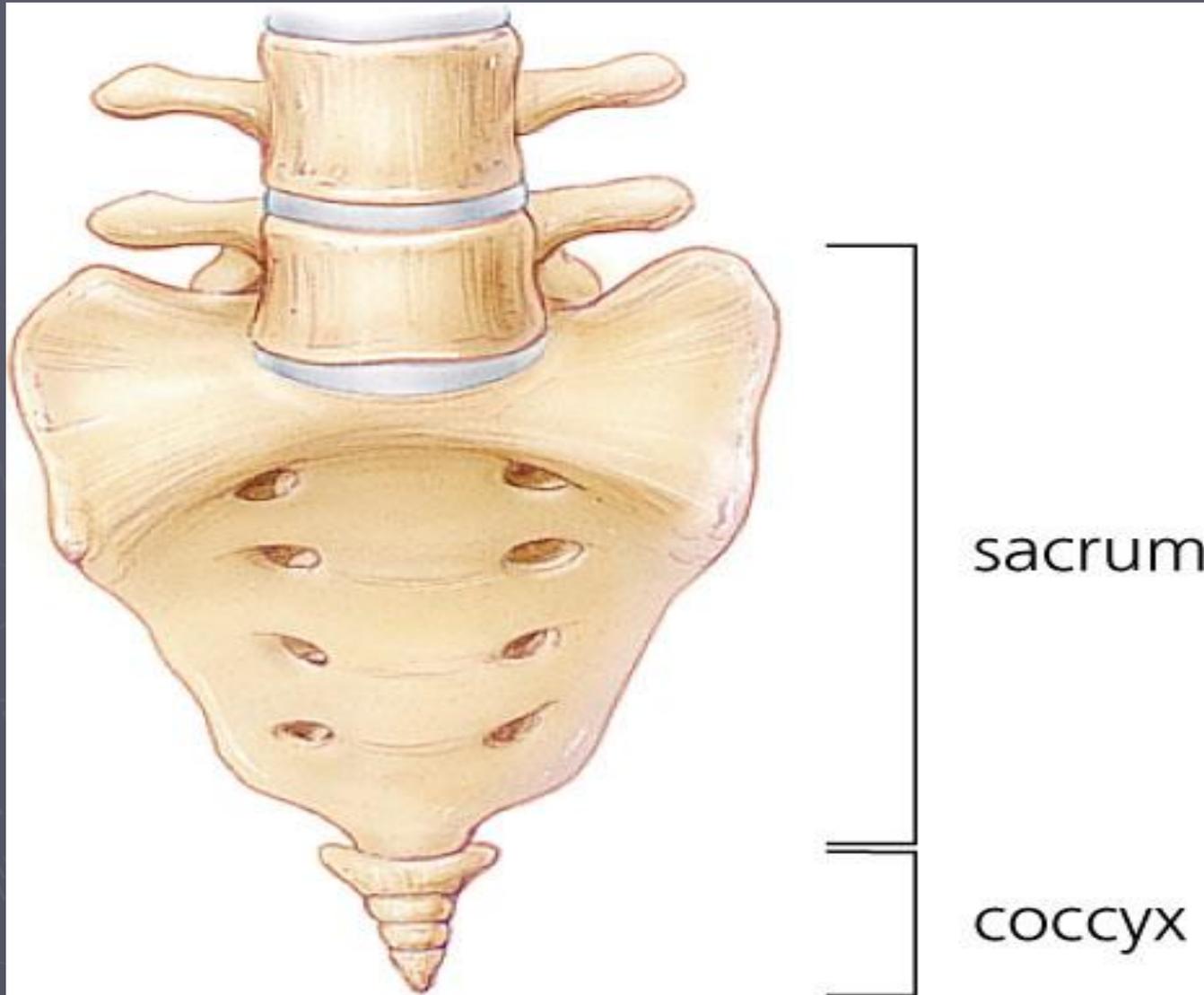
A triangular-shaped bone that consists of five fused vertebrae

Coccyx

A small, triangular-shaped bone made up of 3 to 5 fused vertebrae

Considered unnecessary.
More commonly called the tailbone.

Coccyx and Sacrum

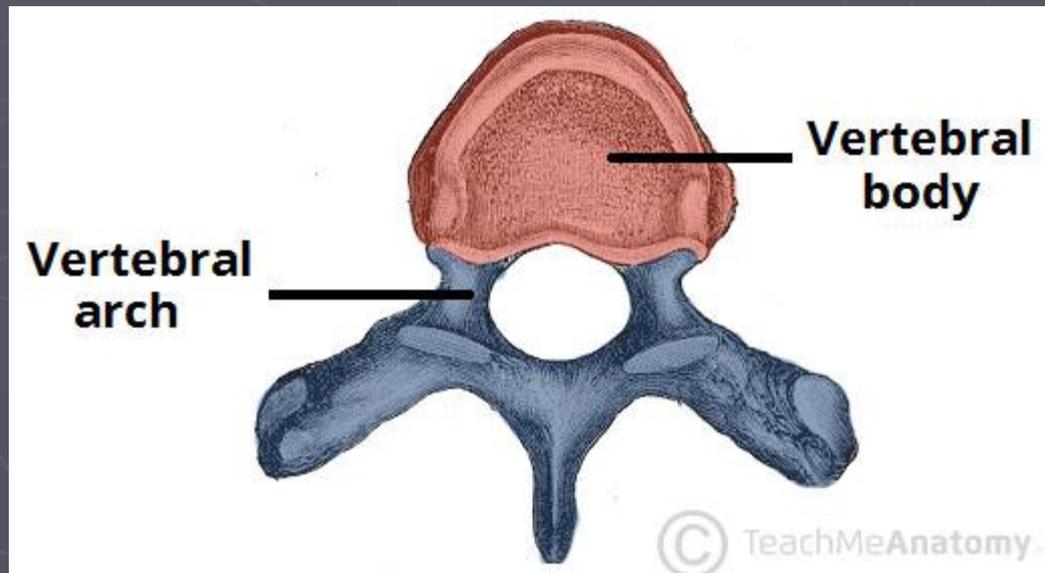


The vertebral body is the anterior part of the vertebrae. It is the **weight-bearing** component, and its size increases as the vertebral column descends (having to support increasing amounts of weight).

The superior and inferior aspects of the vertebral body are lined with **hyaline cartilage**. Adjacent vertebral bodies are separated by a fibrocartiliginous intervertebral disc.

The vertebral arch refers to the lateral and posterior parts of the vertebrae.

With the vertebral body, the vertebral arch forms an enclosed hole, called a vertebral foramen. The foramina of the all vertebrae line up to form the vertebral canal, which encloses the spinal cord.



The vertebral arches have a number of bony prominences, which act as attachment sites for muscles and ligaments:

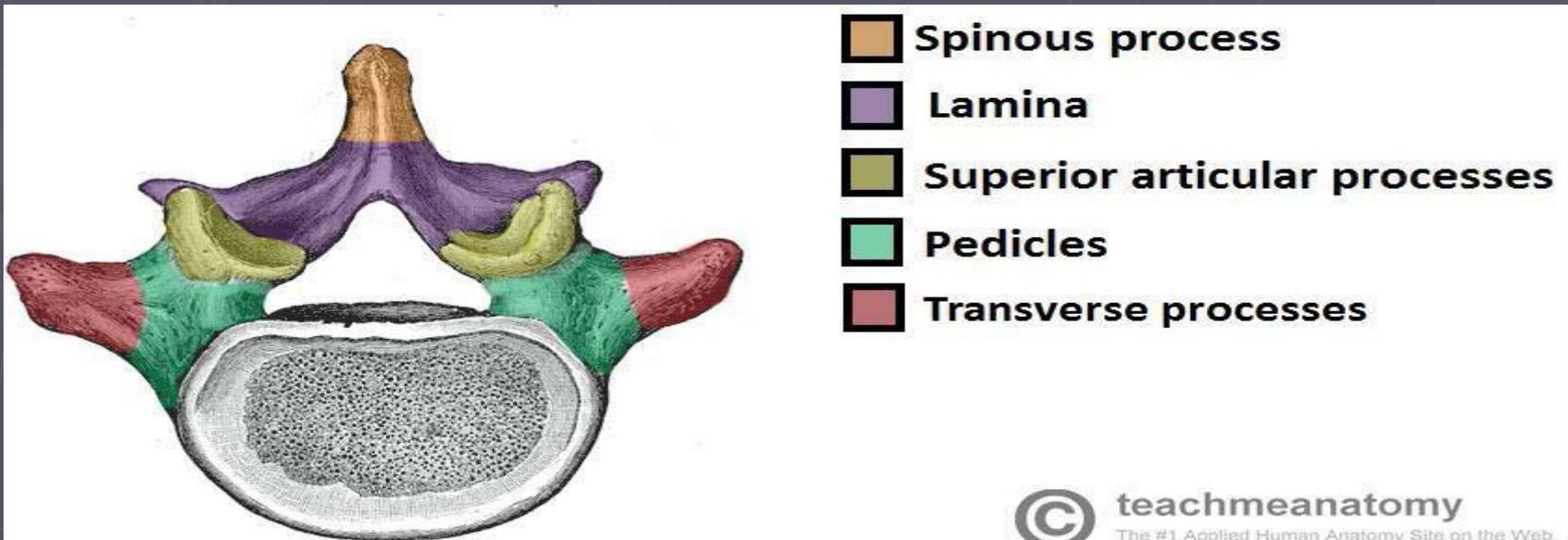
Pedicles: There are two of these, one left and one right. They point posteriorly, meeting the flatter laminae.

Lamina: The bone between the transverse and spinal processes.

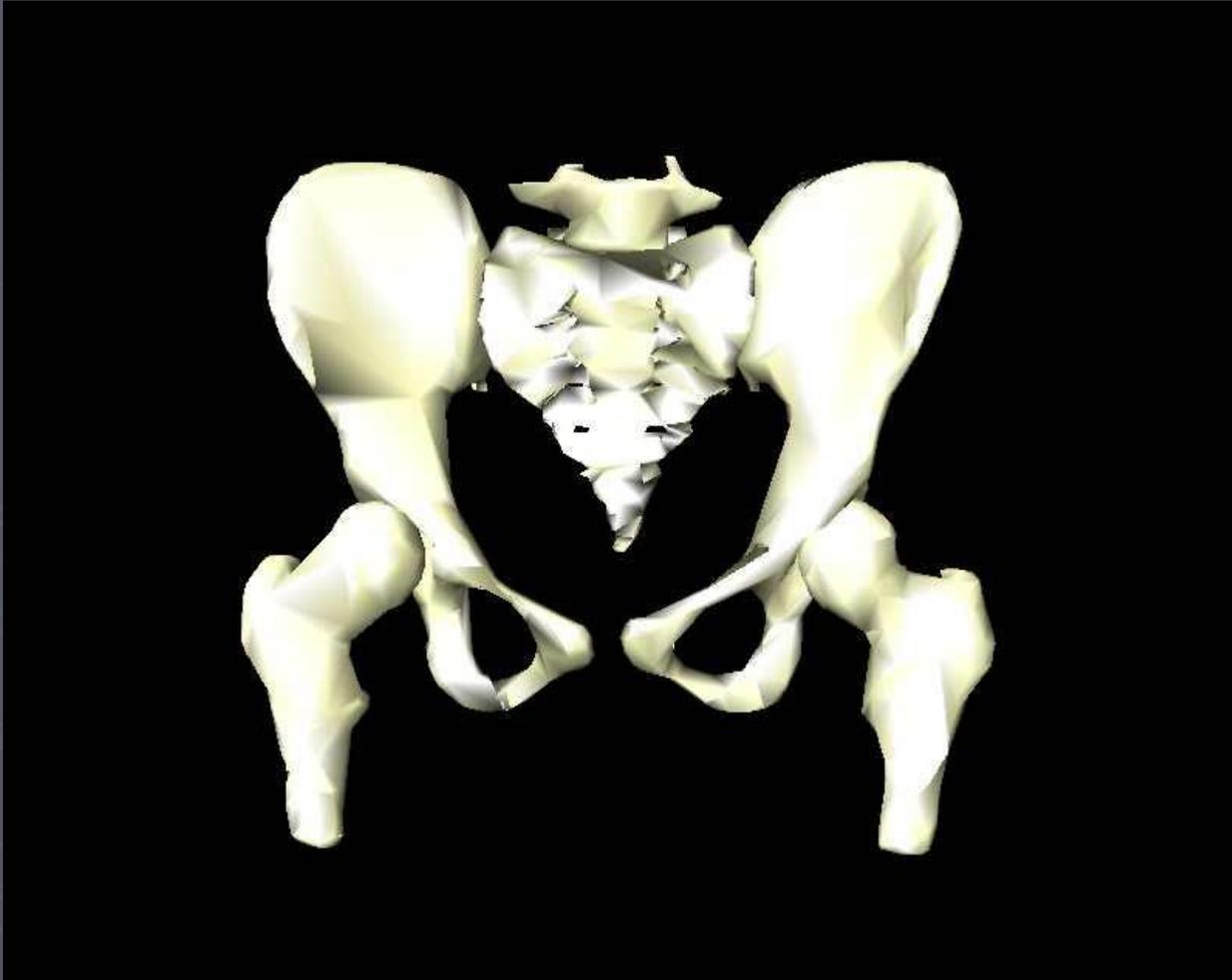
Transverse processes: These extend laterally and posteriorly away from the pedicles. In the thoracic vertebrae, the transverse processes articulate with the ribs.

Articular processes: At the junction of the lamina and the pedicles, superior and inferior processes arise. These articulate with the articular processes of the vertebrae above and below.

Spinous processes: Posterior and inferior projection of bone, a site of attachment for muscles and ligaments.



Pelvis



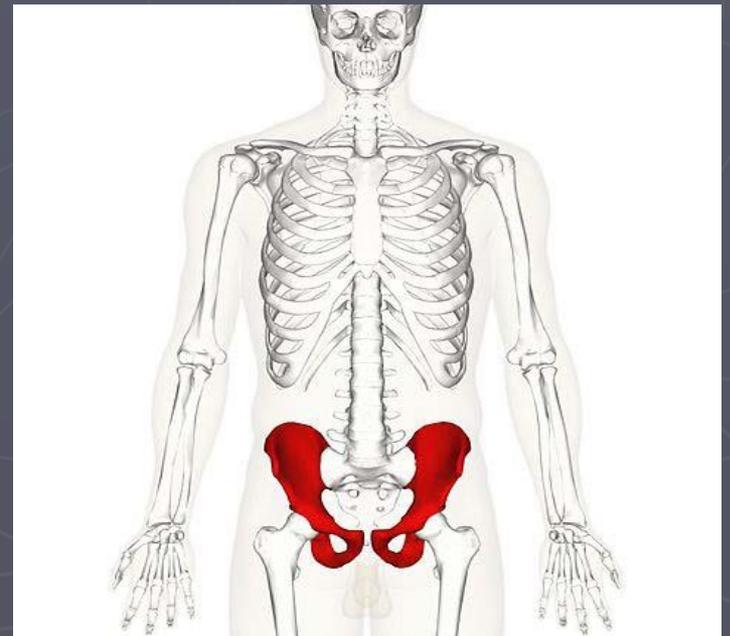
Bones of the Pelvic Girdle

- Composed of two coxal bones (hip bones)
 - Composed of three pair of fused bones
 - Ilium
 - Ischium
 - Pubis
- The total weight of the upper body rests on the pelvis
- Protects several organs
 - Reproductive organs
 - Urinary bladder
 - Part of the large intestine

The two symmetrical **hip bones** (also known as the innominate bones, or pelvic bones) are part of the **pelvic girdle**, the bony structure that attaches the axial skeleton to the lower limbs

The hip bones have three articulations:

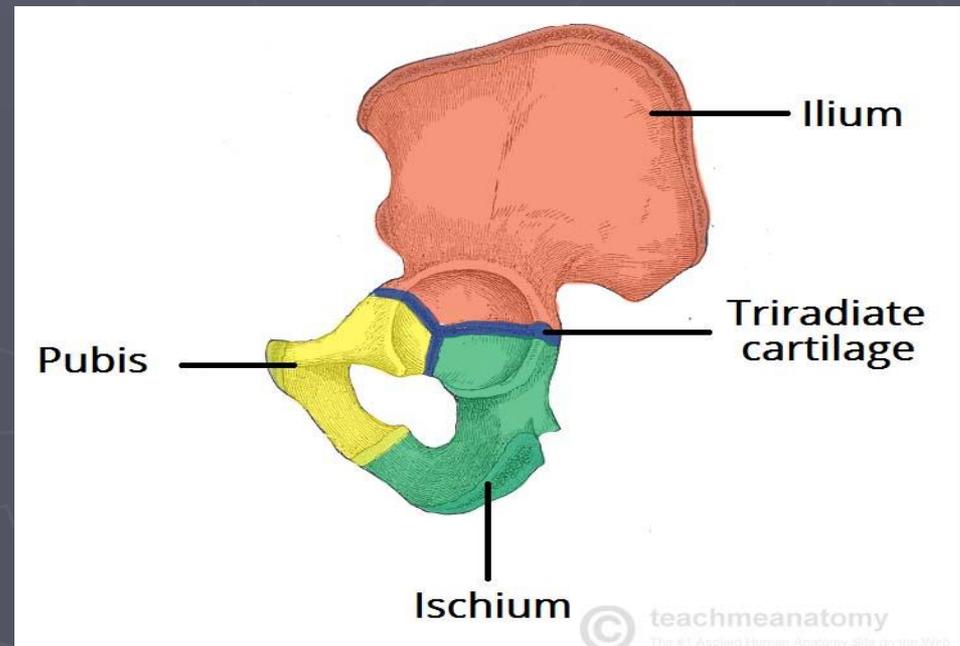
- **Sacroiliac joint** – articulation with sacrum.
- **Pubic symphysis** – articulation with the corresponding hip bone.
- **Hip joint** – articulation with the head of femur.



Composition of the Hip Bone

The hip bone is made up of the three parts – the **ilium**, **pubis** and **ischium**. Prior to puberty, the **triradiate cartilage** separates these constituents. At the age of 15-17, the three parts begin to fuse.

Their fusion forms a cup-shaped socket known as the **acetabulum**, which becomes complete at 20-25 years of age. The head of the **femur** articulates with the acetabulum to form the [hip joint](#).



The Ilium

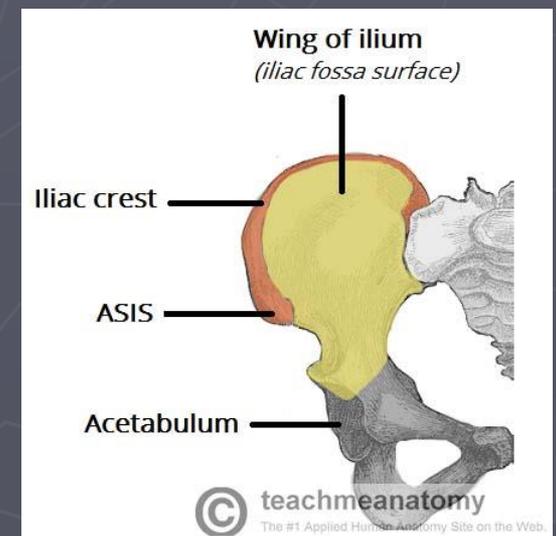
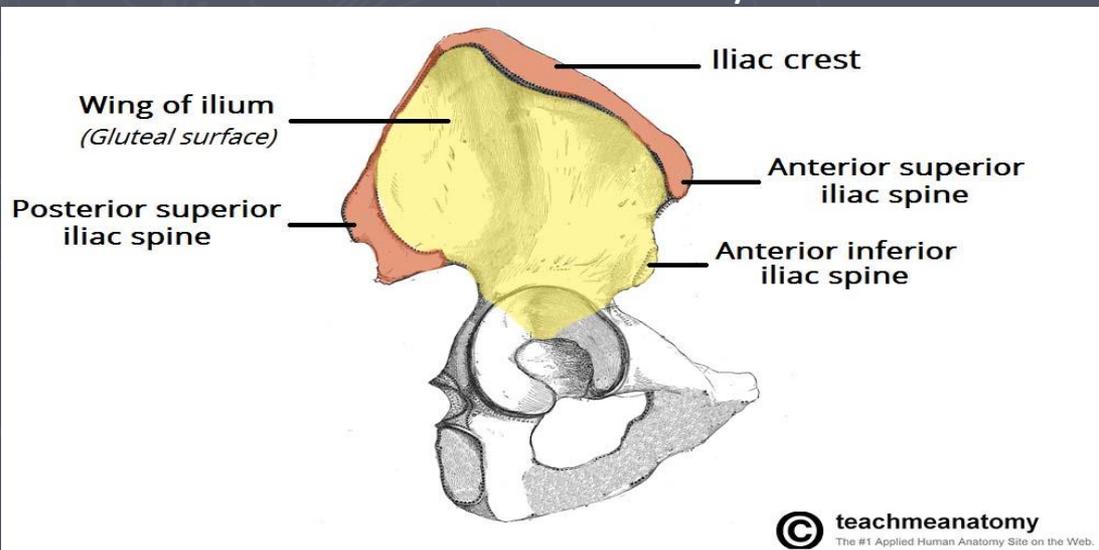
The superior part of the hip bone is formed by the **ilium**, the widest and largest of the three parts. The body of the ilium forms the superior part of the **acetabulum**. Immediately above the acetabulum, the ilium expands to form the **wing** (or ala).

The wing of the ilium has two surfaces. The inner surface is concave, and known as the **iliac fossa**, providing origin to the iliacus muscle. The external surface is convex, and provides attachments to the gluteal muscles. Hence it is known as the **gluteal surface**.

The superior margin of the wing is thickened, forming the **iliac crest**. It extends from the anterior superior iliac spine to the posterior superior iliac spine.

Muscles attaching to the Ilium: –

- **Gluteal muscles** attach to the external surface of the Ilium at the anterior, posterior and inferior gluteal lines.
- The **iliacus muscle** attaches medially at the iliac fossa.

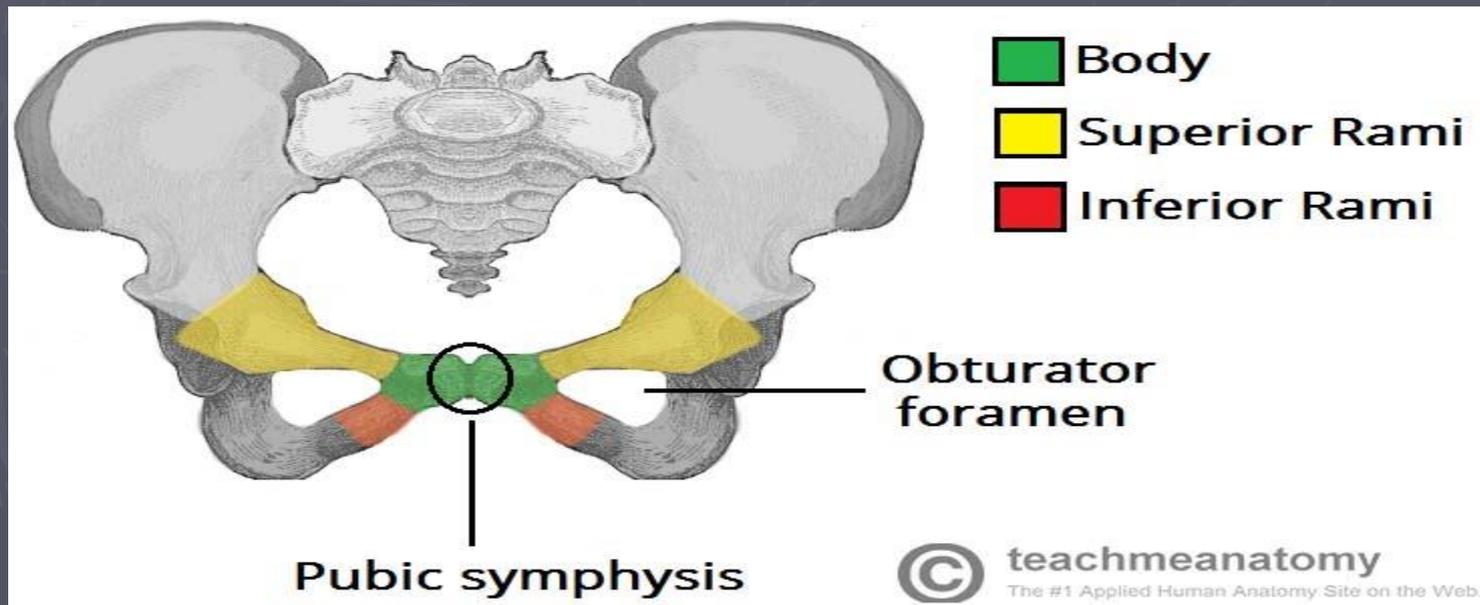


The Pubis

The **pubis** is the most anterior portion of the hip bone. It consists of a body and superior and inferior **rami** (branches).

The body is located medially, articulating with its opposite pubic body, at the **pubic symphysis**.

The **superior ramus** extends laterally from the body, forming part of the **acetabulum**. The inferior ramus projects towards, and joins the **ischium**. Together, the two rami enclose part of the **obturator foramen**, through which the obturator nerve, artery and vein pass through to reach the lower limb.



The Ischium

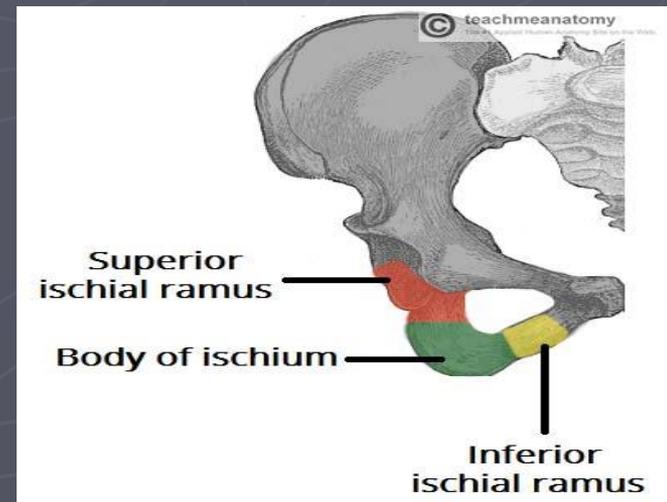
The posteroinferior part of the hip bone is formed by the **ischium**. Much like the pubis, it is composed of a body, an inferior and a superior ramus.

The **inferior ischial ramus** combines with the inferior pubic ramus forming the ischiopubic ramus which encloses part of the obturator foramen. The posteroinferior aspect of the ischium forms the **ischial tuberosities** and when sitting, it is these tuberosities on which our body weight falls.

On the posterior aspect of the ischium there is an indentation known as the **greater sciatic notch**, with the **ischial spine** at its most inferior edge.

Two important ligaments attach to the ischium:

- The **sacrospinous ligament** runs from the ischial spine to the sacrum, thus creating the greater sciatic foramen through which lower limb neurovasculature (including the sciatic nerve) transcends.
- The **sacrospinous ligament** runs from the sacrum to the ischial tuberosity, forming the lesser sciatic foramen.



Comparing Male and Female Pelves

- ▶ Males - bones are larger and heavier
- ▶ Pelvic inlet is smaller and heart shaped
- ▶ Pubic arch is less than 90°
- ▶ Female - wider and shallower
- ▶ Pubic arch is greater than 90°
- ▶ More space in the true pelvis (Table 8.1)

Comparison of Female and Male Pelves

POINT OF COMPARISON

FEMALE

MALE

General structure

Light and thin.

Heavy and thick.

False (greater) pelvis

Shallow.

Deep.

Pelvic brim (inlet)

Larger and more oval.

Smaller and heart-shaped.

Acetabulum

Small and faces anteriorly.

Large and faces laterally.

Obturator foramen

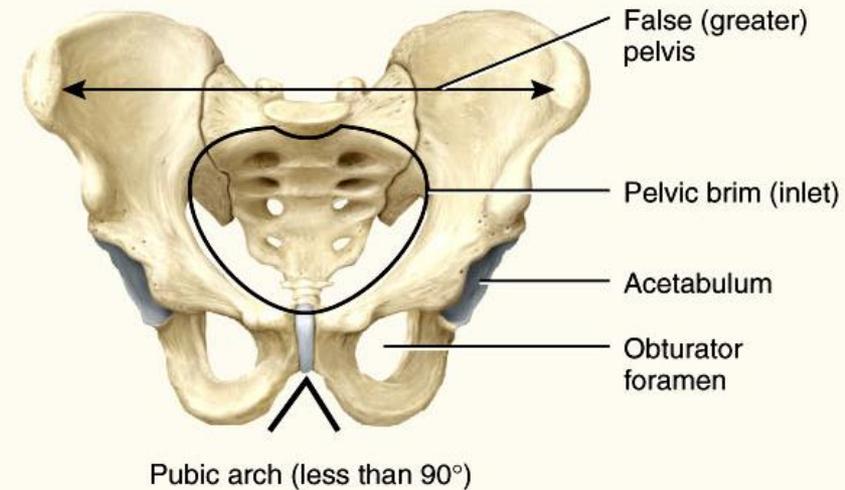
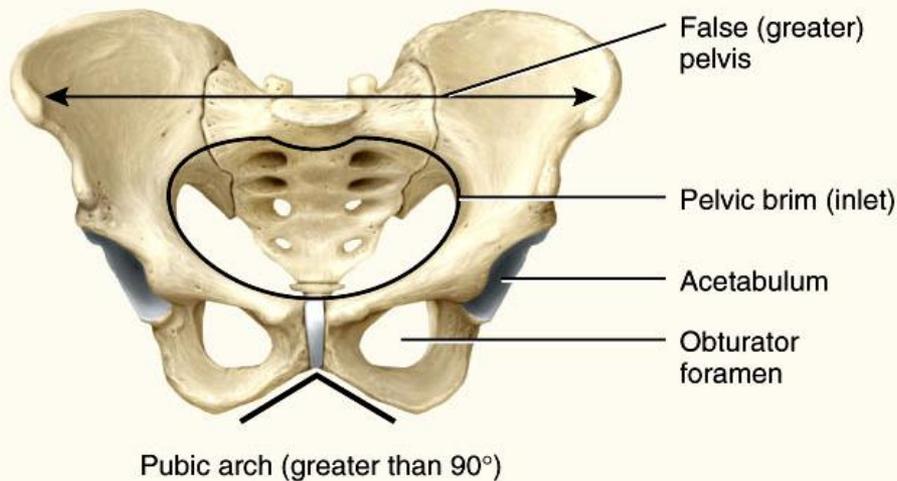
Oval.

Round.

Pubic arch

Greater than 90° angle.

Less than 90° angle.



Anterior views

Comparing Male and Female Pelves

Table 8.1

POINT OF COMPARISON

FEMALE

MALE

Iliac crest

Less curved.

More curved.

Ilium

Less vertical.

More vertical.

Greater sciatic notch

Wide.

Narrow.

Coccyx

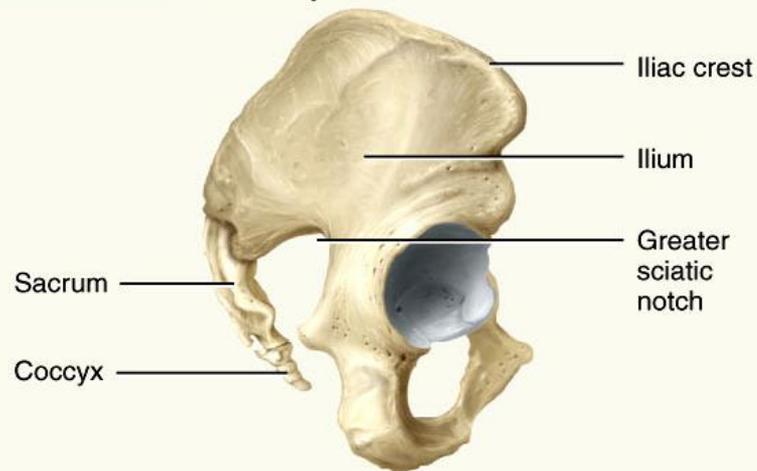
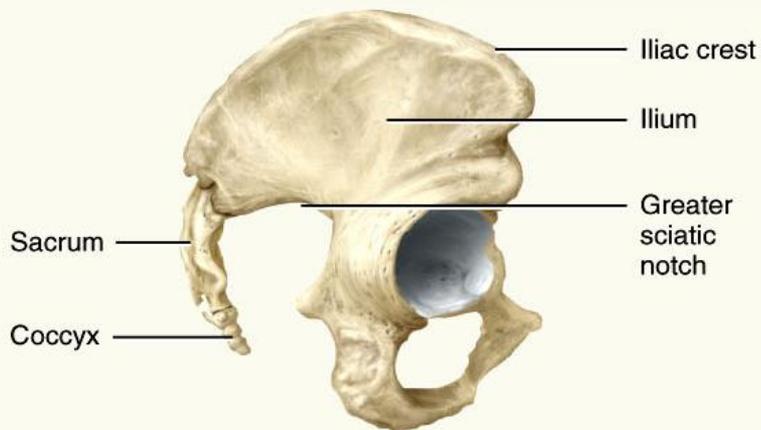
More movable and more curved anteriorly.

Less movable and less curved anteriorly.

Sacrum

Shorter, wider (see anterior views), and less curved anteriorly.

Longer, narrower (see anterior views), and more curved anteriorly.



Right lateral views

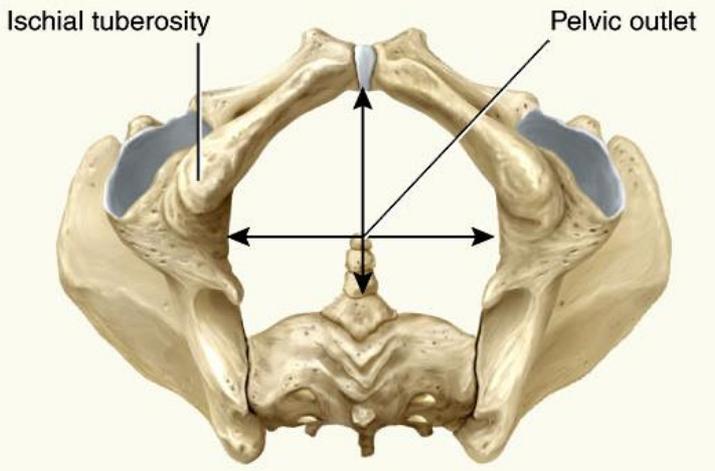
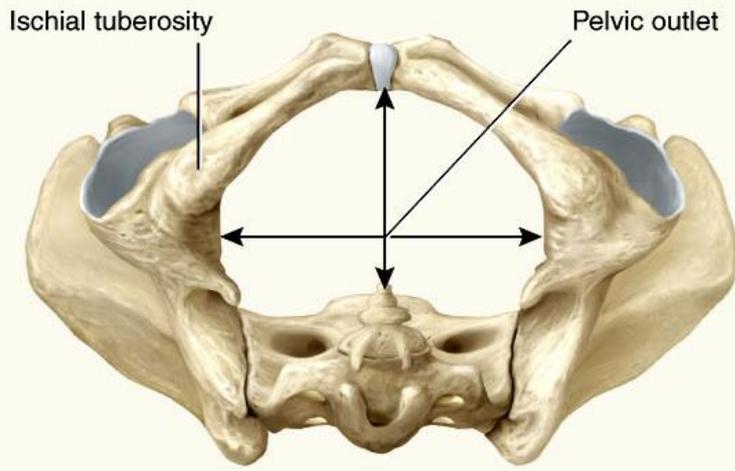
Comparing Male and Female Pelves

Table 8.1

Pelvic outlet
Ischial tuberosity

Wider.
Shorter, farther apart, and more medially projecting.

Narrower.
Longer, closer together, and more laterally projecting.



Inferior views

