ANATO-BEE

Anato-Bee Gross Anatomy Atlas

Co-authored by: Eric DiDomenico, Preston Carey, Maxwell Martin

This atlas is meant to assist in student preparation for the Anato-Bee competitions. This atlas utilizes open-source images, or copyrighted images with permissions, from a variety of electronically accessed resources. These can be found cited with our references at the end of the slide deck.

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Pictured: Maxwell Martin (left), Eric DiDomenico (middle), and Preston Carey (right), student creators of the Anato-Bee Gross Anatomy Review atlas.

Last updated: January 2024

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Human Body Donor Images Contained Within

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- These donations were accepted through the Colorado State Anatomical Board and dissections performed at the University of Colorado School of Medicine.
- Donors were used for anatomical dissection and to display anatomical structures of the human body.
- These images can be alarming to some. It is encouraged that you take your time and practice patience when studying human donor dissections.

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For any questions about the material contained within please contact info@anatobee.org with attention to Jenna Hagerty, MS, PhD.

Introduction to Anatomy

Common Anatomical Terms:

- Anatomical position
- Axial/appendicular skeleton
- Superior/inferior
- Anterior/posterior
- Proximal/distal
- Medial/lateral
- Planes: sagittal, coronal, transverse
- Flexion/extension
- ABduction/ADduction

Anatomical position

Different than the normal functional body position

Involves the body facing forward or in the prone (laying down face up) position with arms at the side and palms facing forward or up (thumbs pointed outwards).

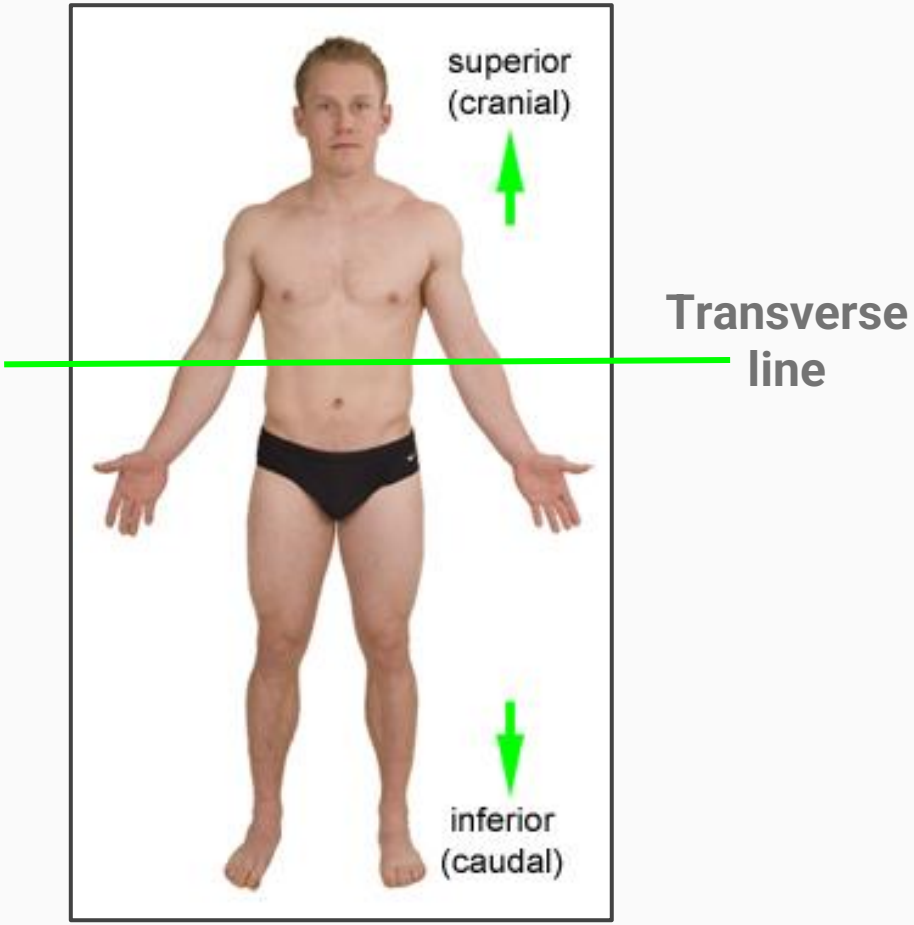
The picture shows two testosterone-driven developed humans. The left one is in anatomical position. The right one is the Visible Human from VH Dissector that is *not* in anatomical position.

Anatomical terms –

all terms reflect relative orientation while in anatomic position

Superior: referring to structures that are above a transverse line across the body (or another object)

Inferior: referring to structures that are below a transverse line across the body (or another object)

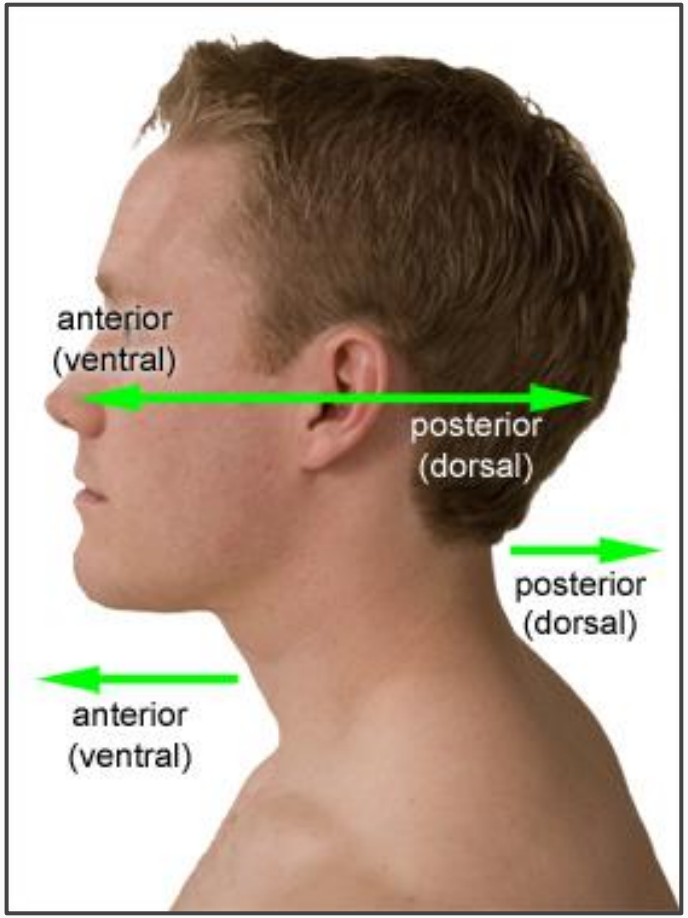


Anatomical terms –

all terms reflect relative orientation while in anatomic position

Anterior: referring to structures that are facing towards or oriented to the front

Posterior: referring to structures that are facing towards or oriented to the back

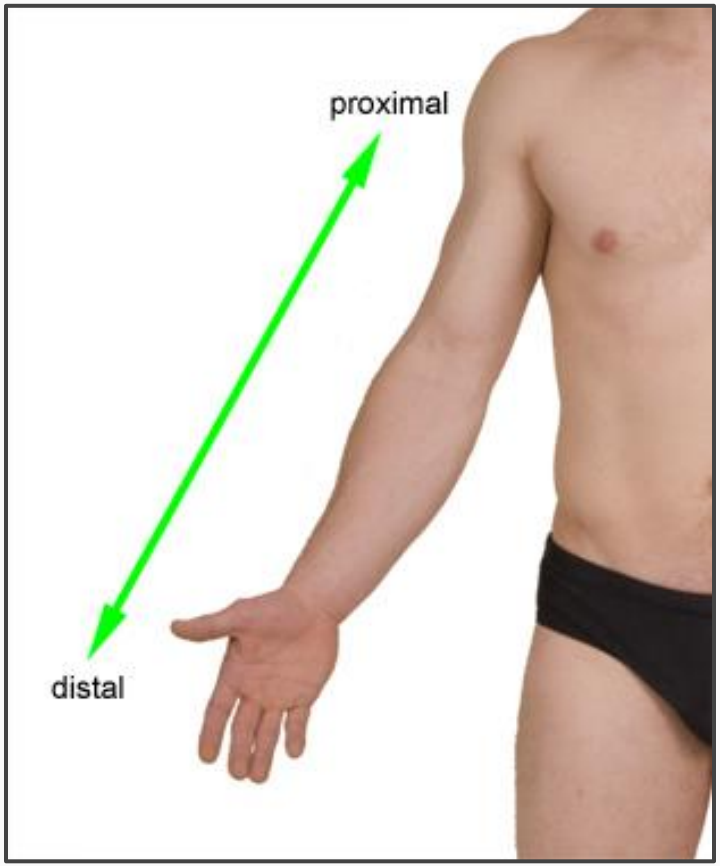


Anatomical terms –

all terms reflect relative orientation while in anatomic position

Proximal: referring to structures that closer to the center of the body

Distal: referring to structures that are further from the center of the body

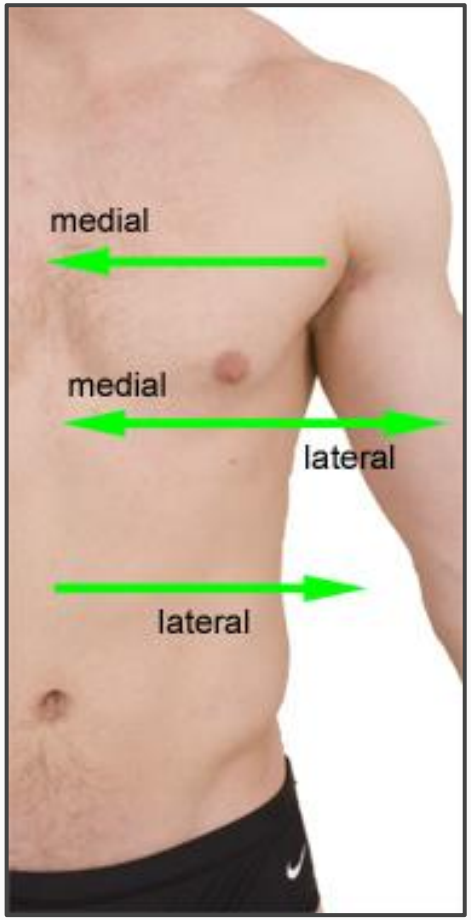


Anatomical terms –

all terms reflect relative orientation while in anatomic position

Medial: referring to structures that closer to the midline of the body

Lateral: referring to structures that are further from the midline of the body



Anatomical planes

Orientation: anterolateral view

Sagittal plane: plane dividing the body into right and left parts

- Median plane is midsagittal plane and divides body into equal right and left halves

Sagittal plane

Midsagittal (median) plane

Anatomical planes

Orientation: anterolateral view

Transverse plane: plane separating the body into superior and inferior sections

Anatomical planes

Orientation: anterolateral view

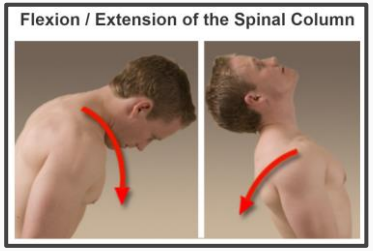
Coronal plane: plane sectioning the body into anterior and posterior halves

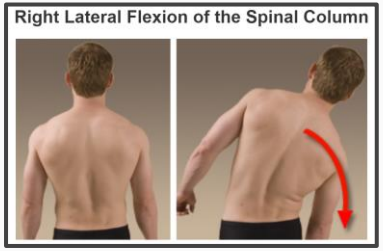
Anatomical motions

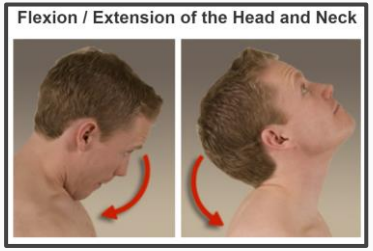
Flexion/extension: movement in sagittal plane around a transverse axis of rotation

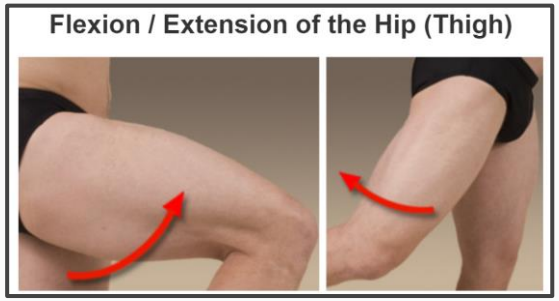
- Flexion may also be thought of as reducing the angle between two elements of a joint

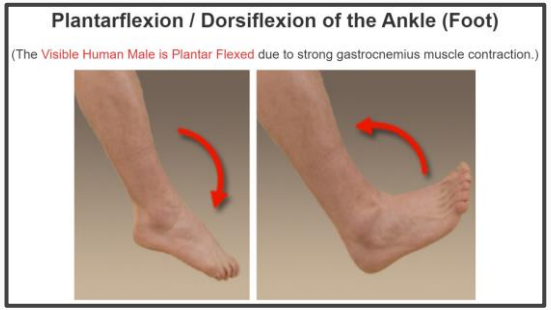
Flexion is usually an anterior movement while extension is usually posterior

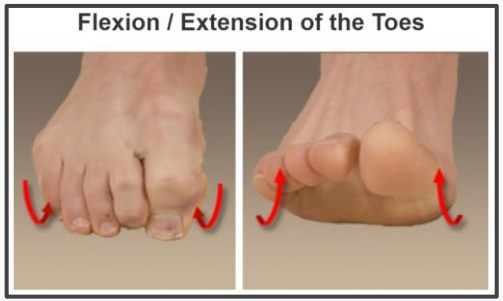












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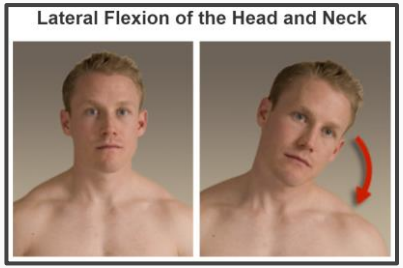
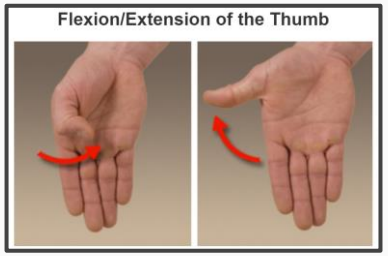
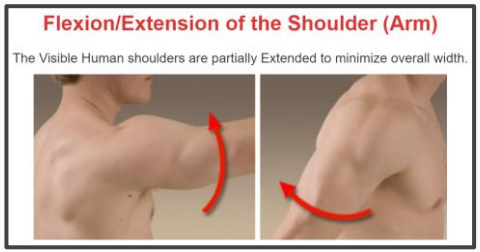
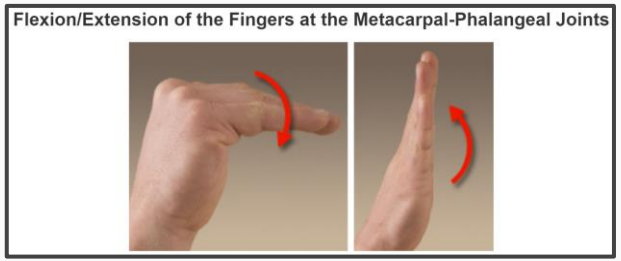
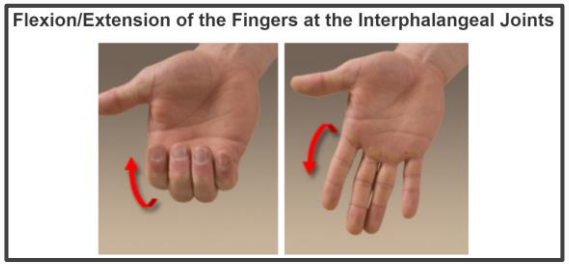








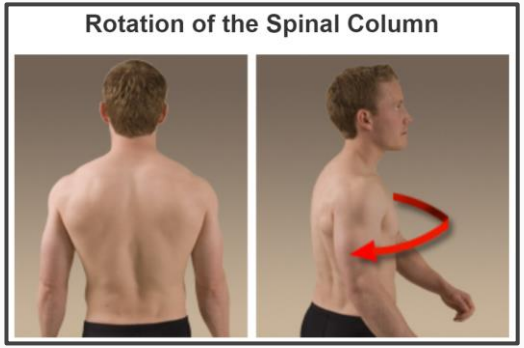


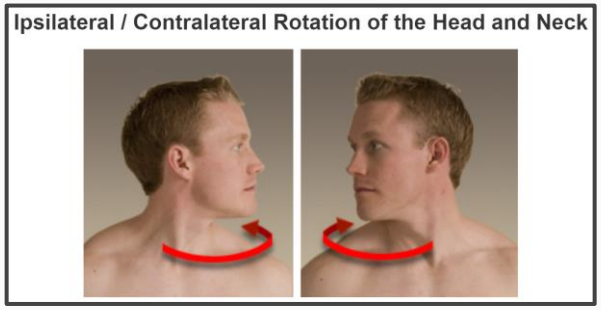
Anatomical motions

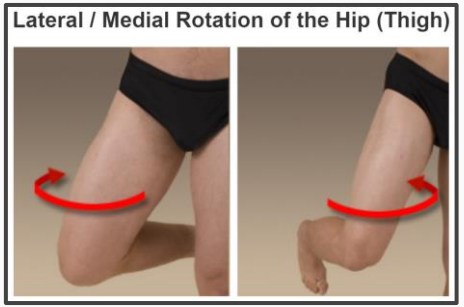
ABduction: movement in coronal plane away from the midline of the body

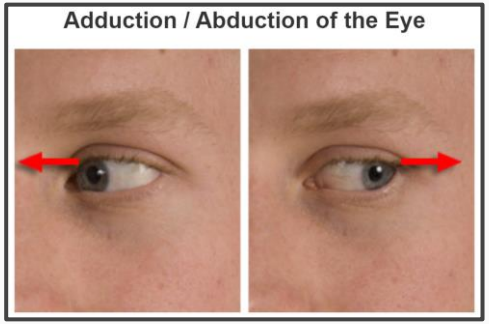
ADduction: movement in a coronal plane towards the midline of the body

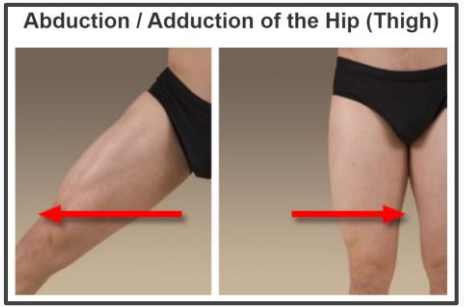
Rotations: movements in the transverse plane around a vertical axis of rotation

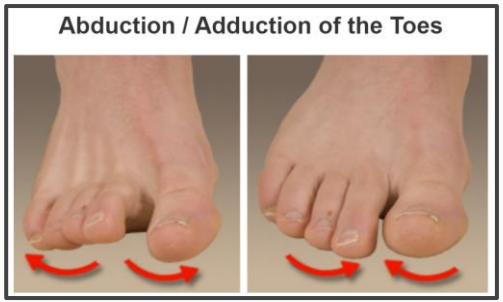












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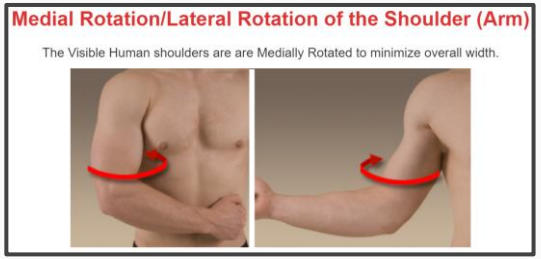
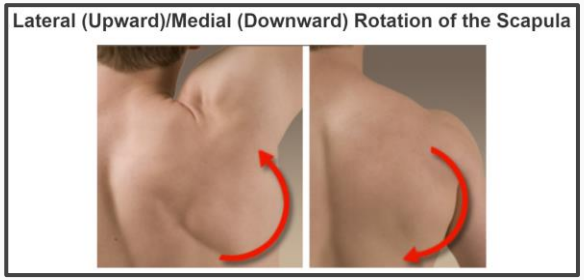
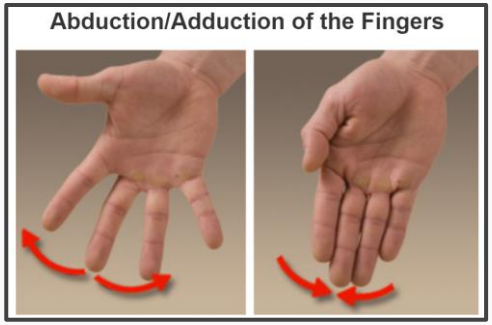
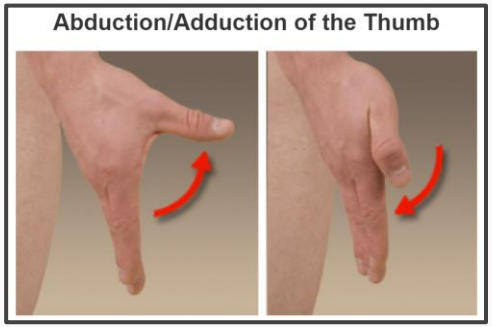
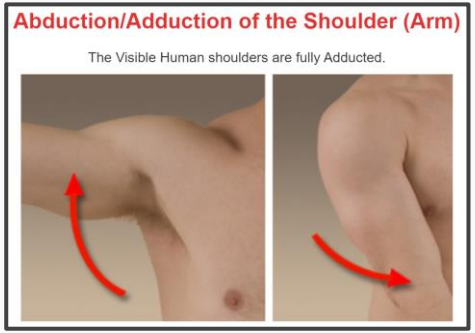
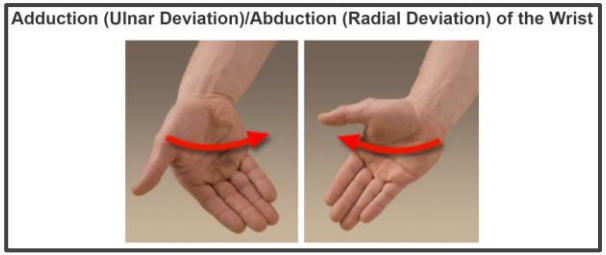












Skeletal System

Skeletal System

Axial skeleton: skeletal components consisting of the cranium, vertebrae, thoracic cage, and sacrum

Appendicular skeleton: skeletal components consisting of the upper and lower limbs as well as the bones linking these appendages to the axial skeleton

Axial (left) versus Appendicular (right)
The specific skeletons are highlighted white

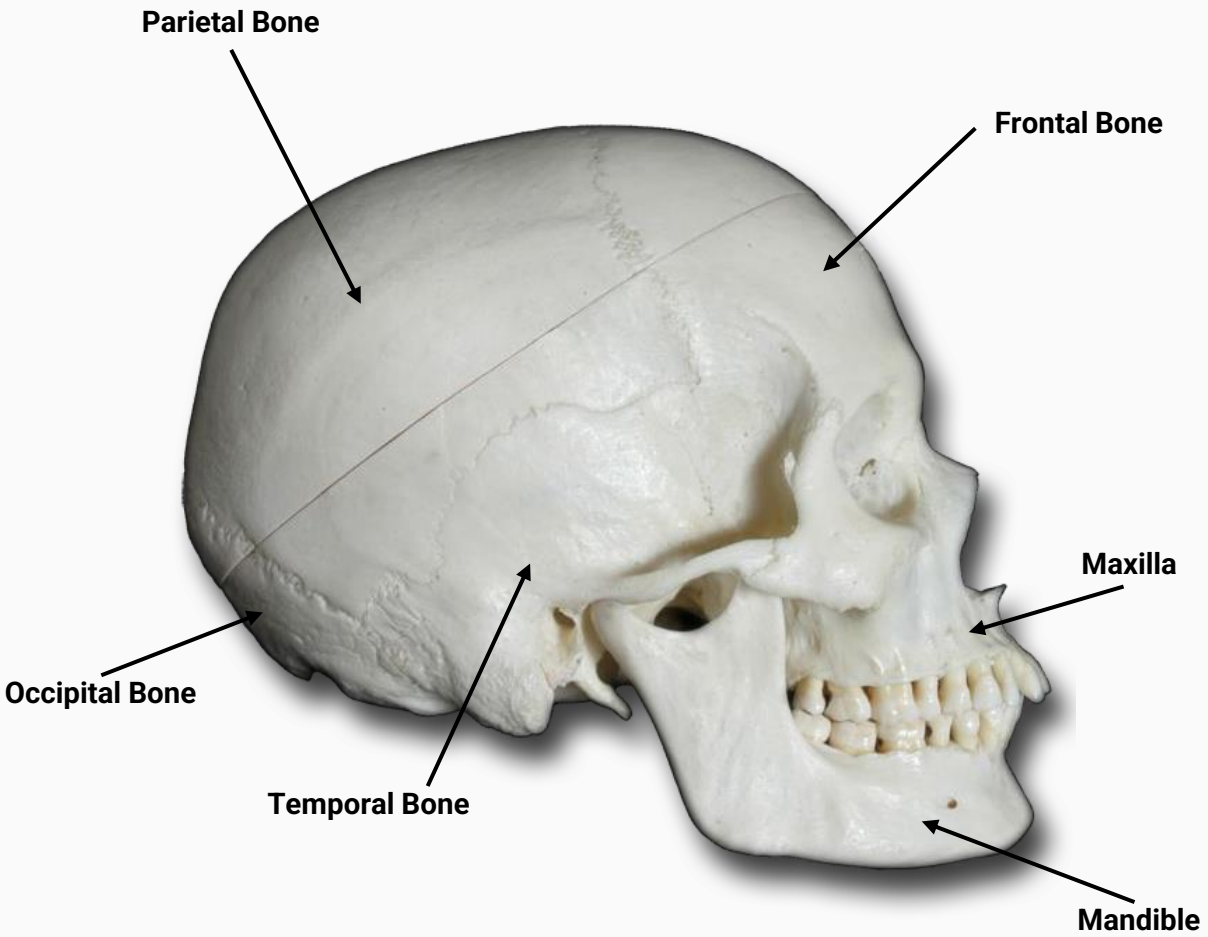
Skeletal System: Axial Skeleton

Key Points:

There are two major groups of bones in the skull; those of the **cranium** and those of the **face**

The cranium is composed of 4 bones; **frontal**, **parietal**, **temporal**, and **occipital** which function to protect the brain

Two important facial bones are the **mandible** and the **maxilla**



Orientation: this is a right lateral view of the skull.

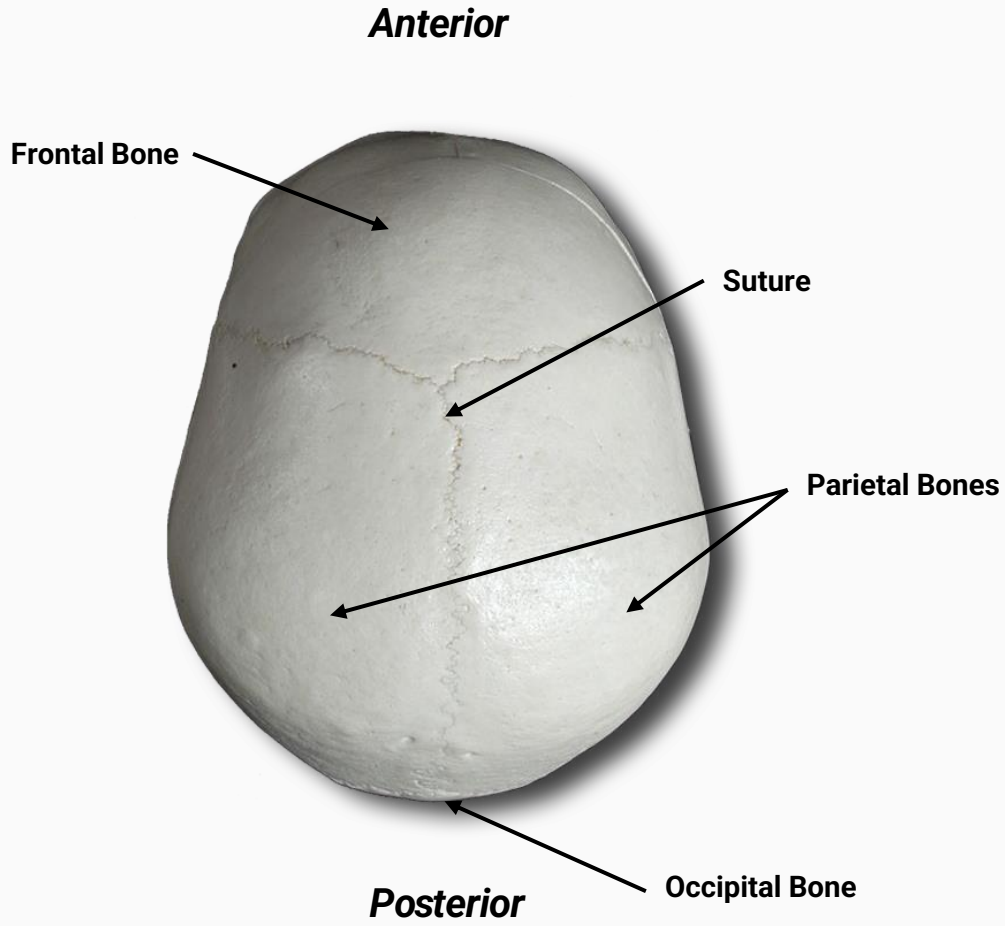
Skeletal System: Axial Skeleton

Key Points:

Note the **frontal** bone positioned anteriorly while the **occipital** bone lies posteriorly

Notice the two **parietal** bones that comprise the roof of the cranium.

The bones of the skull join at fibrous joints called **sutures**



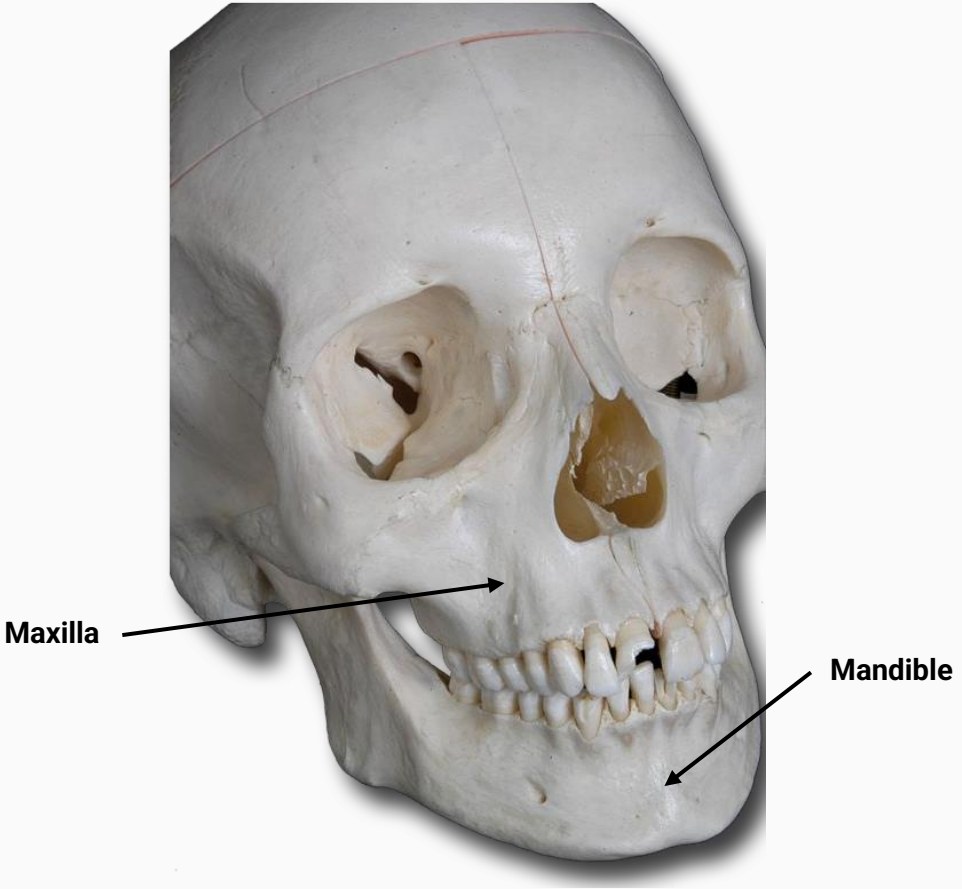
Orientation: this is a superior view of the skull

Skeletal System: Axial Skeleton

Key Points:

The **maxilla** comprises the part of the upper jaw and hard palate

The **mandible** forms the jaw and articulates with the cranium at the temporomandibular joint



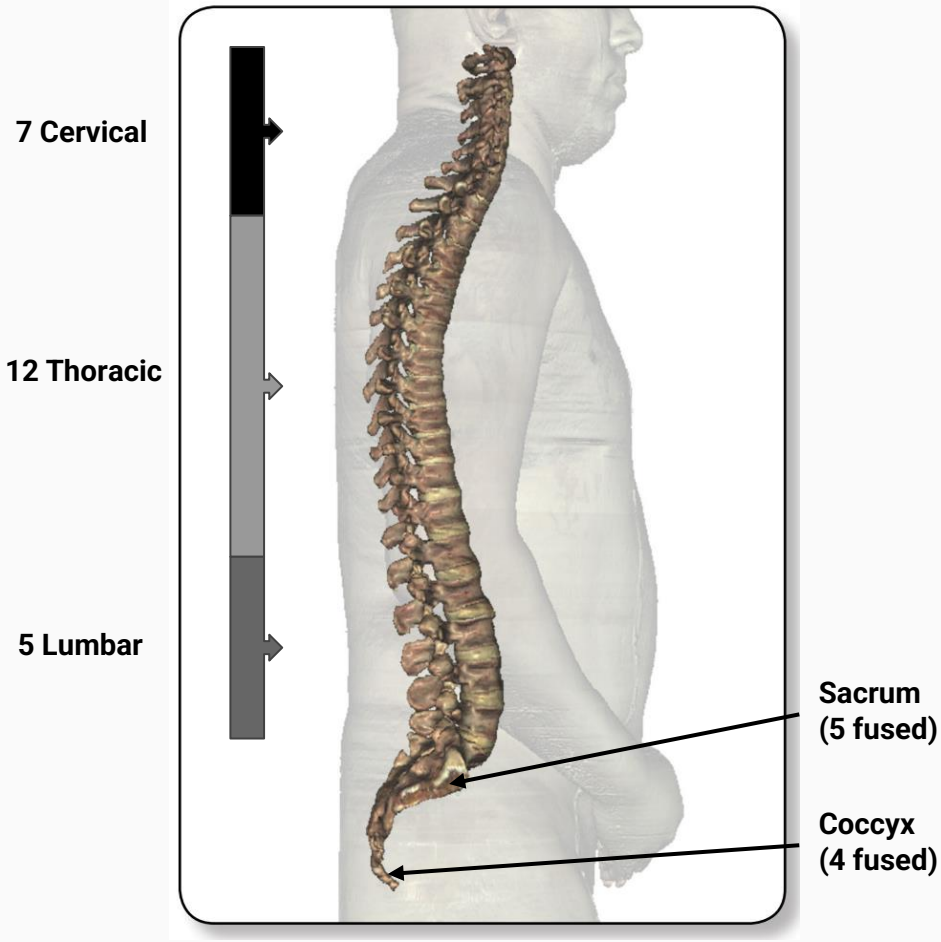
Orientation: this is an anterolateral view of the skull

Skeletal System: Axial Skeleton

Key points:

Examine the general organization of the **vertebral column** including the number of vertebrae at each level

The vertebral column has several important functions, including protection of the spinal cord which it encases, supporting the weight of the body and assist in both posture and movement



Orientation: this is a right lateral view of the vertebral column

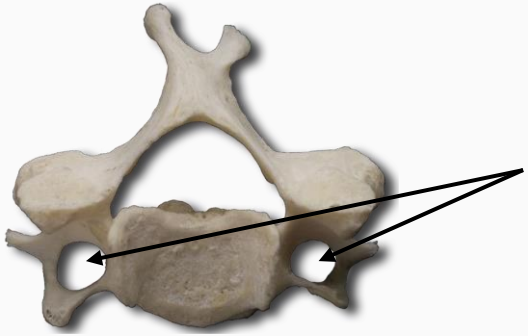
Skeletal System: Vertebrae

Orientation:

Posterior views of individual vertebrae.

Key points:

All three sections, cervical, thoracic, and lumbar, have distinct features that correlate with their anatomical function.

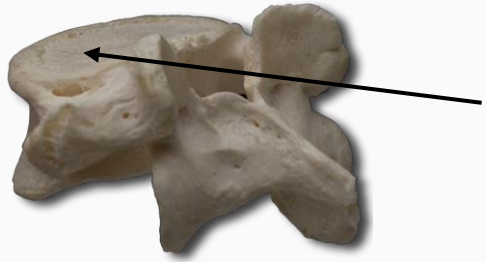


Superior view of cervical vertebrae:

The intervertebral foramen is the distinguishing feature. The vertebral arteries and veins run through these foramen to supply the brain.[2]

Left lateral view of thoracic vertebrae:

The costal facets where the ribs attach are the distinguishing features. The dashed lines in the image show the borders of the facets.[2]



Posterolateral view of lumbar vertebrae:

The massive body is the distinguishing feature.[2]

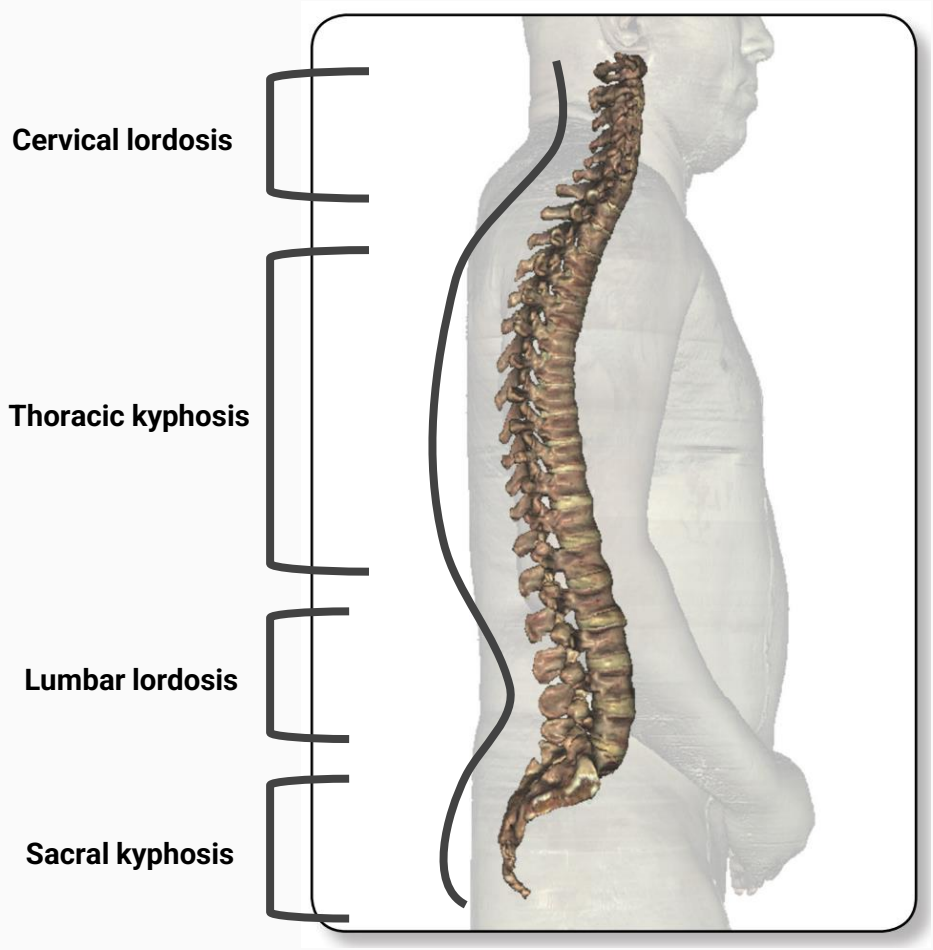
Skeletal System: Axial Skeleton

Key Points:

Observe the normal curvature of the spine.

Lordosis- anterior curvature of the spine that results in a concave shape *(normal in **cervical** and **lumbar** vertebrae)*

Kyphosis- posterior curvature of the spine that results in a convex shape *(normal in the **thoracic** and **sacral** regions)*



Orientation: this is a right lateral view of the vertebral column

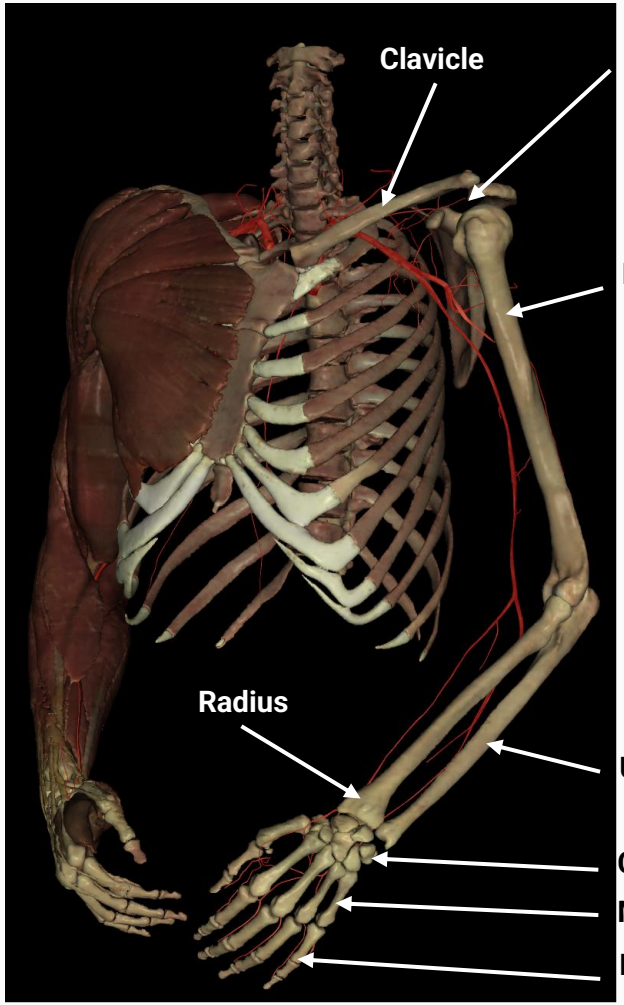
Skeletal System: Appendicular Skeleton

Observe the general orientation of the upper limb from proximal → distal

Humerus- single arm bone between the shoulder and elbow

Radius- lateral bone of forearm

Ulna- medial bone of forearm



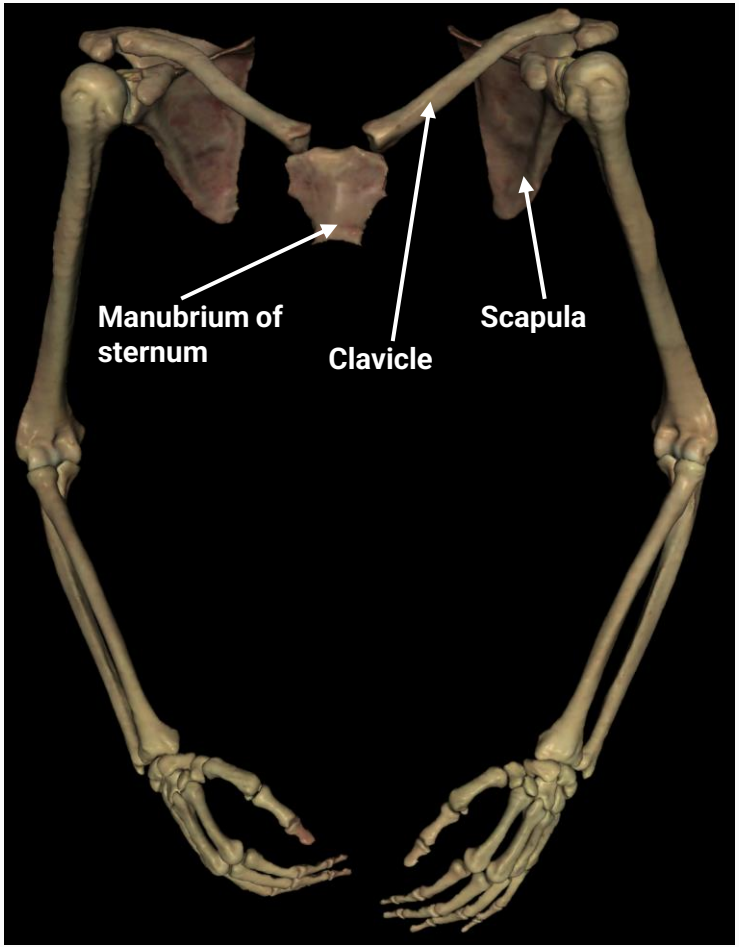
Note: The Visible Human from VH dissector is not in anatomical orientation.

Skeletal System: Appendicular Skeleton

Key Points:

The **scapula** (shoulder blade) and the **clavicle** (collar bone) both play important roles in connecting the upper limb to the axial skeleton

Notice the **clavicle** connecting to the **sternum** at the midline via the sternoclavicular joint



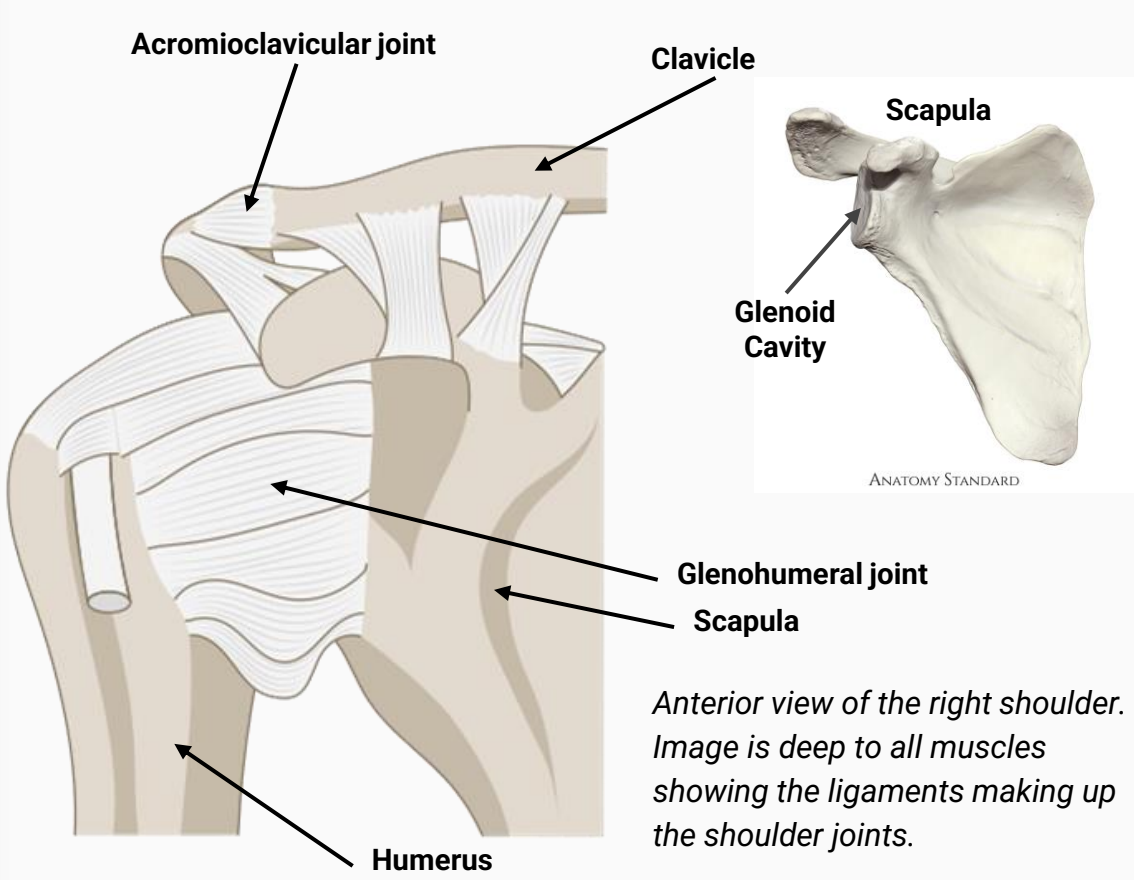
Skeletal System: Appendicular Skeleton

Key points:

Observe the **scapula** and **clavicle** meeting the **humerus** forming several joints:

Glenohumeral joint- main “ball and socket” joint formed by the head of the **humerus** and the glenoid cavity of the **scapula**

Acromioclavicular Joint- the lateral portion of the **clavicle** meets the **acromion** process (portion of the **scapula**)

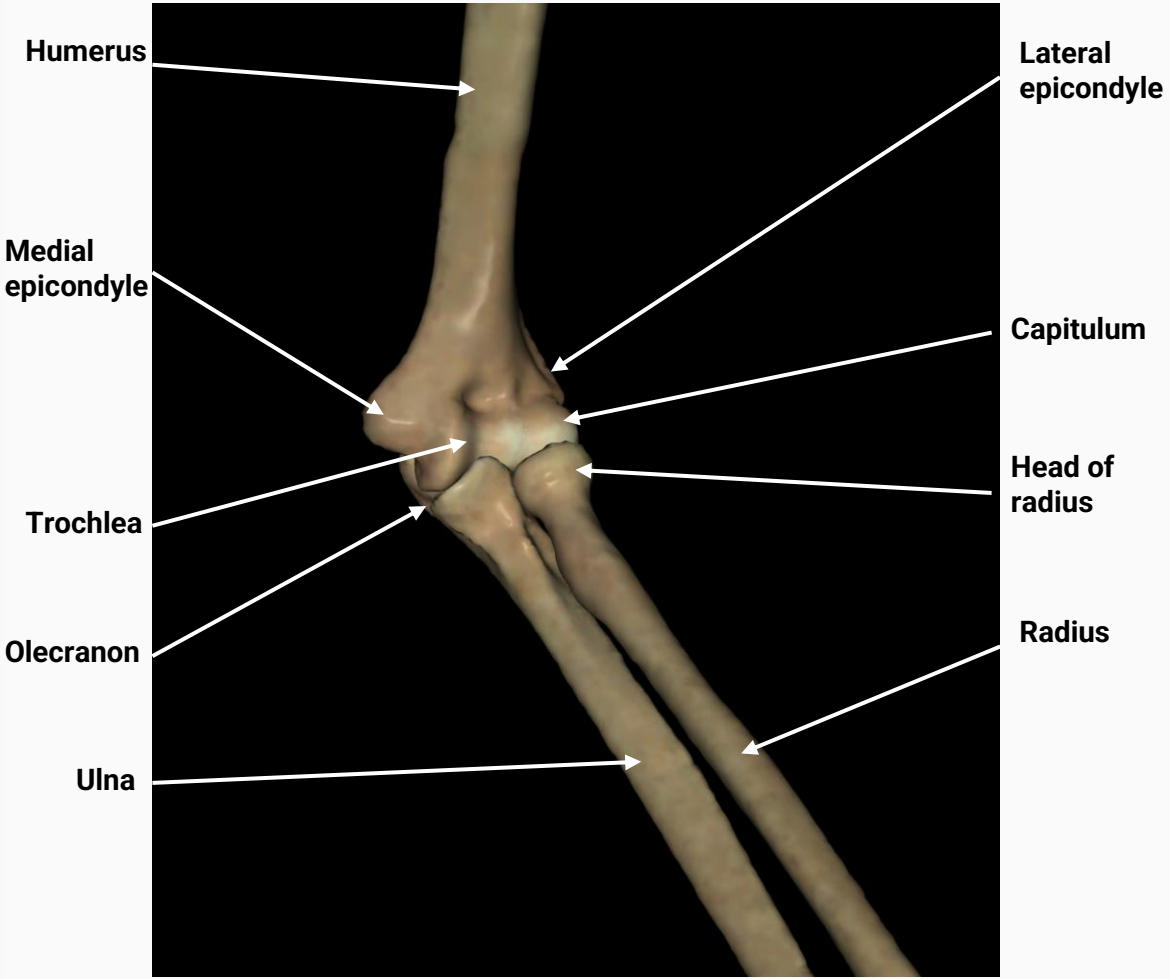


Anterior view of the right shoulder. Image is deep to all muscles showing the ligaments making up the shoulder joints.

Skeletal System: Appendicular Skeleton

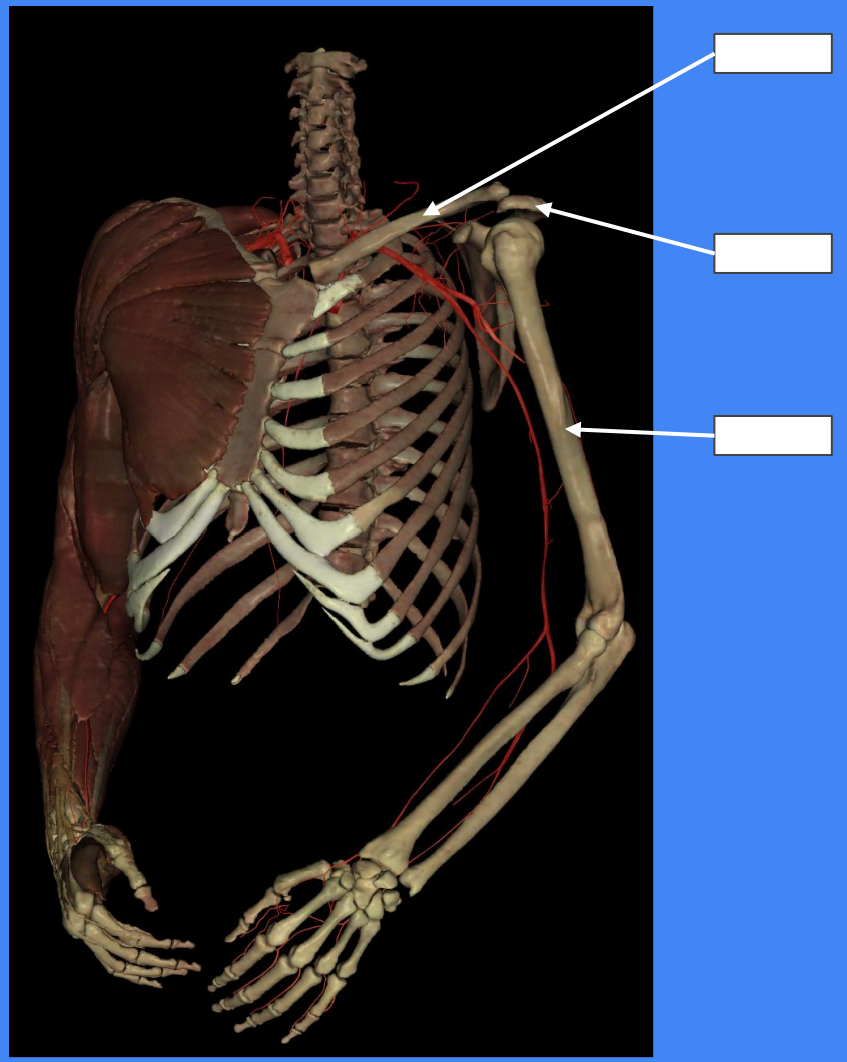
Notice the relationships of the elbow joint:

1. **Capitulum** of the humerus meets the **head of the radius**
2. **Trochlea** of the humerus meets the **olecranon** of the ulna.



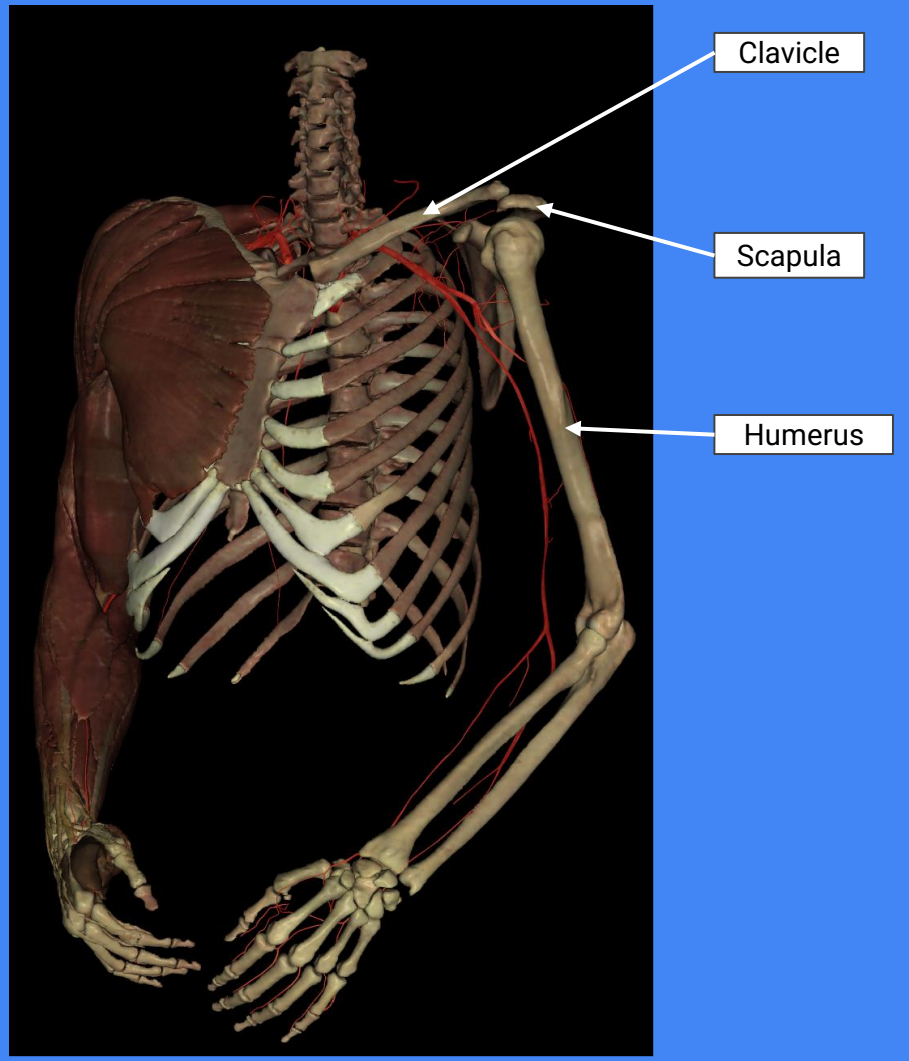
Practice

Can you identify these three bones?



Practice

Answer Key:

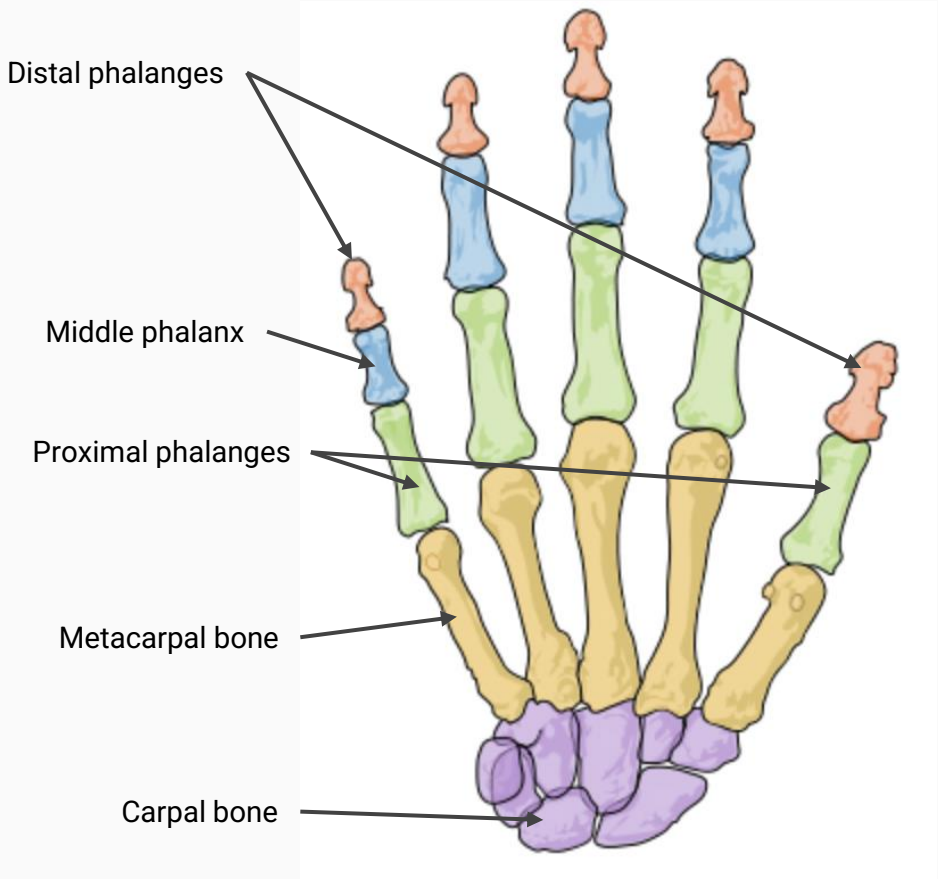


Skeletal System: Appendicular Skeleton

Carpals- 8 wrist bones connecting the distal forearm with the metacarpals

Metacarpals- numbered 1-5 lateral → medial

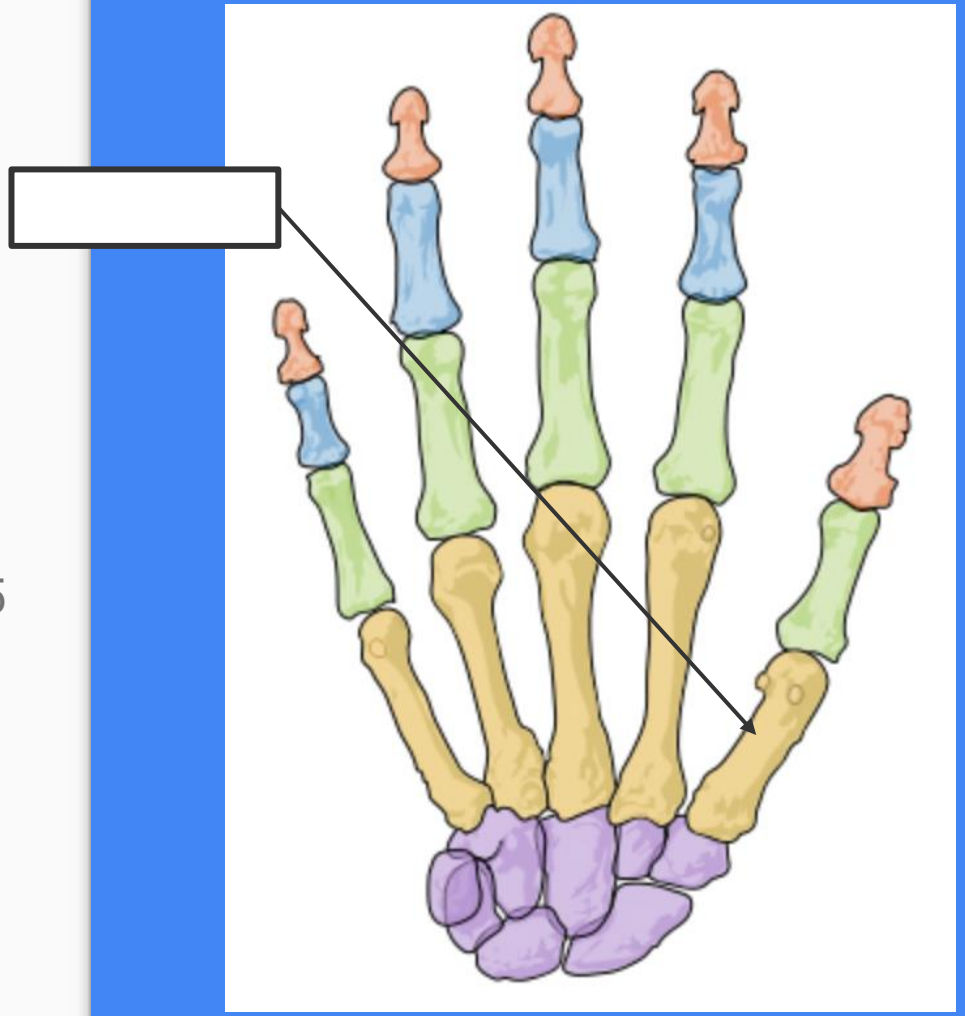
Phalanges- proximal, middle, distal bones of the fingers (notice the thumb only has proximal and distal phalanges)



Note: the thumb is lateral when in anatomical position

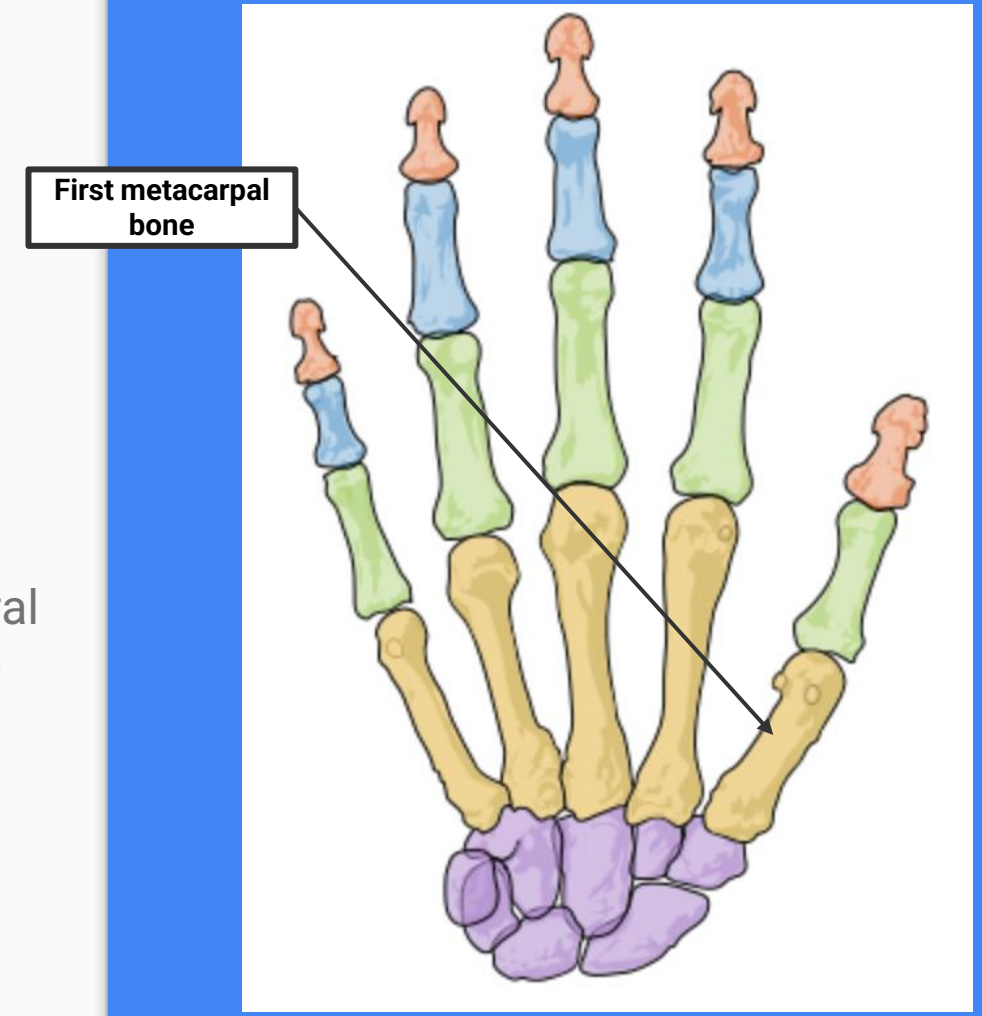
Practice

1) Practice numbering the digits 1-5
2) Identify the bone in the image



Practice

1) The digits are numbered 1-5 lateral to medial starting with the thumb
2) First metacarpal bone



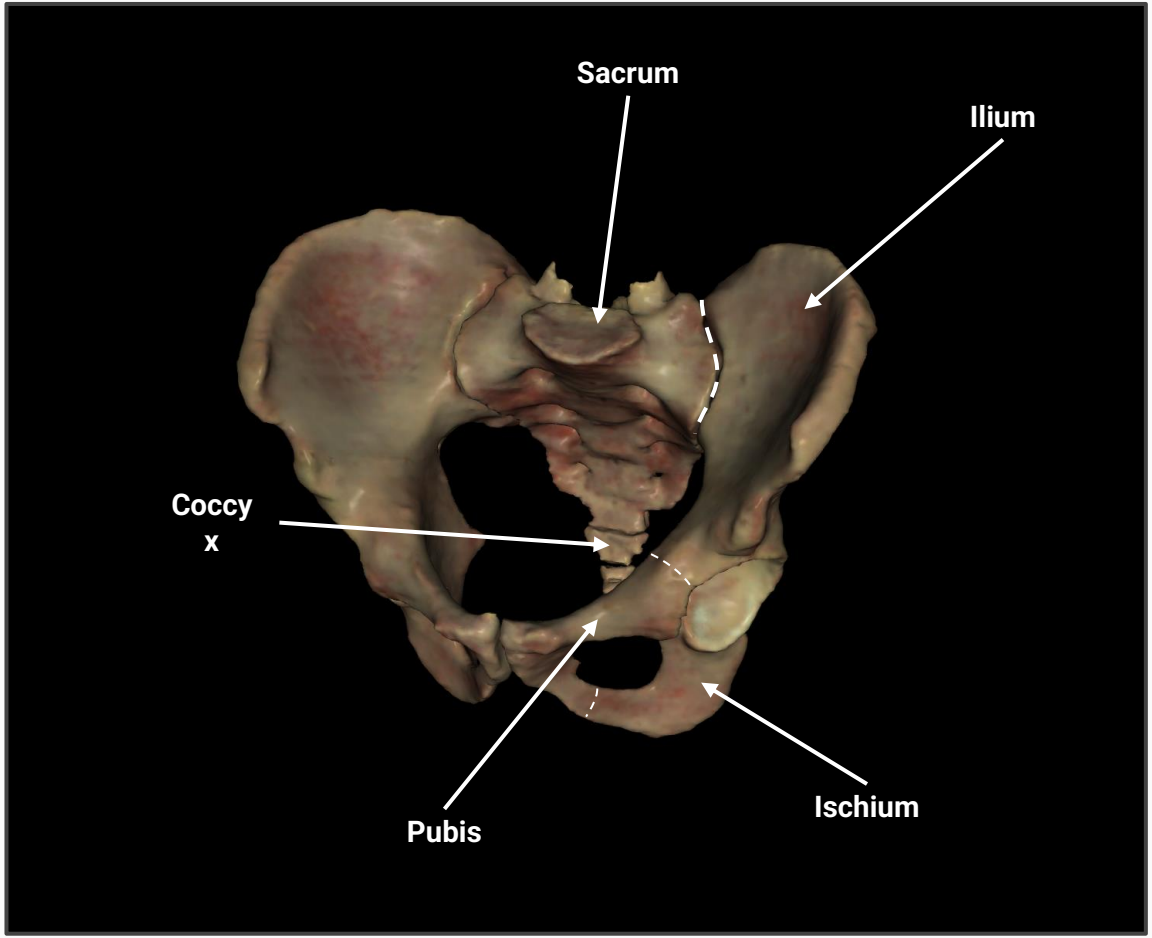
Skeletal System: Appendicular Skeleton

Next explore the pelvis which serves as the transition between the axial and appendicular skeleton of the lower limb

Major bones:

Ilium, ischium, pubis, sacrum, coccyx

The ilium, ischium, and pubis together are known as the *os coxa*.



Orientation: this is an antero-supero-lateral view of the pelvis

Skeletal System: Appendicular Skeleton

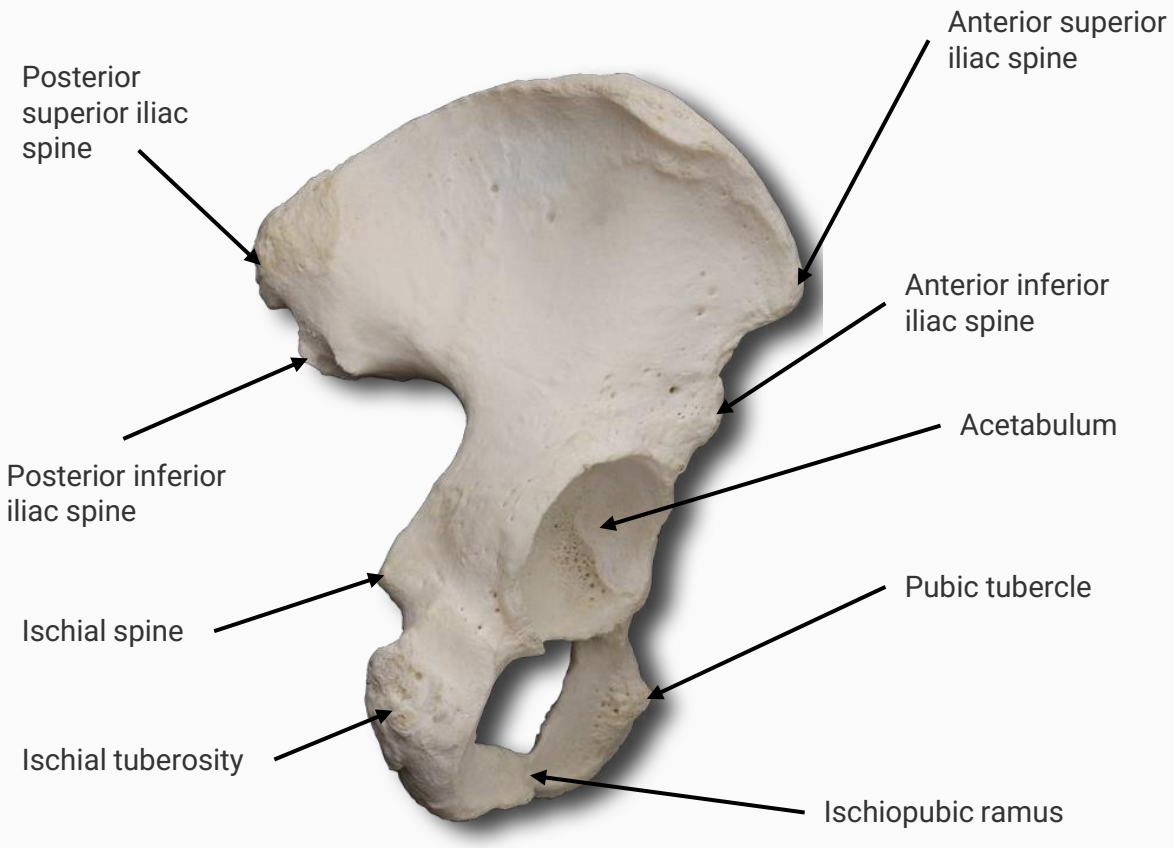
When examining the pelvic bones it is important to orient:

First, identify the **acetabulum**, which is the socket of the hip joint and therefore tells us we are on the lateral surface of the hip

Next, identify the **pubic tubercle** anteriorly

Therefore, we know we are looking at a postero-lateral view of the right hip using those two landmarks.

The various other labeled bony landmarks can be helpful in orienting you too. You will not be tested on them.

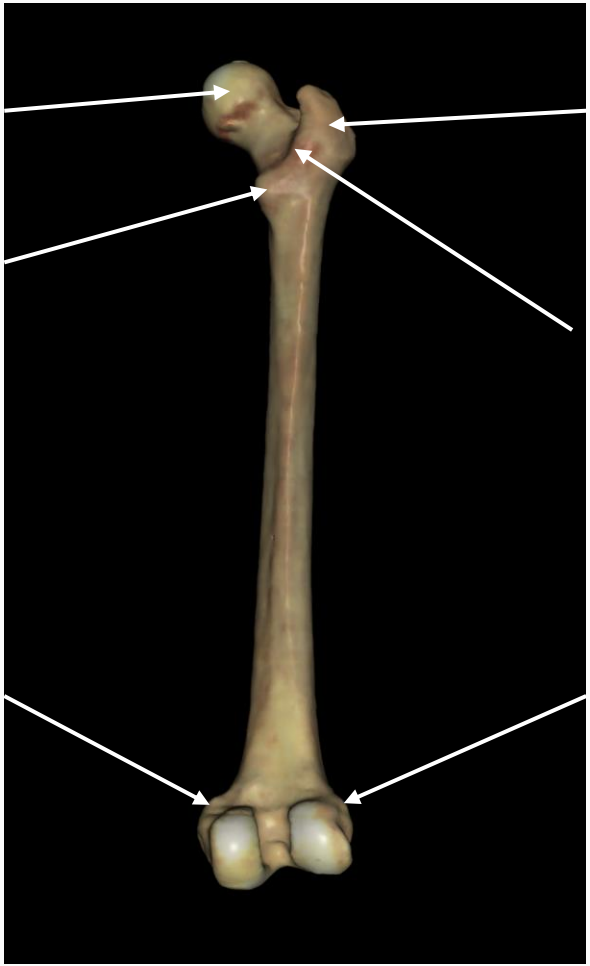


Orientation: this is a postero-lateral view of the right hip

Skeletal System: Appendicular Skeleton

Moving distally from the hip, notice the head of the **femur** which articulates with the **acetabulum** of the hip

The femur is the strongest bone in the body and is the sole long bone of the proximal leg



Orientation: this is an posterior view of the right femur

Skeletal System: Appendicular Skeleton

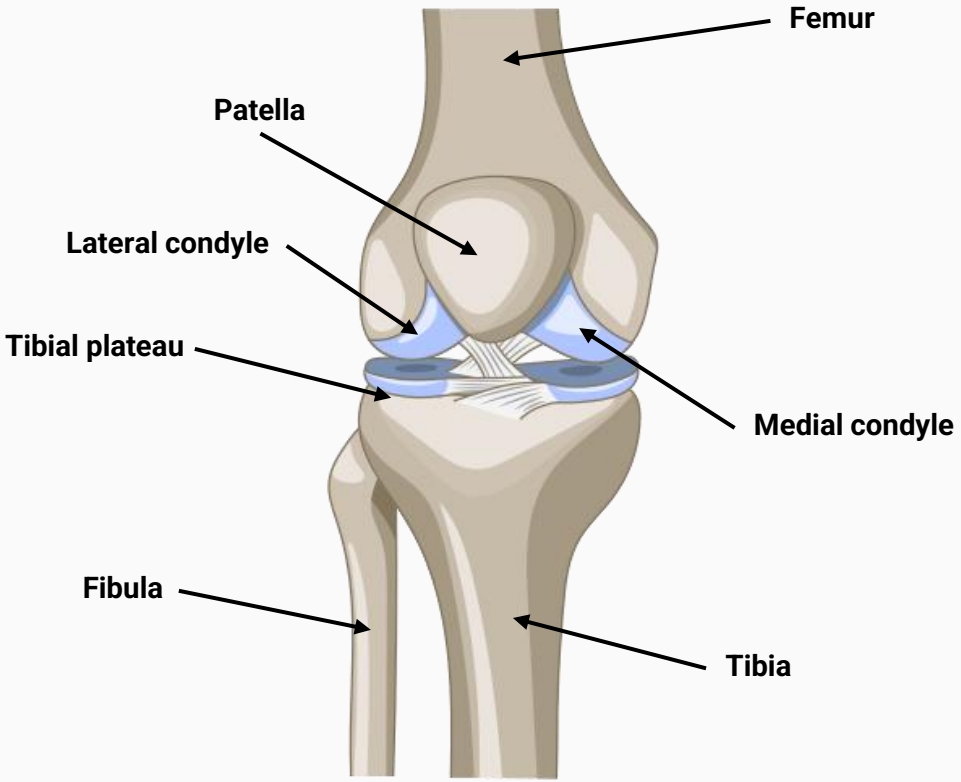
Moving distally, notice the medial and lateral **femoral condyles** articulating with the **tibial plateau** to make the knee joint

Patella- “kneecap”found anterior to the knee joint (not shown)

Two long bones make up the distal legs:

Tibia- found medially, contributes to the knee joint

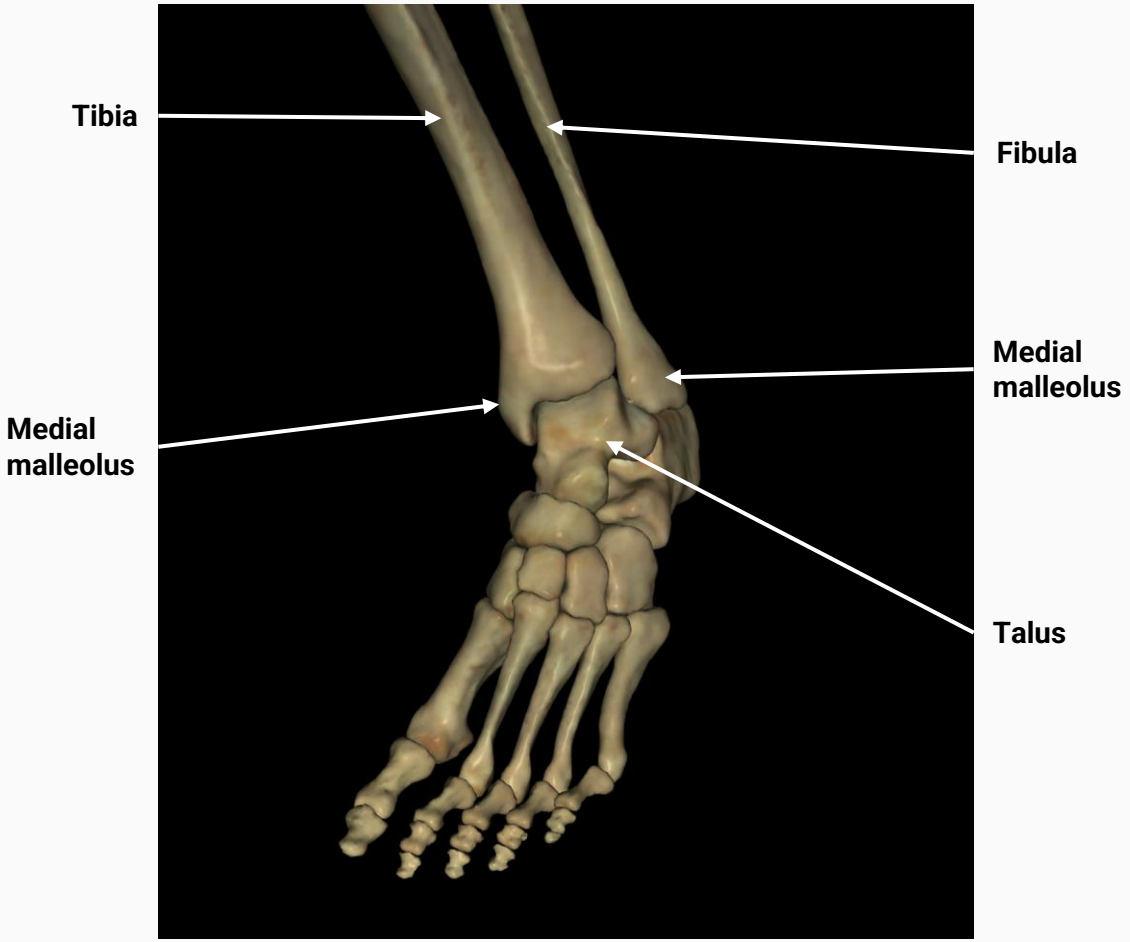
Fibula- skinny, non weight-bearing bone found laterally



Orientation: this is an anterior view of the right knee joint

Skeletal System: Appendicular Skeleton

At the distal leg, the tibia and fibula combine with the talus to create the ankle joint. The bony prominences of the fibula and tibia create the **medial** and **lateral malleoli**. When discussing the “ankle” in typical conversation, we are usually referring to these prominences.

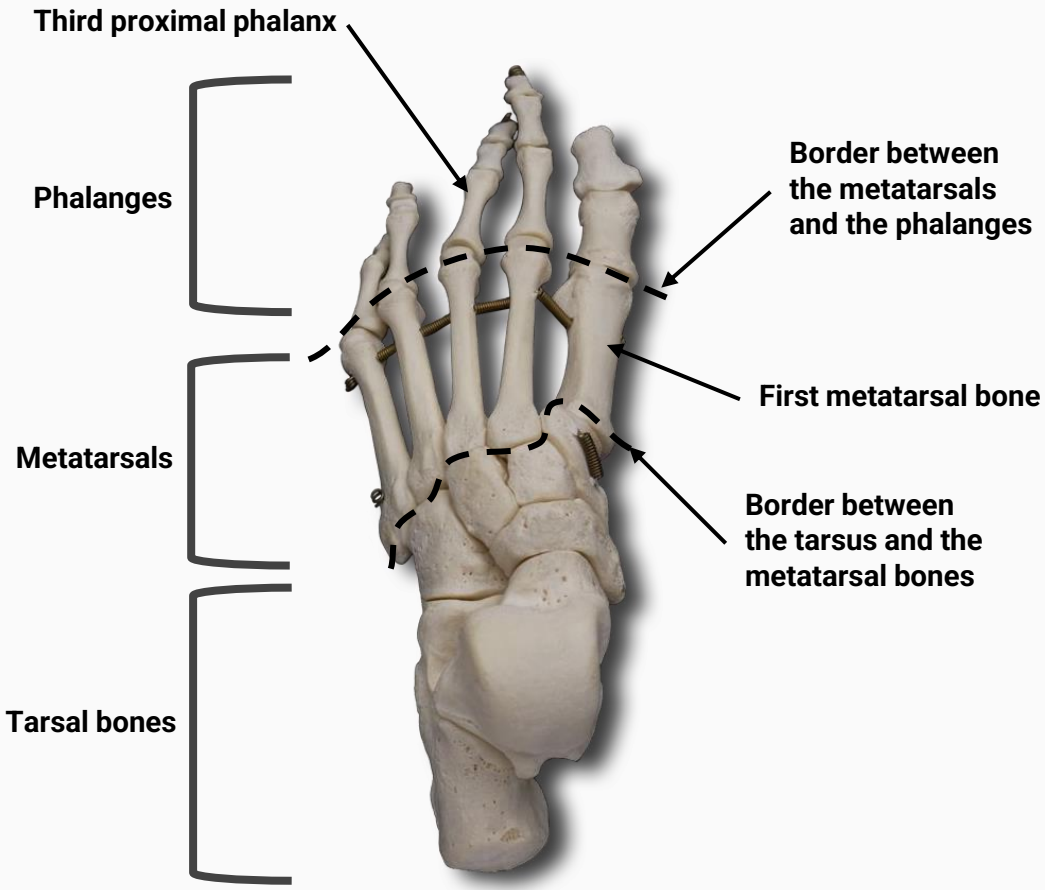


Orientation: this is an anterior view of the left foot

Skeletal System: Appendicular Skeleton

The tarsus (proximal foot)- consists of 7 bones that articulate with the **metatarsals** distally.

Similar to the hand, there are three **phalanges** for digits 2-5 and two **phalanges** for the first digit.



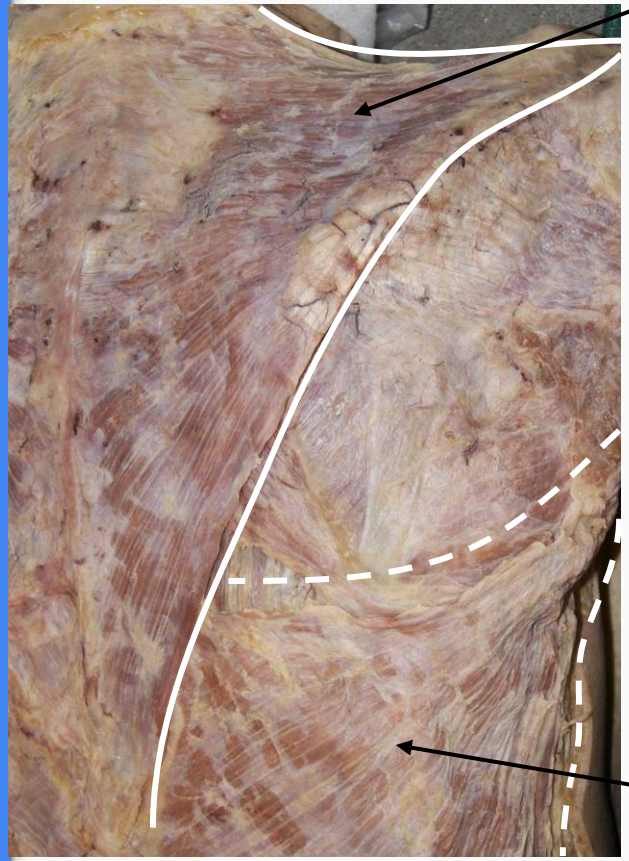
Orientation: this is a dorsal view of the left foot

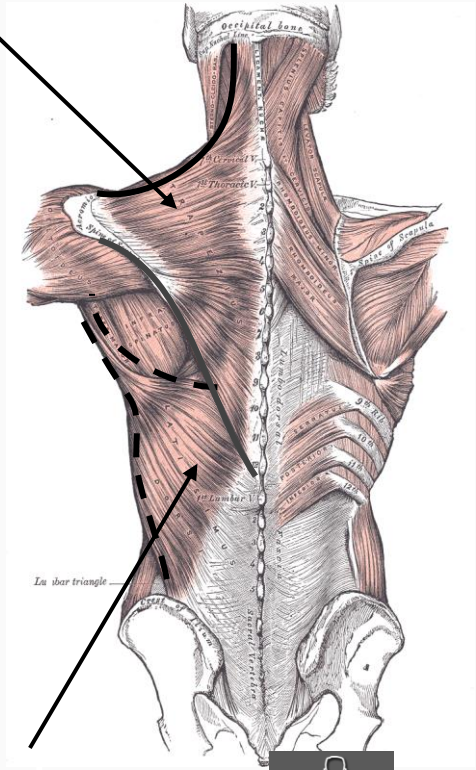
Muscular System

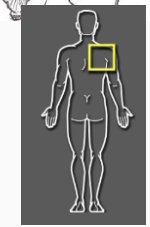
Superficial Back Muscles

Trapezius- pair of triangular muscles with attachments superiorly on the occipital bone of the skull to the T12 vertebrae inferiorly and laterally over the spine of the scapula. Functions to stabilize and move the scapula

Latissimus- broad flat muscle occupies the dorsal inferior thorax. Functions to move the upper limb as it attaches on the humerus.







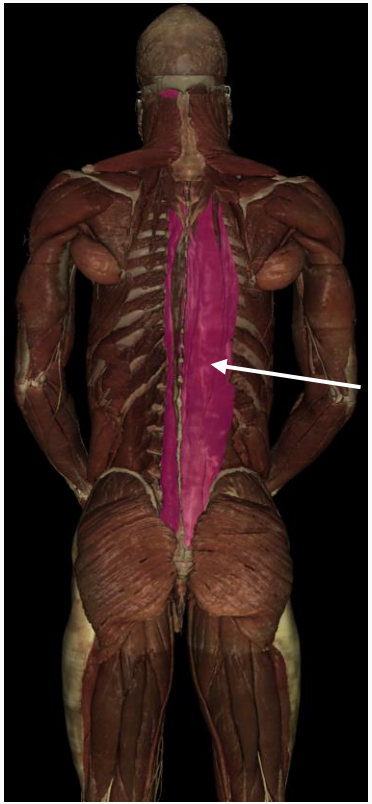
Left image orientation: posterior right upper back

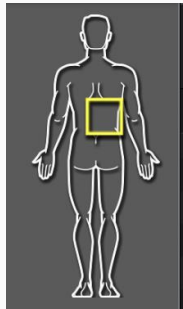
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 409.

Deep Back Muscles

Erector spinae- group of deep back muscles that function to extend and laterally rotate the spine

Note: in the image, the trapezius and latissimus dorsi (superficial back muscles) are reflected and are not seen



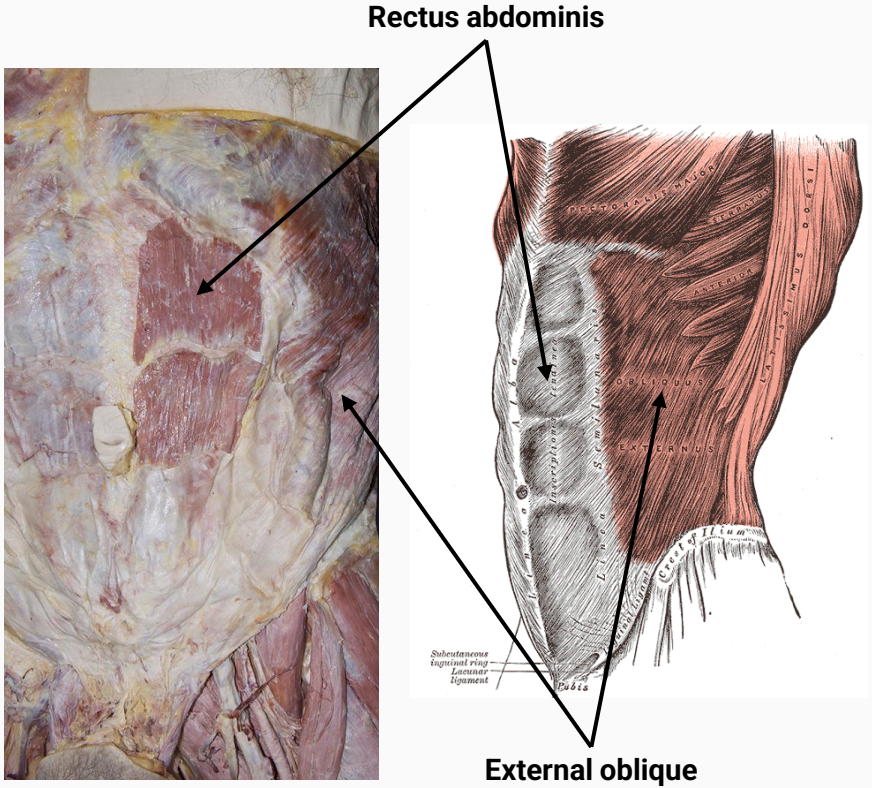


Right image orientation: posterior deep middle/lower back

Abdominal Muscles

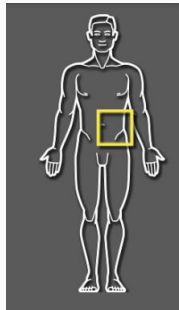
Rectus abdominis- main flexor of the trunk

External oblique- found lateral to the rectus abdominis covering the rib cage. Functions to twist and assist in flexion of the trunk.



Left image orientation: anterior view of abdomen

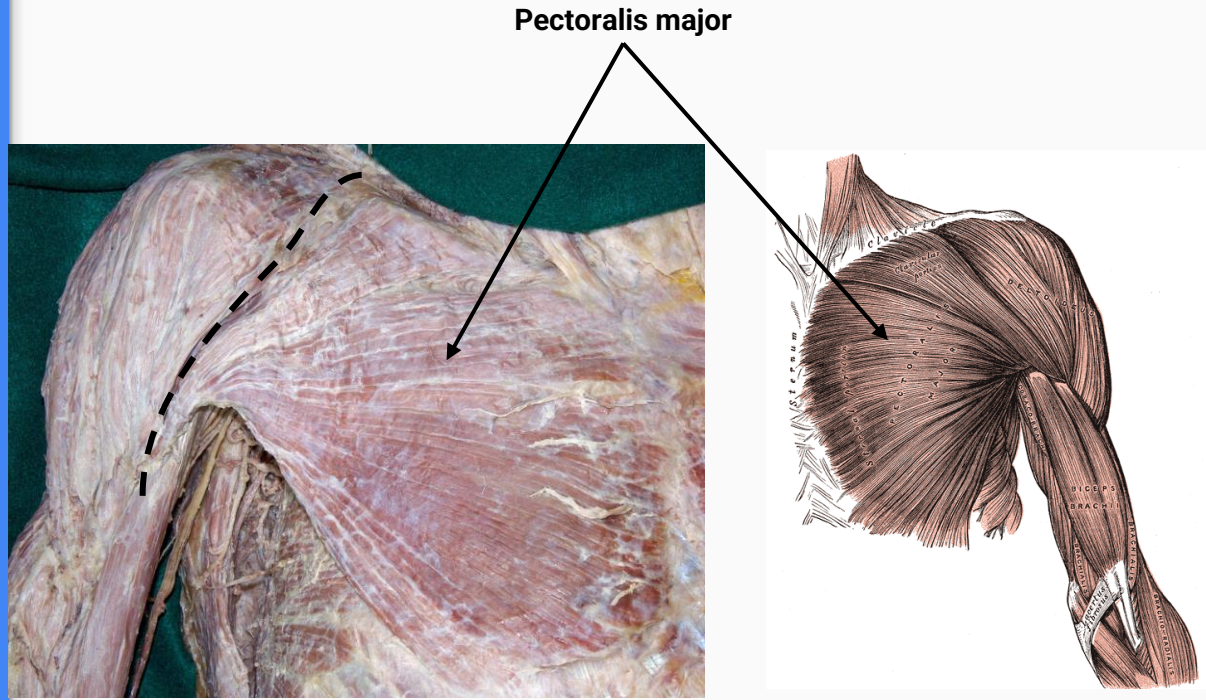
Right image orientation: left lateral view of abdomen



Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 392.

Pectoralis Major

Pectoralis Major- functions to flex, adduct and internally rotate the humerus. Has attachments on the humerus, clavicle, scapula



Left image orientation: anterior view of right arm and chest

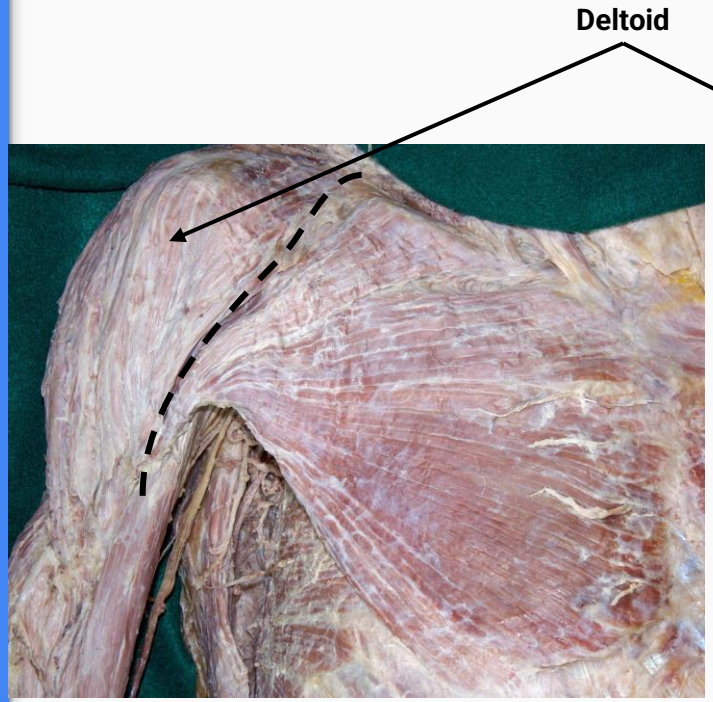
Right image orientation: anterior view of left arm and chest

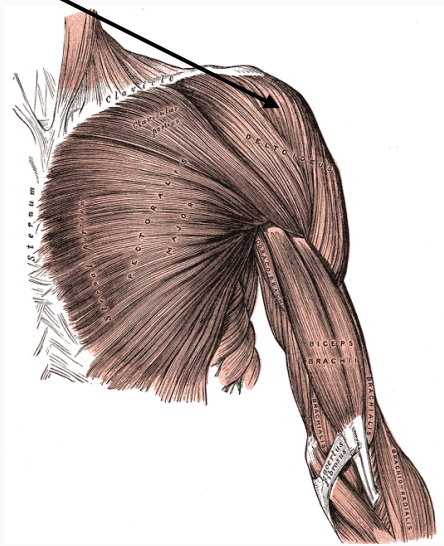
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 410.

Upper Limb & Shoulder Muscles

Deltoid- functions to stabilize the glenohumeral joint and is the main abductor of the upper limb.

Note: the deltopectoral groove separates the deltoid from the pectoralis major





Left image orientation: anterior view of right arm and chest

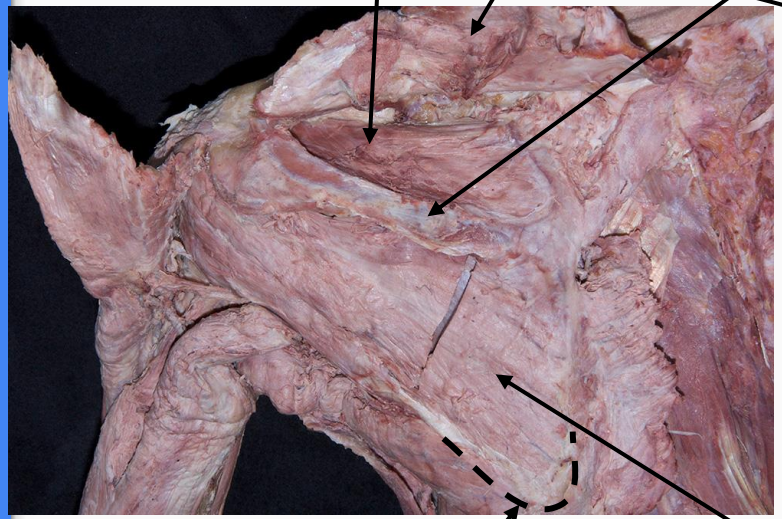
Right image orientation: anterior view of left arm and chest

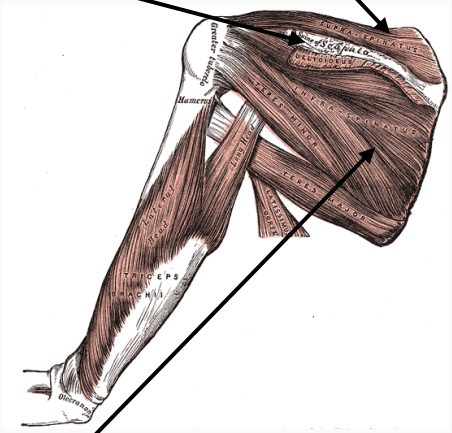
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 410.

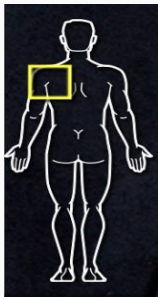
Upper Limb & Shoulder Muscles

The **spine of the scapula** (seen posteriorly) is used as a landmark..

Superior to the spine of the scapula lies the **supraspinatus** and below lies the **infraspinatus**. The supraspinatus muscle is normally covered by the trapezius muscle, however it is reflected in the image. Both muscles are members of the rotator cuff.







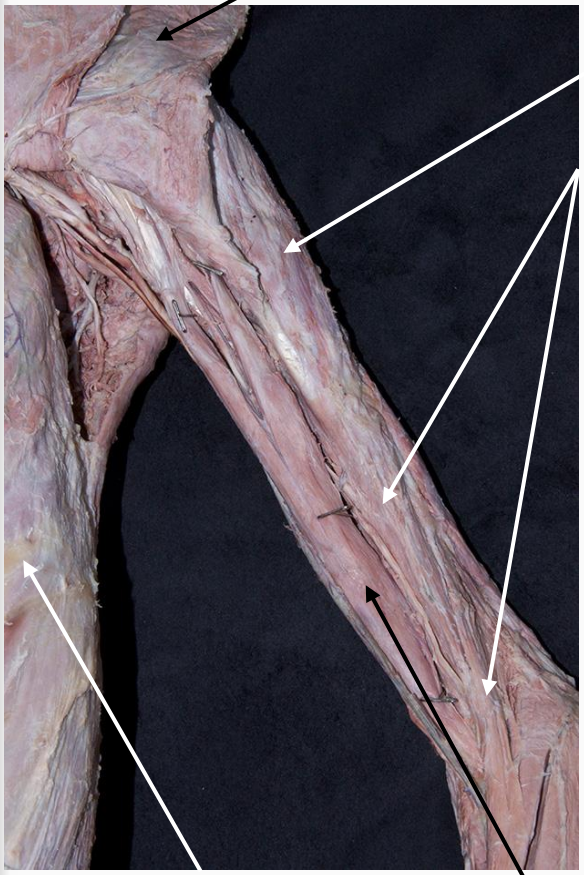
Orientation: this is a posterior view of the left shoulder

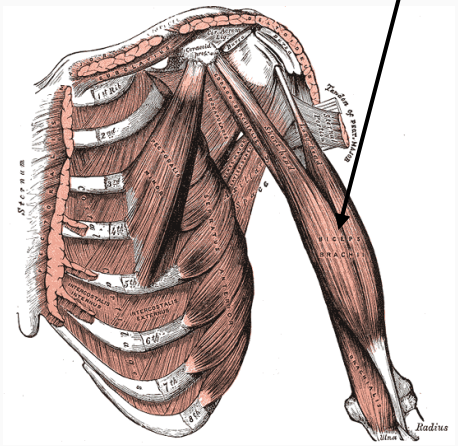
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 412.

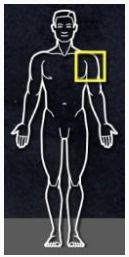
Upper Limb & Shoulder Muscles

Biceps Brachii-two muscles on the anterior portion of the arm that function to flex and supinate (face one's palm towards the sky) the arm

Notice that these also have different proximal attachments







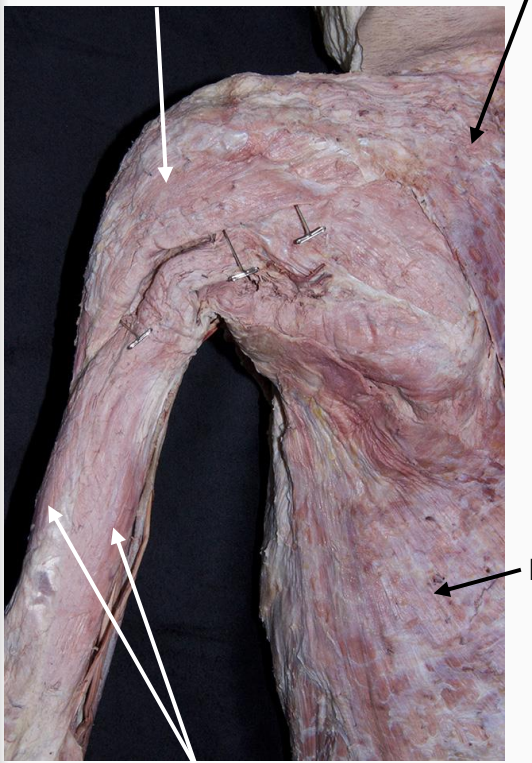
Orientation: this is an anterior view of the left upper limb

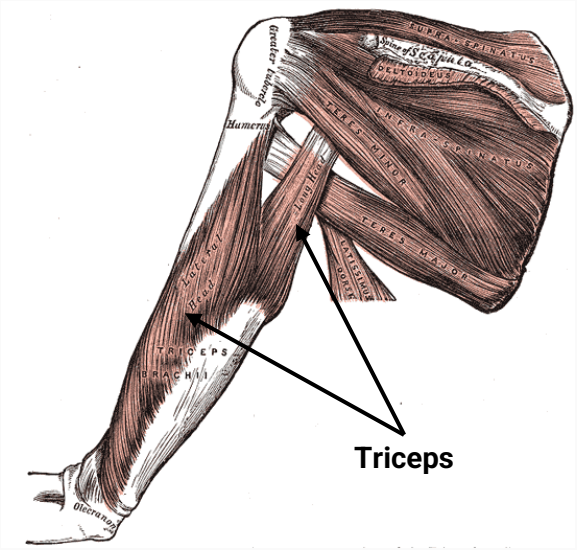
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 411.

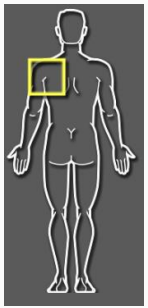
Upper Limb & Shoulder Muscles

Triceps Brachii- a group of three thick muscles on the posterior part of the arm that function to extend the arm at the elbow.

Notice the different heads of the triceps attach at different locations proximally







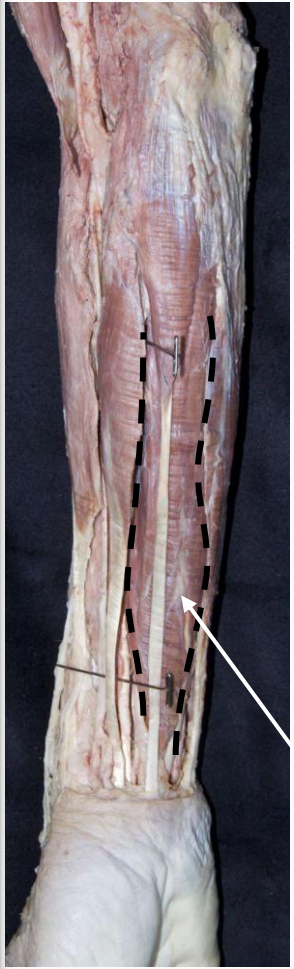
Orientation: this is a posterior view of the left upper limb

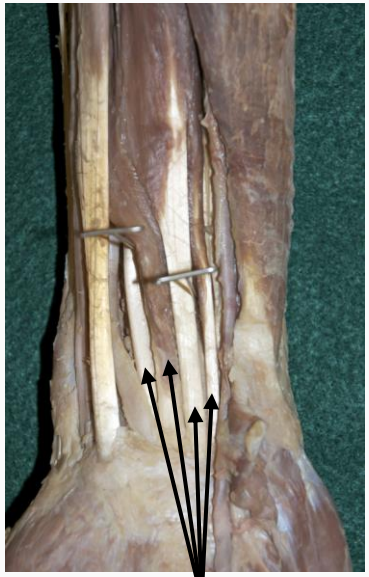
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 412.

Upper Limb & Shoulder Muscles

Flexor digitorum superficialis- flexor of the medial four digits.

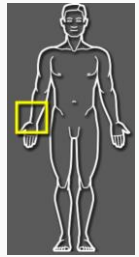
Its broad muscle belly lies in the second layer of forearm muscles and can be difficult to appreciate. However, it sends tendons to each of the medial four digits which can be easily seen distally as they approach the hand.





Flexor digitorum superficialis tendons to digits 2-5

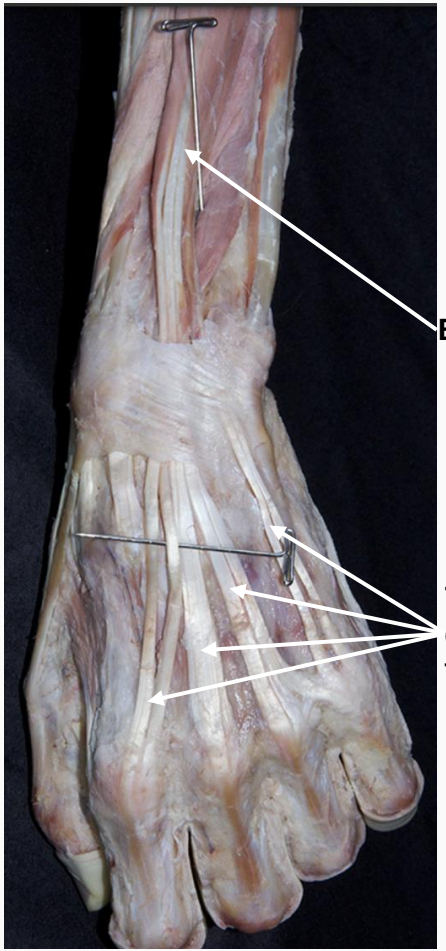
Flexor digitorum superficialis

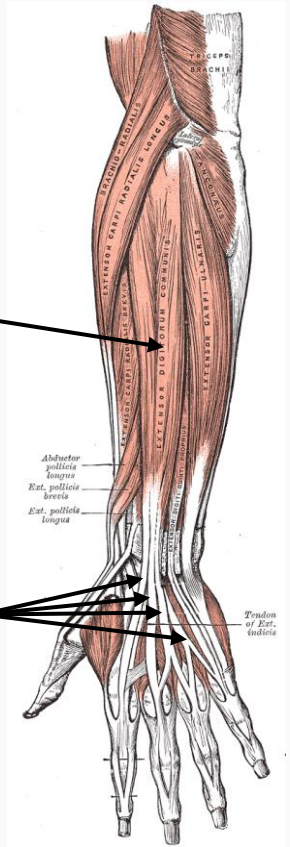


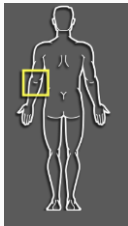
Orientation: anterior views of the <u>right</u> forearm

Upper Limb & Shoulder Muscles

Extensor digitorum- located on the posterior forearm. Sends four tendons to the posterior phalanges to extend the medial 4 digits.







Orientation: this is a posterior view of the left forearm and hand

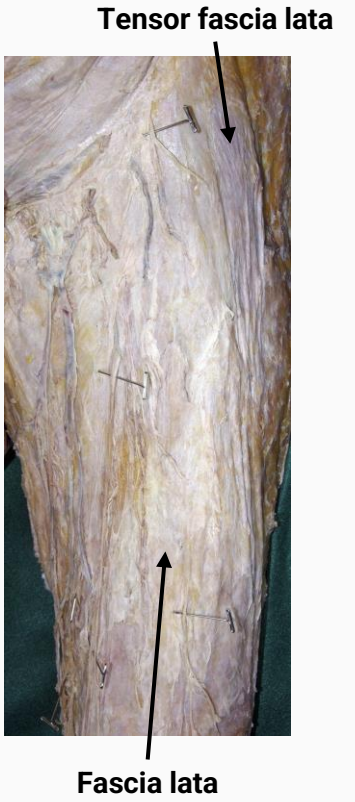
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 418.

Hip & Lower Limb

Fascia lata- fascia that covers the muscles of the thigh

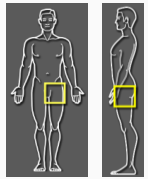
Tensor fascia lata- a muscle of the anterolateral thigh that lies within the iliotibial (IT) band.

The TFL muscle is difficult to appreciate in the image, however be able to recognize that the I**T band** as a thickening of the fascia lata on the lateral surface of the thigh and the TFL muscle lies within it.



Left image: anterior view of left thigh

Middle/right images: lateral view of left thighs

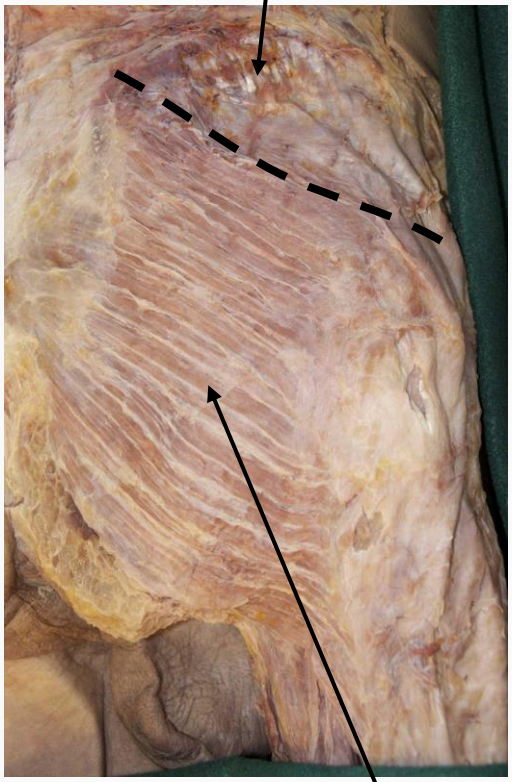


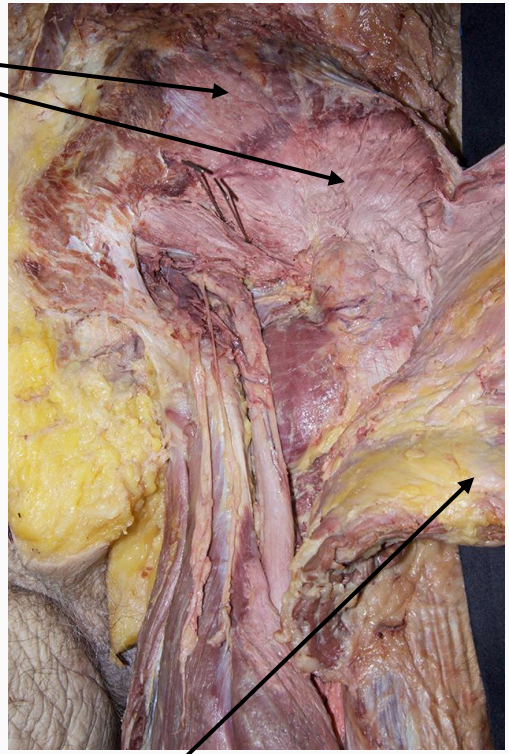
Hip & Lower Limb

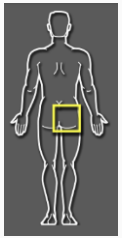
Gluteus maximus- extension and lateral rotation of the thigh at the hip joint. Attaches to the posterior iliac crest (of os coxae) and is continuous with the IT band laterally

Gluteus medius- lies deep to and slightly anterior to gluteus maximus; main action is abduction of the hip.

Note: Best observed with gluteus maximus reflected laterally however can still be appreciated without.







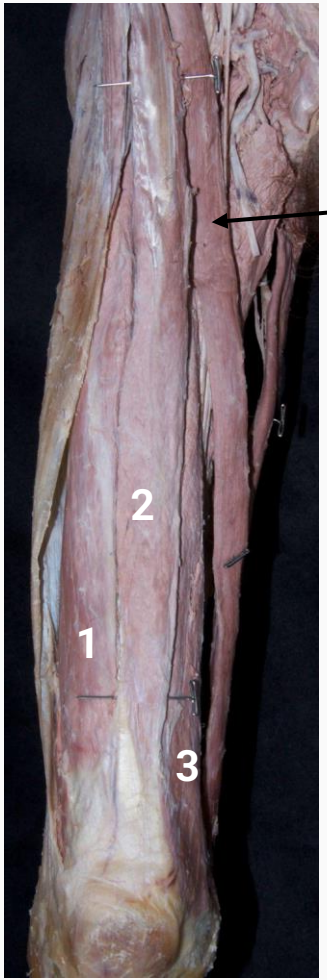
Orientation: this is a right posterior view of the hip

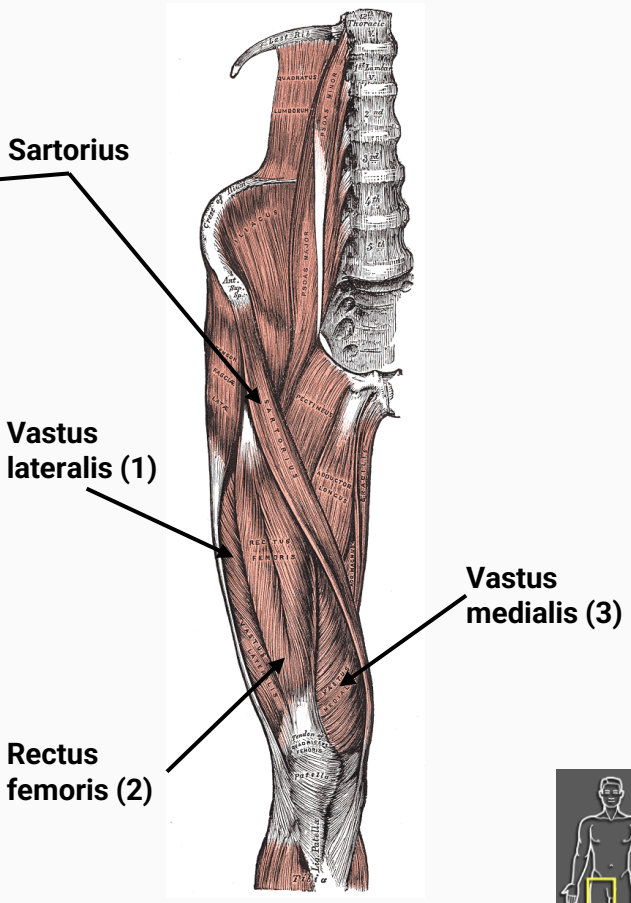
Hip & Lower Limb

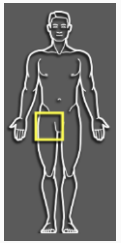
Quadriceps- group of four extensor muscles of the anterior thigh that function to extend the leg at the knee

Four named muscles: **vastus lateralis**, **rectus femoris**, **vastus medialis**, **vastus intermedius** (directly deep to rectus femoris and not visible in the images)

Sartorius- flexor, external rotator and adductor of the leg. Longest muscle in the body spanning both the hip and knee joints.







Orientation: this is an anterior view of the right thigh

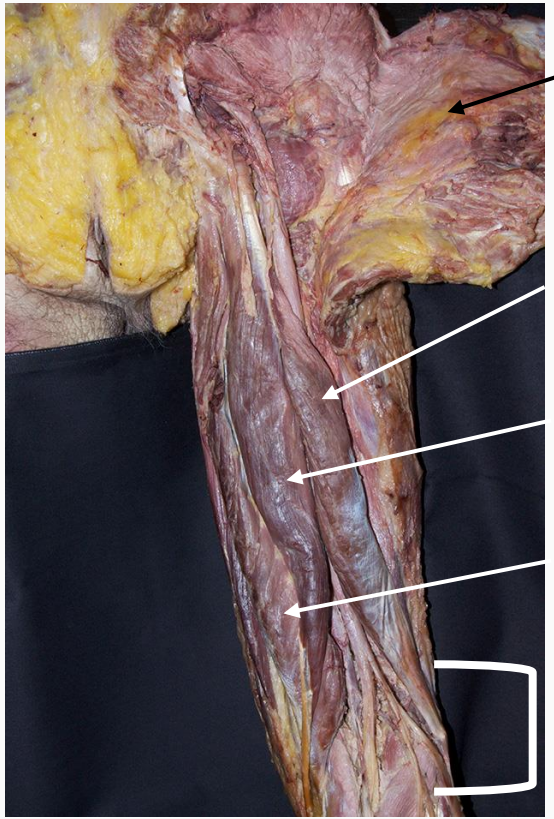
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 430.

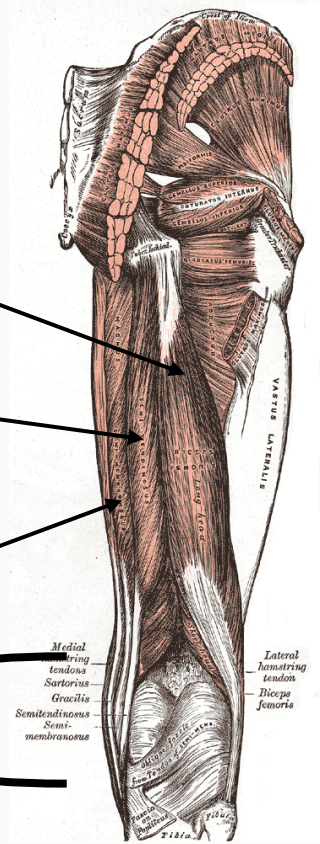
Hip & Lower Limb

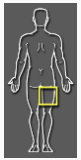
Hamstrings (from lateral to medial):

Biceps femoris, semitendinosus, semimembranosus

All function to flex the knee and extend the hip joint.





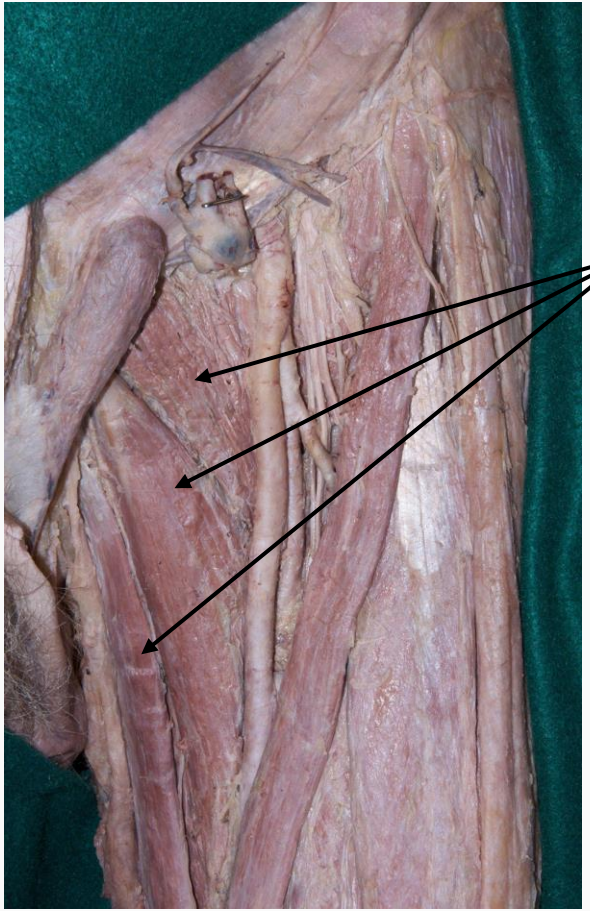


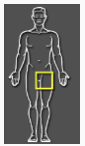
Orientation: this is a right posterior view of the thigh

Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 434.

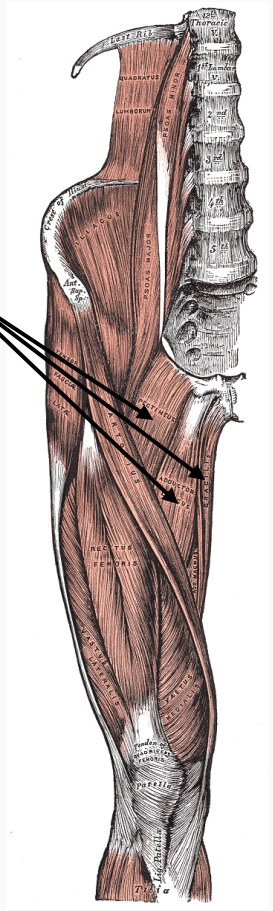
Hip & Lower Limb

Adductor group- group of muscles that go from the pelvis to the medial thigh and knee and function to adduct the leg





Adductor muscles

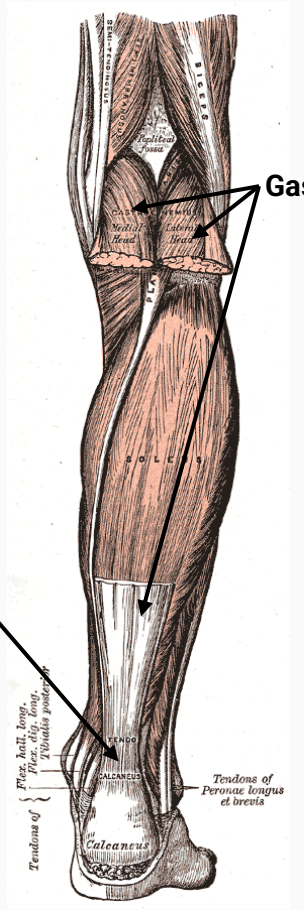


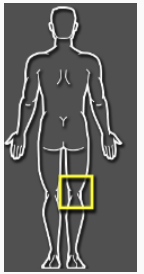
Left image orientation: anterior view of left upper thigh
Right image orientation: anterior view of right upper thigh

Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 430.

Hip & Lower Limb

Gastrocnemius- two main calf muscles of the leg which function to plantar flex the foot and flex the knee. Share a common attachment distally via the achilles tendon.





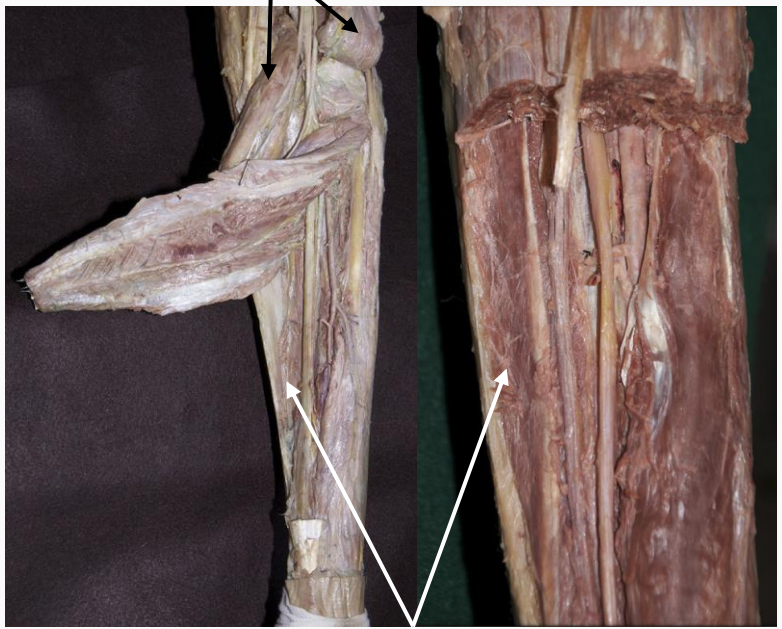
Orientation: this is a posterior view of the right leg

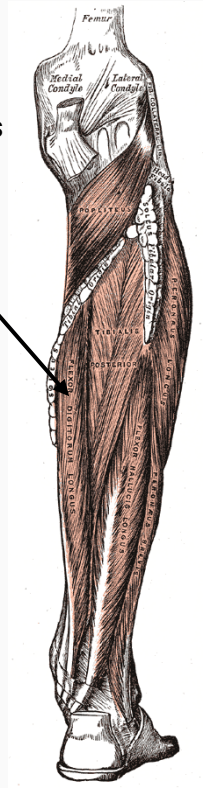
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 438.

Hip & Lower Limb

Flexor digitorum longus- deep muscle located on the medial portion of the lower limb; responsible for flexion of digits 2-5

Note- gastrocnemius and soleus (superficial calf muscles) are cut in these images





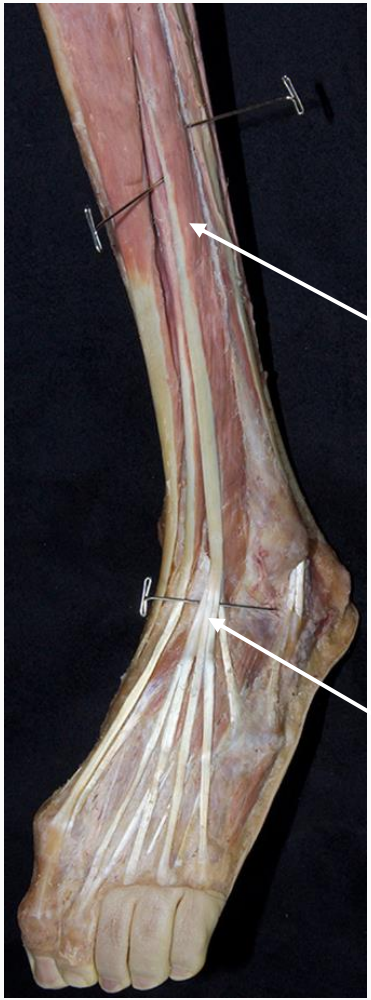
Flexor digitorum longus

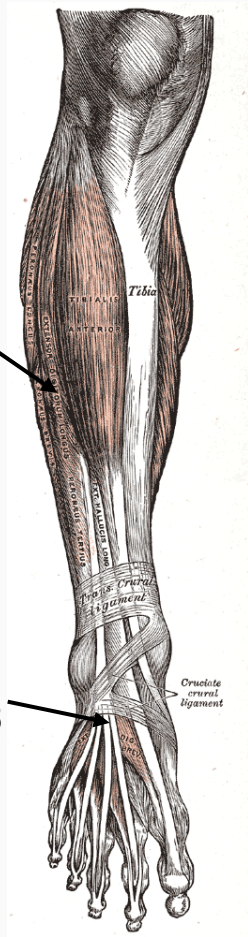
Orientation: this is a posterior view of the right leg

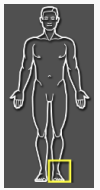
Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 439.

Hip & Lower Limb

Extensor digitorum longus- muscle on the lateral lower limb that extends the lateral four digits







Left image orientation: this is an anterior view of the left leg and foot

Right image: public domain image from *Anatomy of the human body, by Henry Gray. 20th ed., thoroughly rev. and re-edited by Warren H. Lewis*. Obtained via Bartleby.com FIG. 437.

Nervous System

Nervous System

Overview:

- Central Nervous System (CNS)
  - Brain (cerebrum and cerebellum)
  - Spinal cord
- Peripheral Nervous System (PNS)
  - Sciatic nerve
  - Musculocutaneous nerve
  - Radial nerve
  - Median nerve
  - Ulnar nerve
  - Phrenic nerve
  - Sympathetic chain
  - Vagus nerve

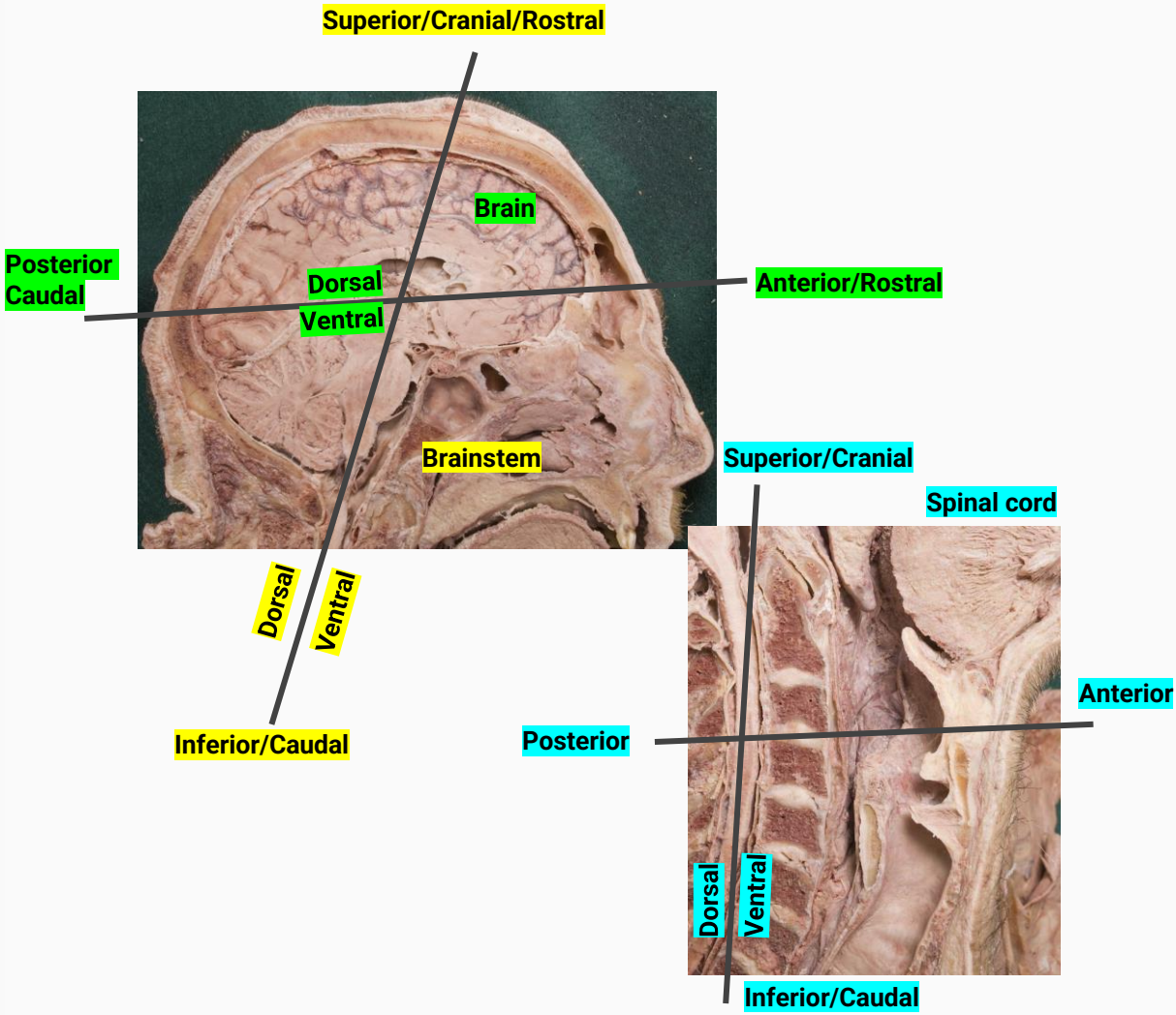
Nervous system - Anatomical Orientation Changes

The anatomical terminology discussed earlier in this atlas applies to the CNS differently due to the way the brain and brainstem/spinal cord embryological development works. The long axis of the cerebrum is different than the long axis of the brainstem/spinal cord.

The meaning of the terms **dorsal/ventral** change depending on which axis you are looking at. However, the terms **anterior/posterior** and **superior/inferior** do **not** change.

Another term, **rostral**, is often used. It means “towards the beak” and regularly takes the place of anterior for the long axis of the cerebrum.

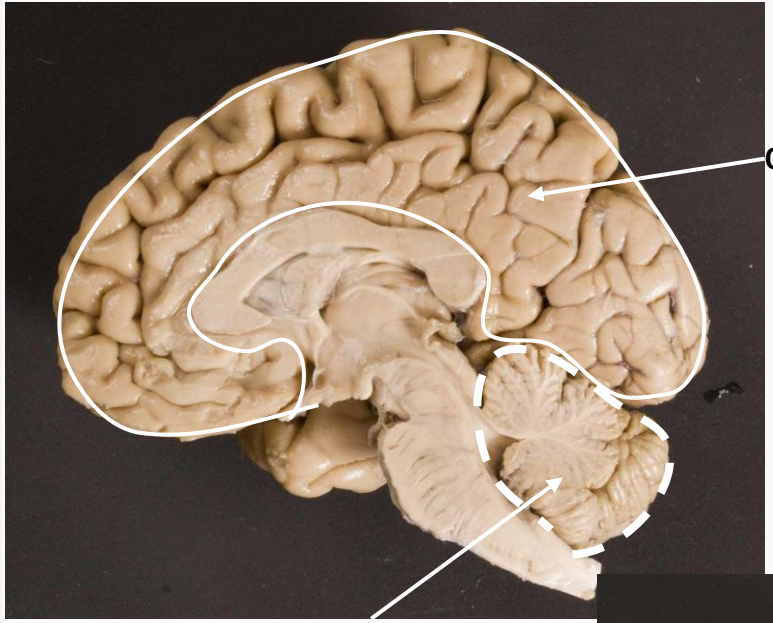
The **brain stem/spinal cord** share similar orienting terms with the rest of the body (ie. anterior, posterior, superior, inferior, proximal, distal, etc.)

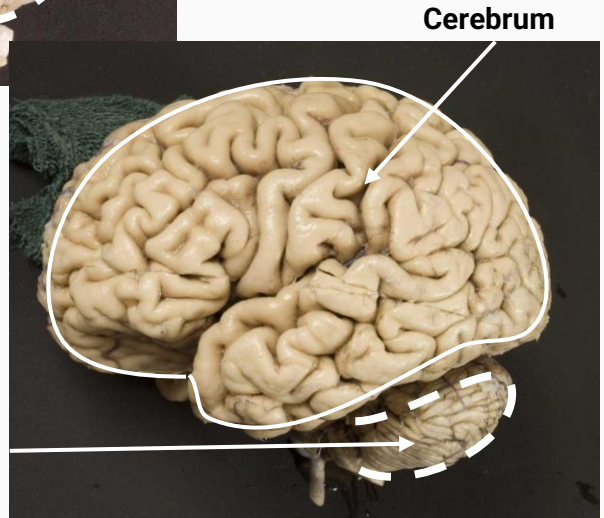


Nervous system – CNS

Brain

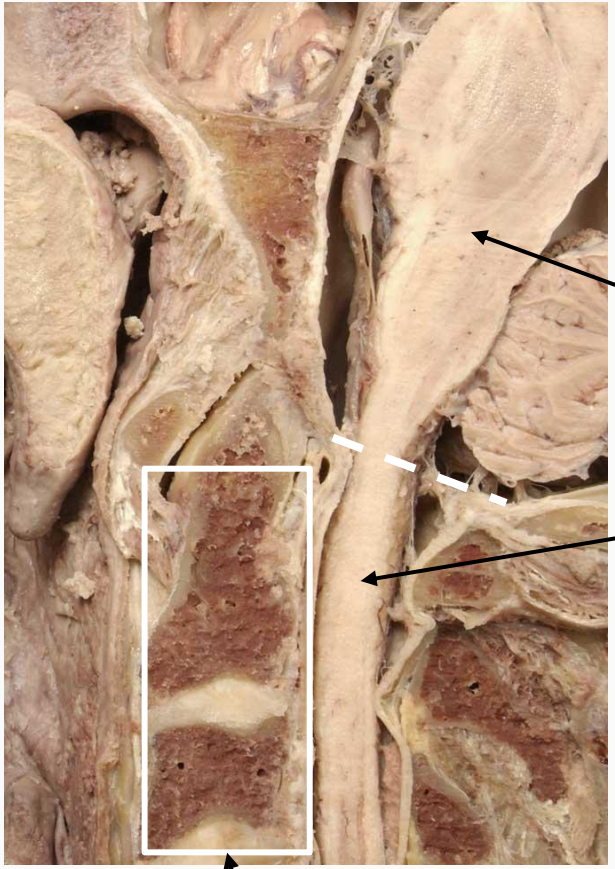
- **Cerebrum**: situated superiorly and composed of multiple lobes contributing to bodily function
- **Cerebellum**: situated inferiorly and responsible for coordinating movement and primitive bodily functions

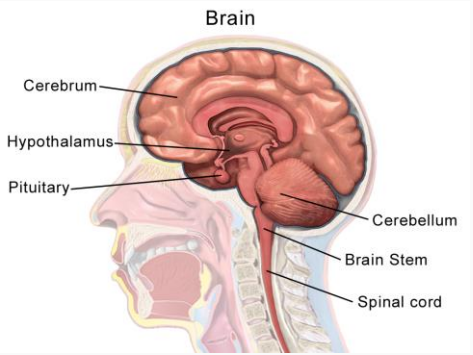




Nervous system – CNS

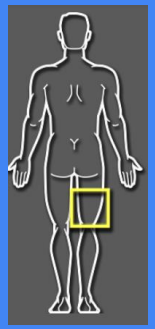
Spinal cord: descends from the brain to the lumbar vertebrae within the vertebral canal to carry nerves throughout the body

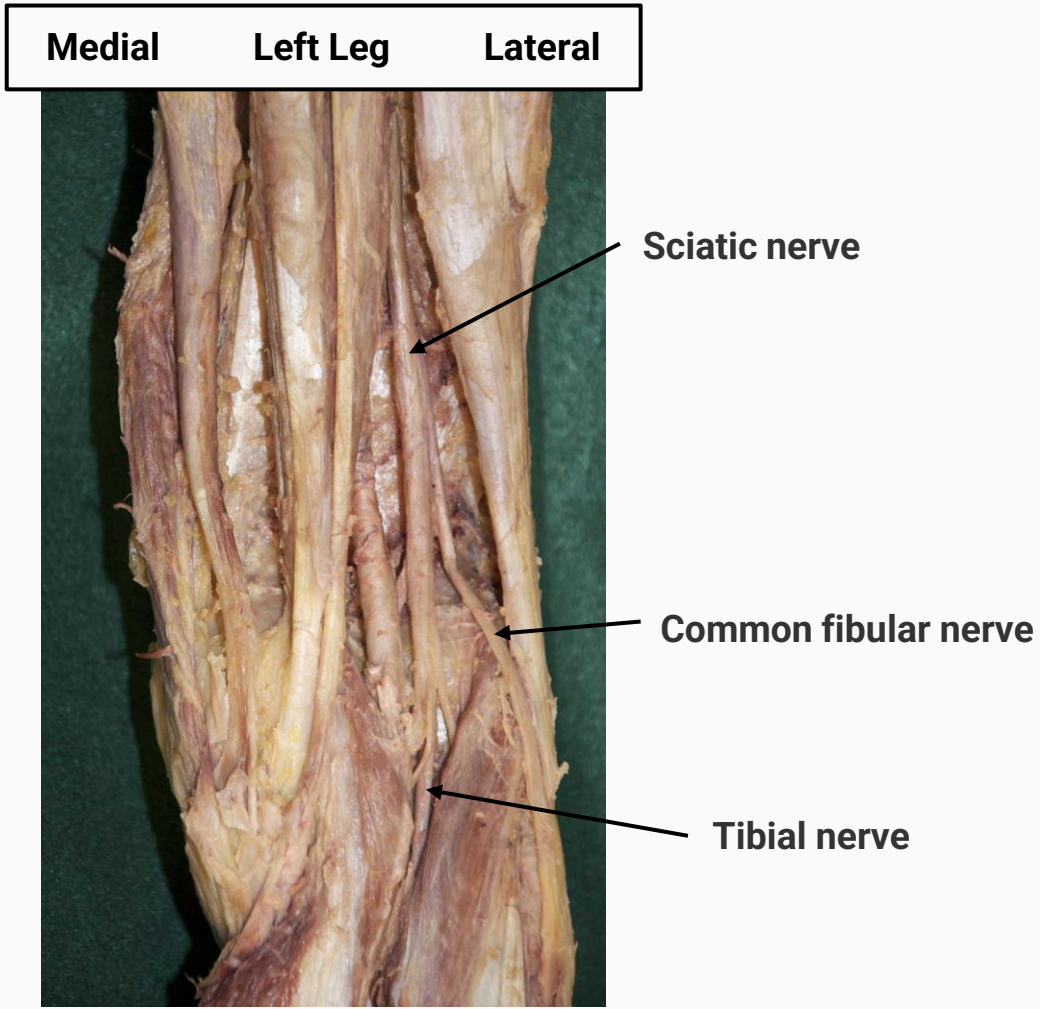




Nervous system – PNS

Sciatic nerve: the largest nerve in the body, made up of the tibial nerve and common fibular (peroneal) nerves that divide further down the leg

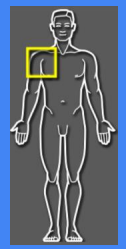




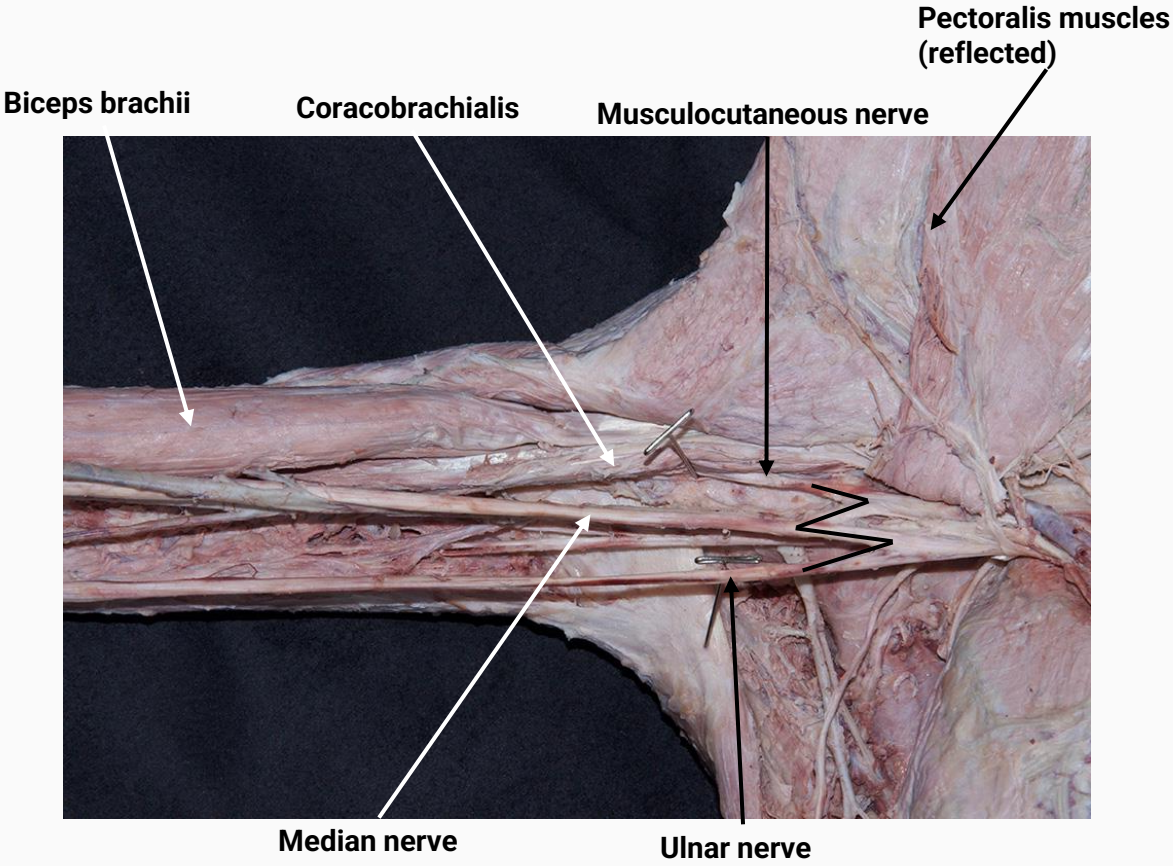
Nervous system – PNS

Musculocutaneous nerve: innervates anterior arm muscles and provides sensory innervation to lateral forearm

- The nerve is most easily identified where it pierces the coracobrachialis muscle

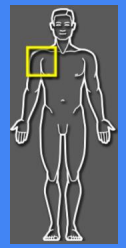


Orientation: this is an anterior view of the right shoulder and arm (axilla)

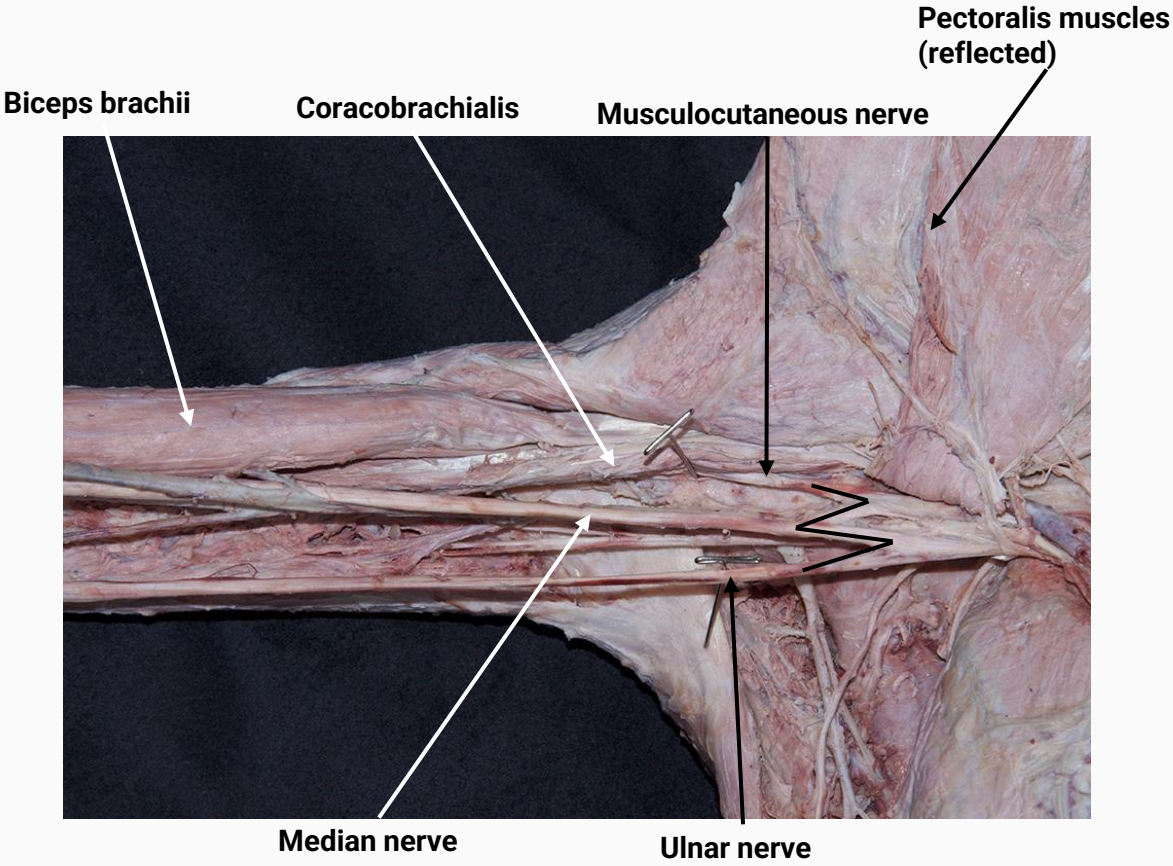


Nervous system – PNS

Median nerve: innervates anterior forearm muscles and forms the middle of the “M” of the brachial plexus



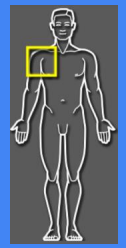
Orientation: this is an anterior view of the right shoulder and arm (axilla)

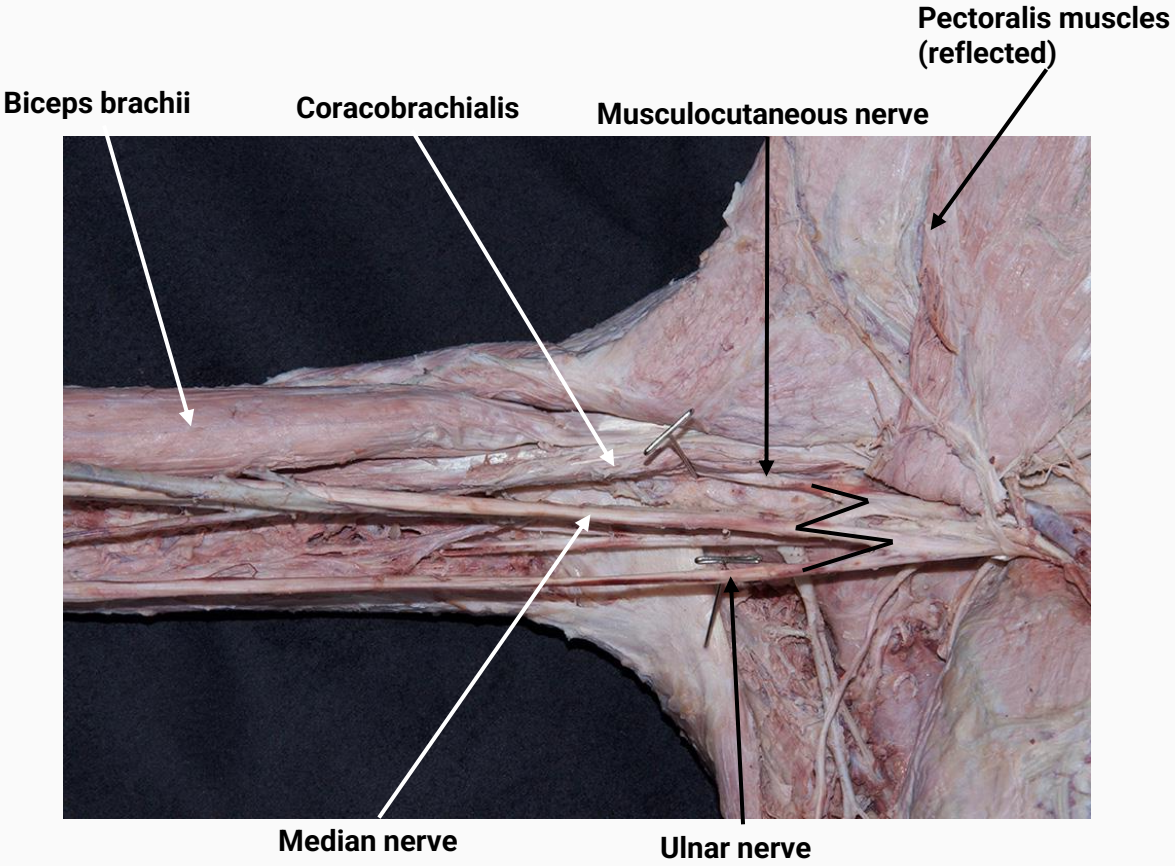


Nervous system – PNS

Ulnar nerve: innervates intrinsic hand muscles and forms the most medial continuation of the “M” of the brachial plexus

Orientation: this is an anterior view of the right shoulder and arm (axilla)



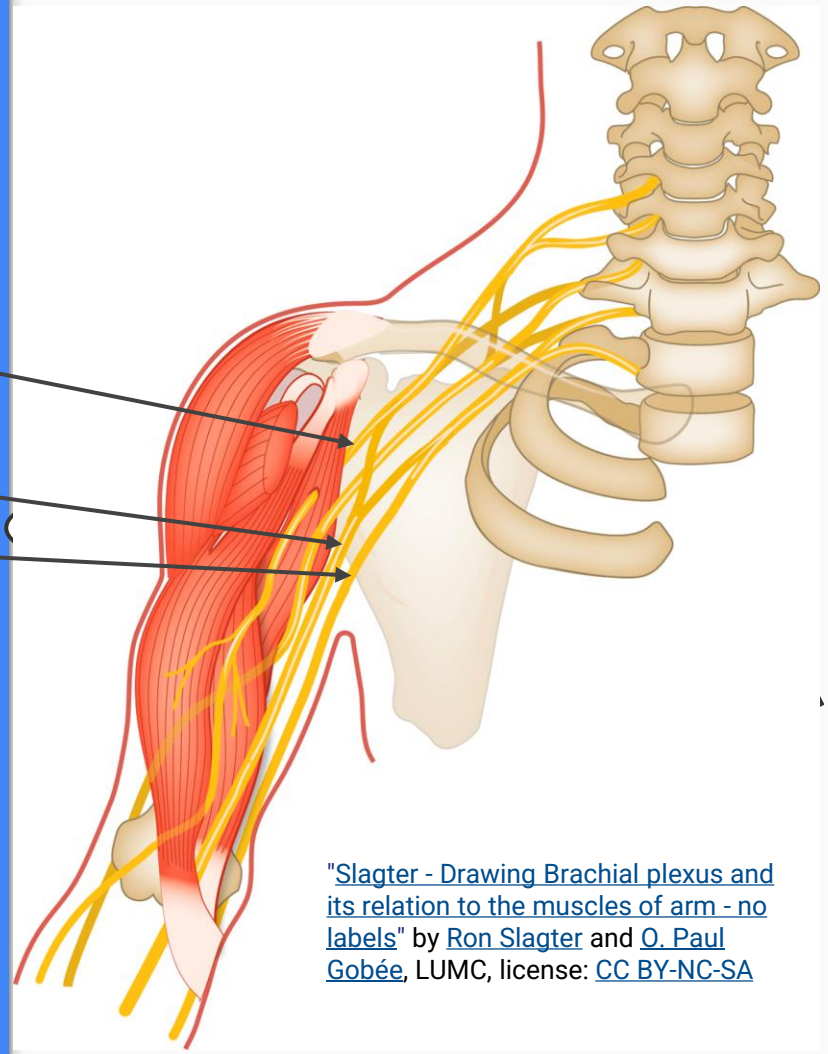


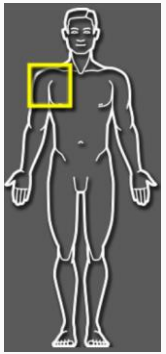
Nervous system – PNS

Musculocutaneous nerve

Median nerve

Ulnar nerve

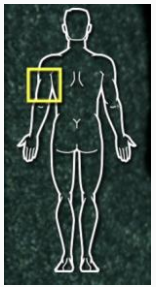


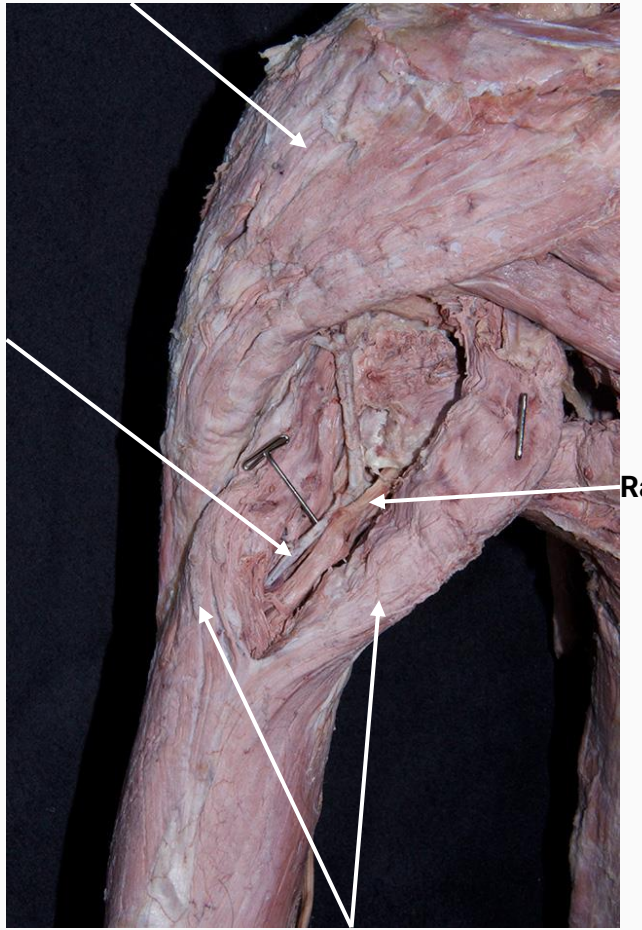


Nervous system – PNS

Radial nerve: innervates posterior arm muscles and provides sensory innervation to posterior arm/forearm/hand

- The nerve is most easily identified on the posterior arm running with the deep brachial artery

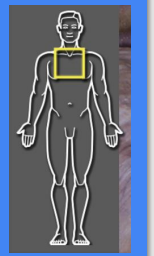


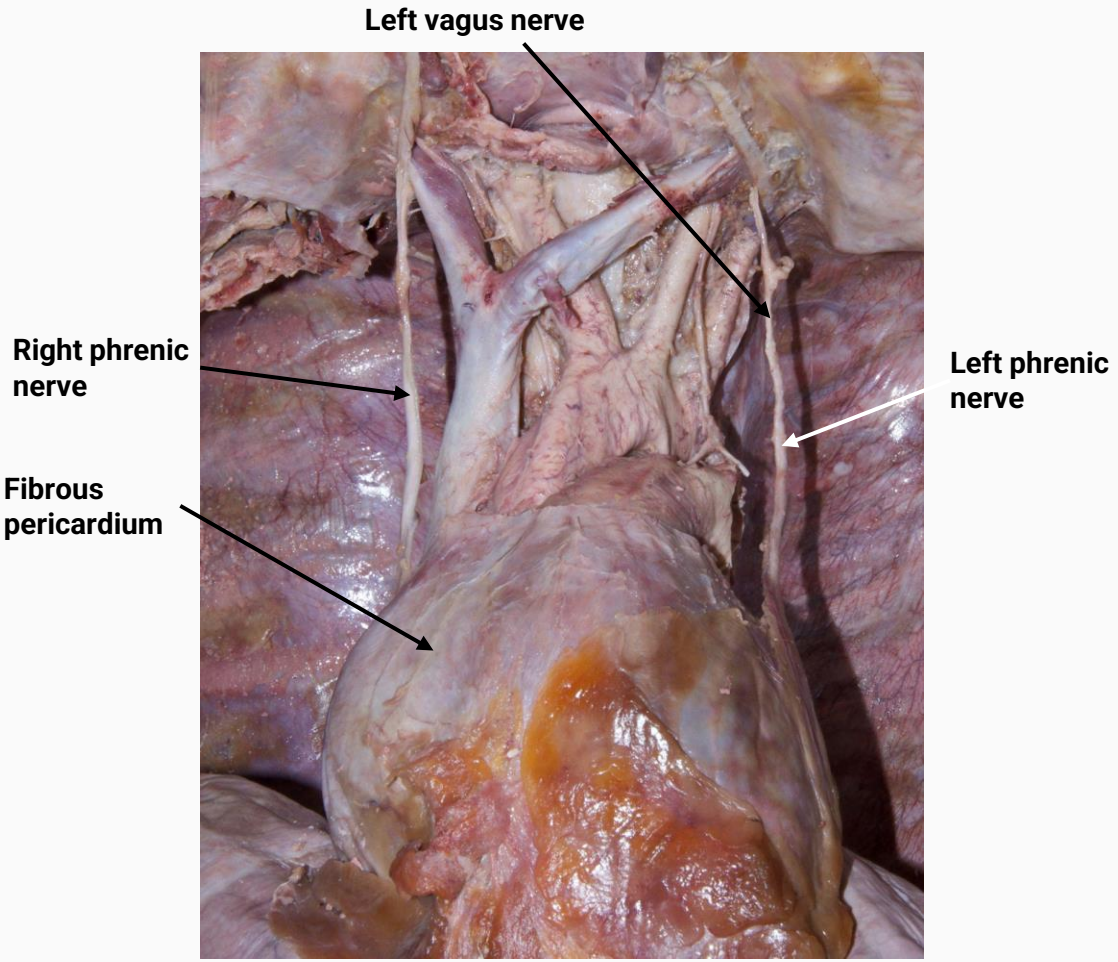


Nervous system – PNS

Phrenic nerve: branch off C3/4/5 and responsible for innervating the diaphragm muscle for breathing

- With lungs removed, may be found draped over the fibrous pericardium of the heart

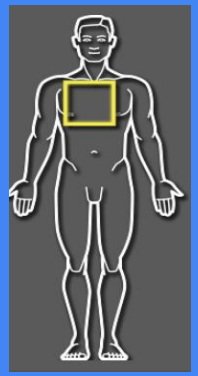


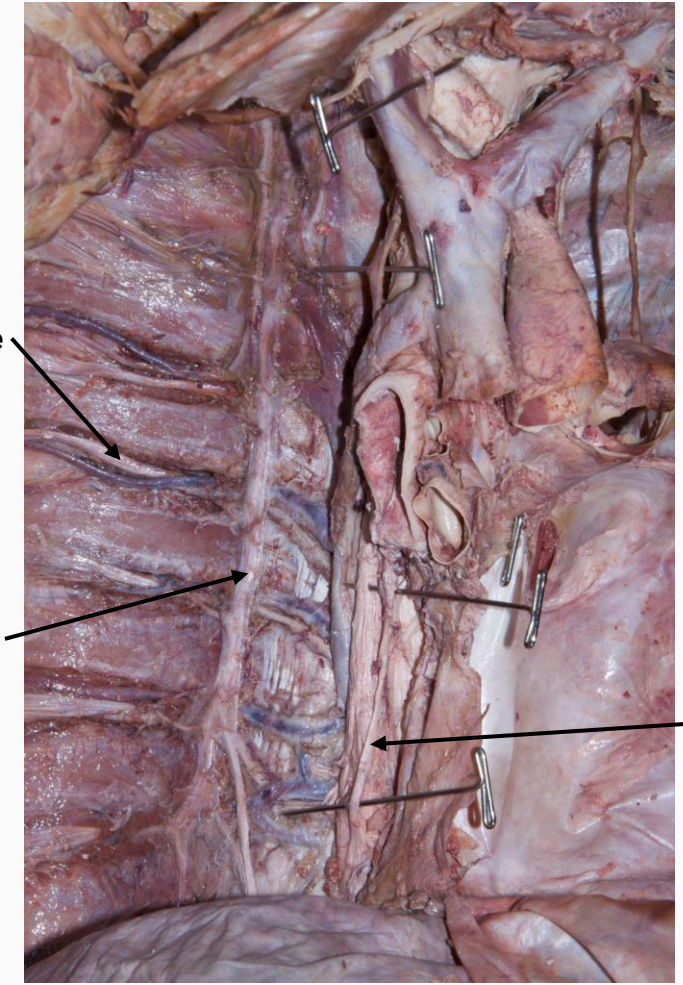


Nervous system – PNS

Sympathetic chain: chain of ganglions responsible for sympathetic “fight or flight” response in the thorax

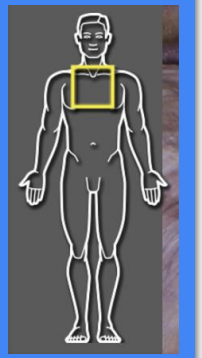
- Runs from skull base to sacrum

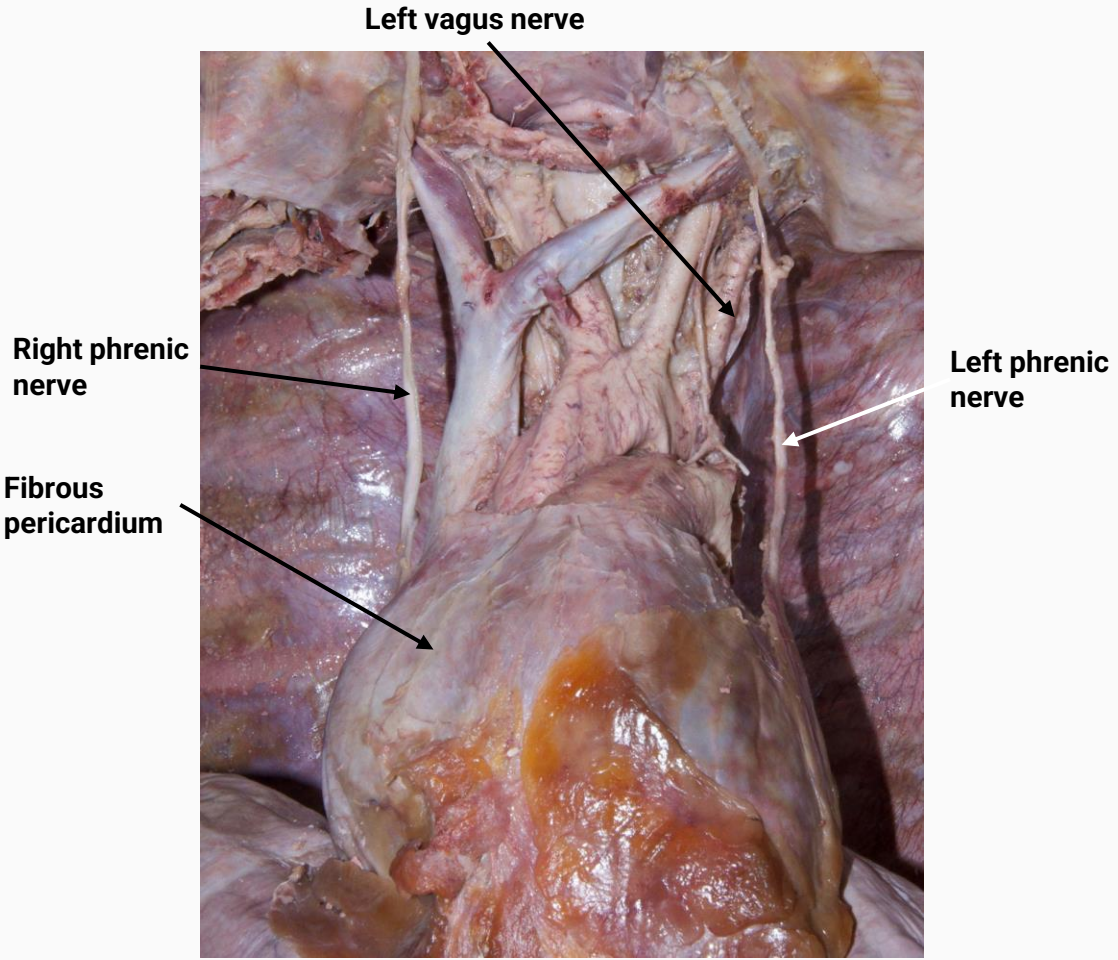




Nervous system – PNS

Vagus nerve (CN X): Cranial nerve X originates in the brainstem and continues down throughout the body to provide visceral innervation





Cardiovascular System

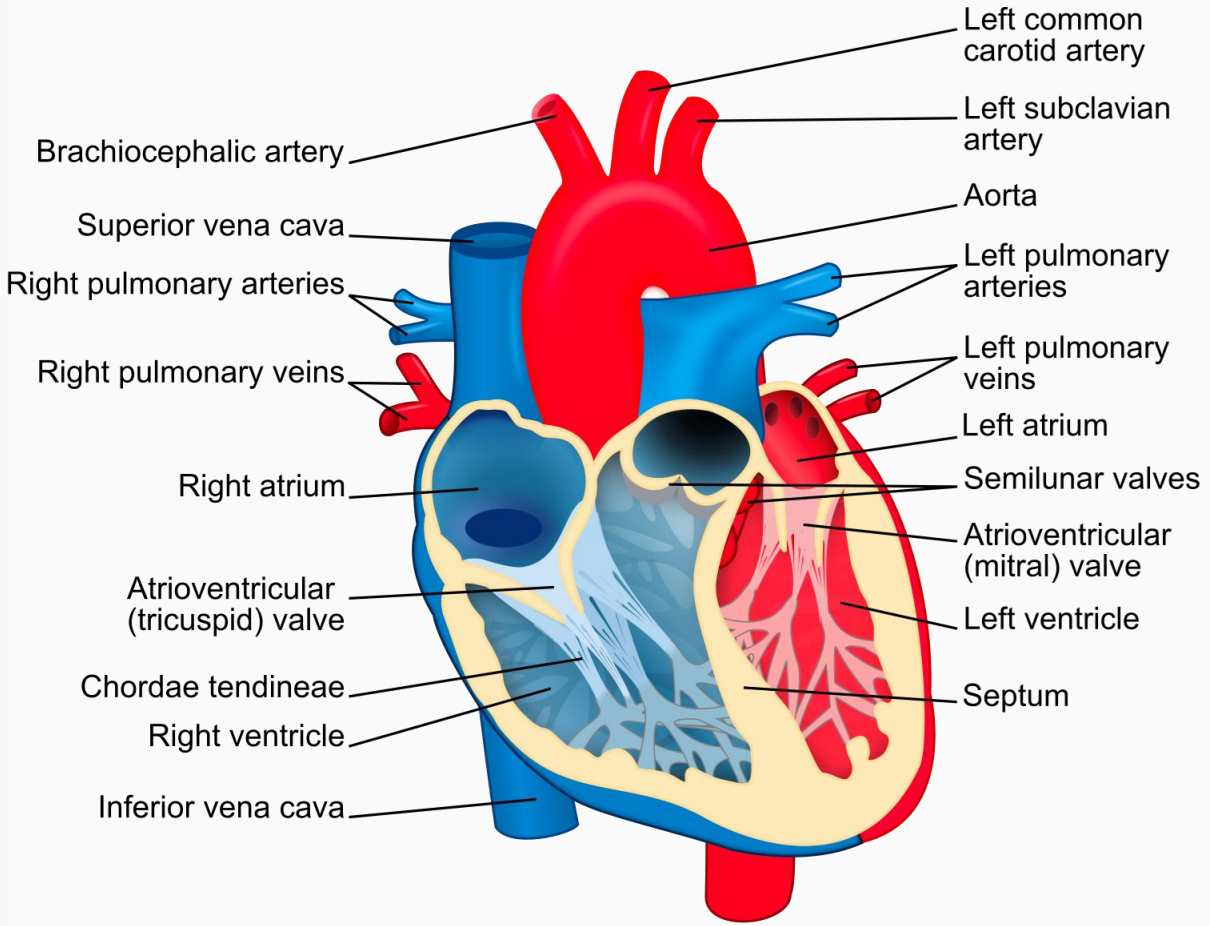
Overview:

- Heart
  - Atria (Right and Left)
  - Ventricles (Right and Left)
- Arteries
  - Aorta
  - Common Carotid
  - Subclavian
  - Femoral

Cardiovascular System – Heart

Use this image to orient yourself on the anatomy of the heart before looking at the donor images.

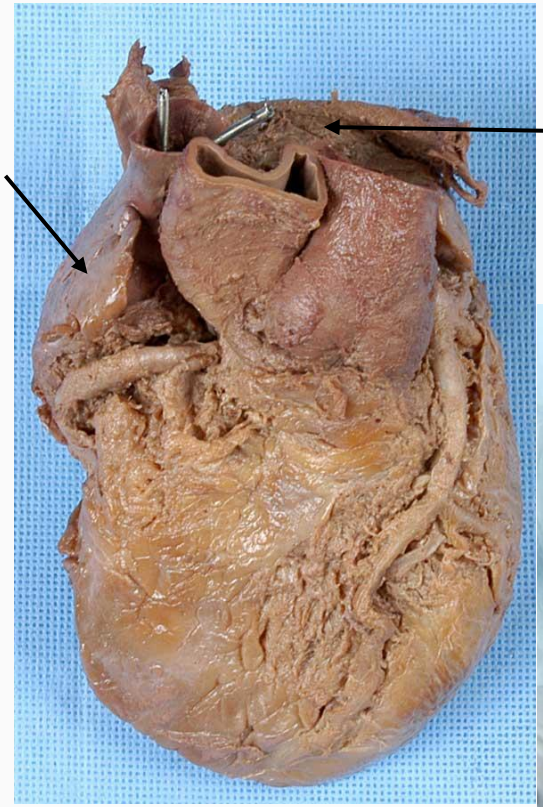
Note: Donor hearts do not look exactly like the diagrams. They come in many shapes and sizes.



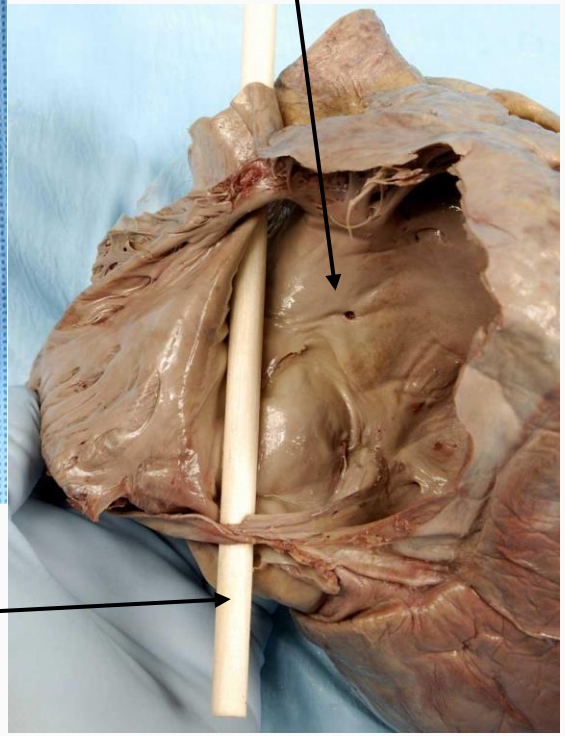
Cardiovascular System – Heart

Right atrium: receives deoxygenated blood from inferior vena cava (IVC) and superior vena cava (SVC) to begin cardiac circulation and pumps to right ventricle

Left atrium: receives oxygenated blood from pulmonary vein and pumps to left ventricle



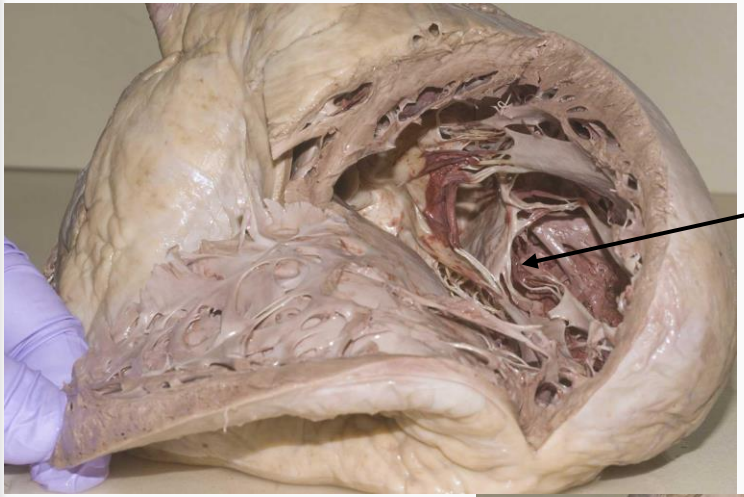
Right atrium (cut open to see inside)

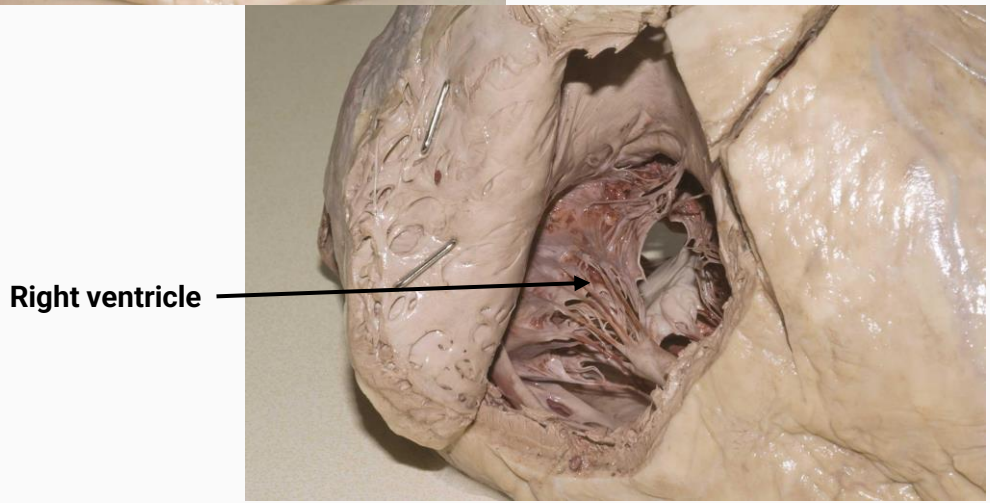


Cardiovascular System – Heart

Right Ventricle: receives deoxygenated blood from right atrium and pumps blood through the pulmonary artery to the lungs

Left Ventricle: large muscular chamber receives oxygenated blood from left atrium and sends it systemically to the body





Cardiovascular System – Heart

Putting it together:

IVC/SVC → Right atrium → Right ventricle → Pulmonary artery → Lungs → Pulmonary veins → Left atrium → Left ventricle → Aorta → Body

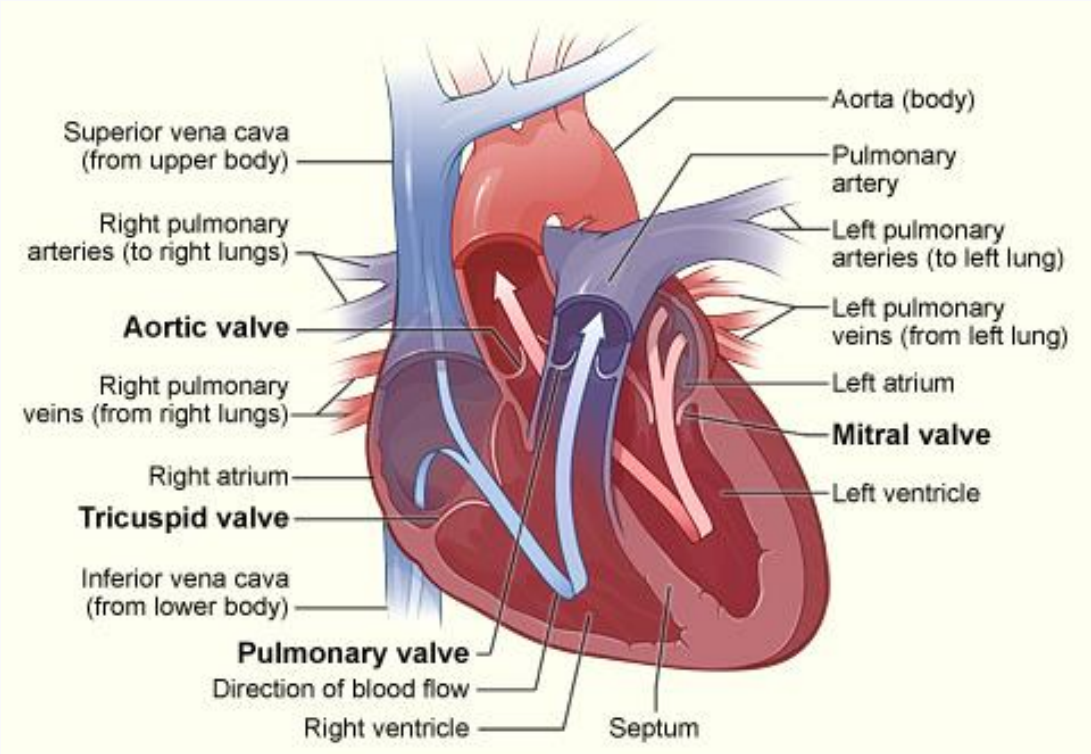
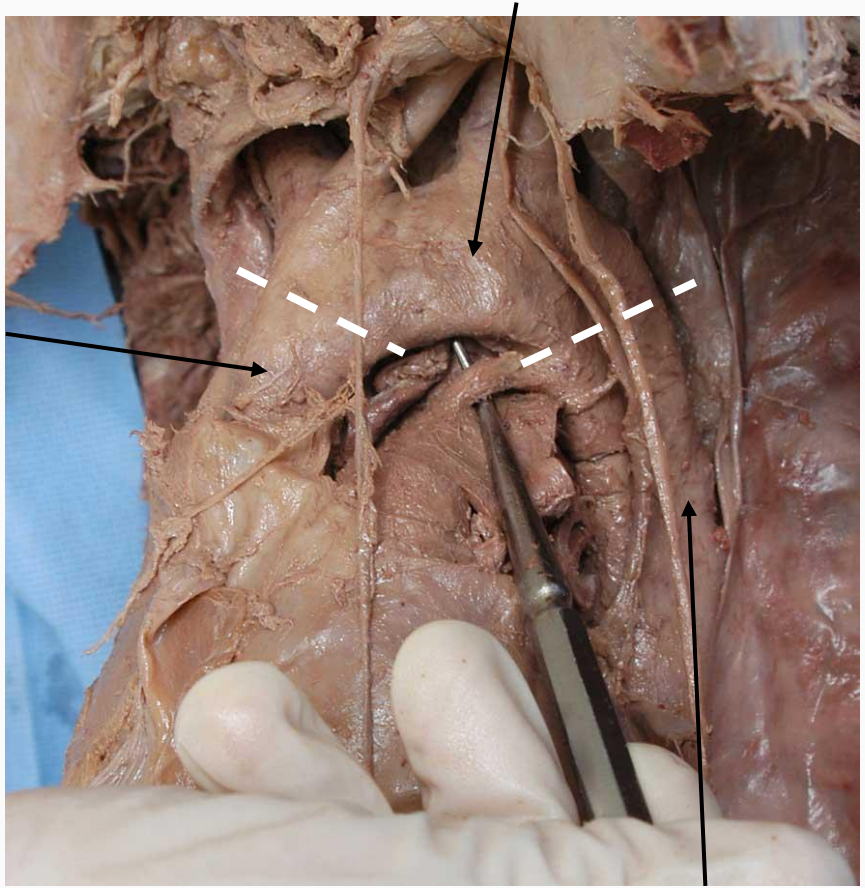


Image: public domain image from *National Heart Lung and Blood Institute (NIH)*. Obtained via via Wikimedia Commons.

Cardiovascular System – Arteries

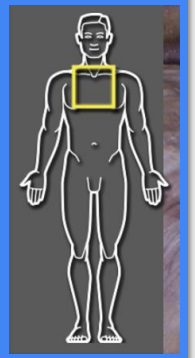
Aorta: largest artery in the body receiving oxygenated blood from the left ventricle to send throughout the body

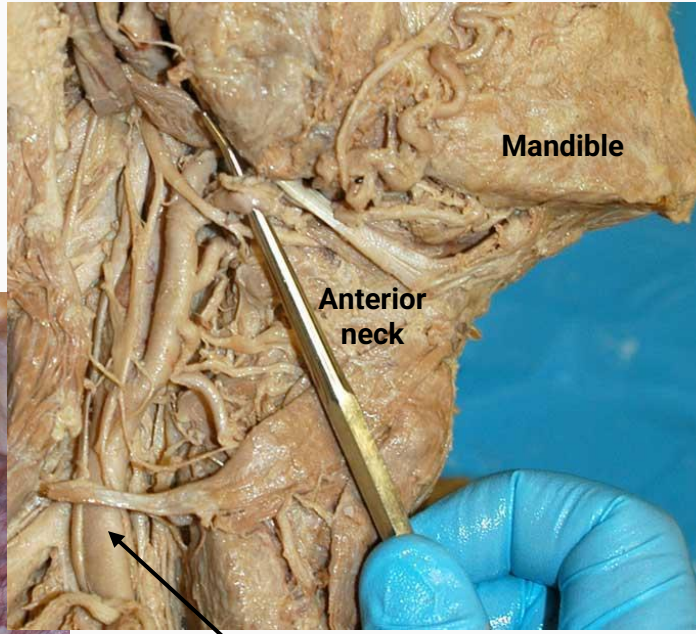
- Ascending aorta: from heart to aortic arch
- Aortic arch: branch point for all blood going to upper limbs/head
- Descending aorta: descends through thorax to send blood to rest of body



Cardiovascular System – Arteries

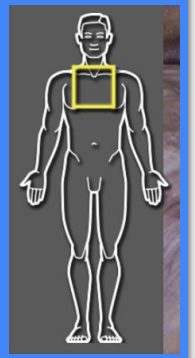
Common Carotid: large arteries on both sides of the neck carrying oxygenated blood to the head/brain

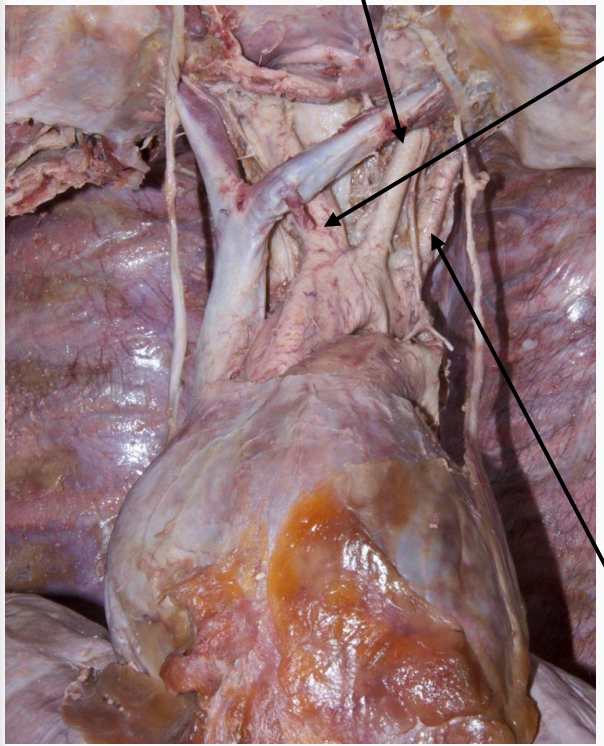


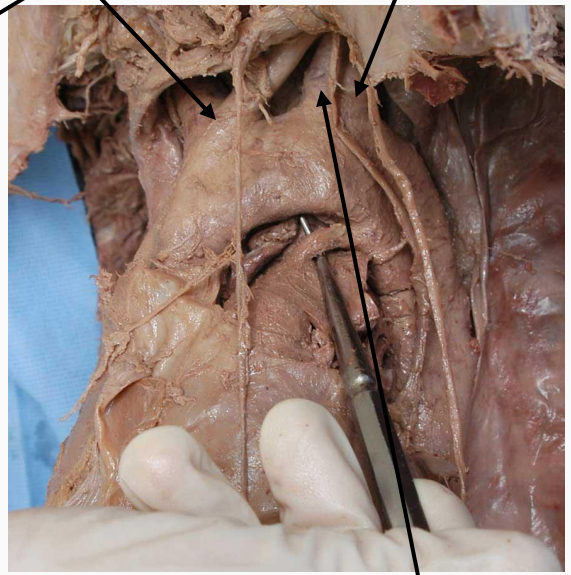


Cardiovascular System – Arteries

Subclavian artery: large arteries on both sides of the body carrying oxygenated blood to the upper limb that branch directly or indirectly off of the aorta

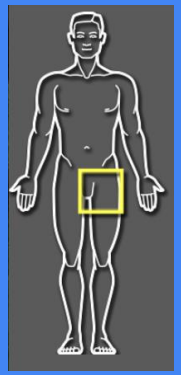


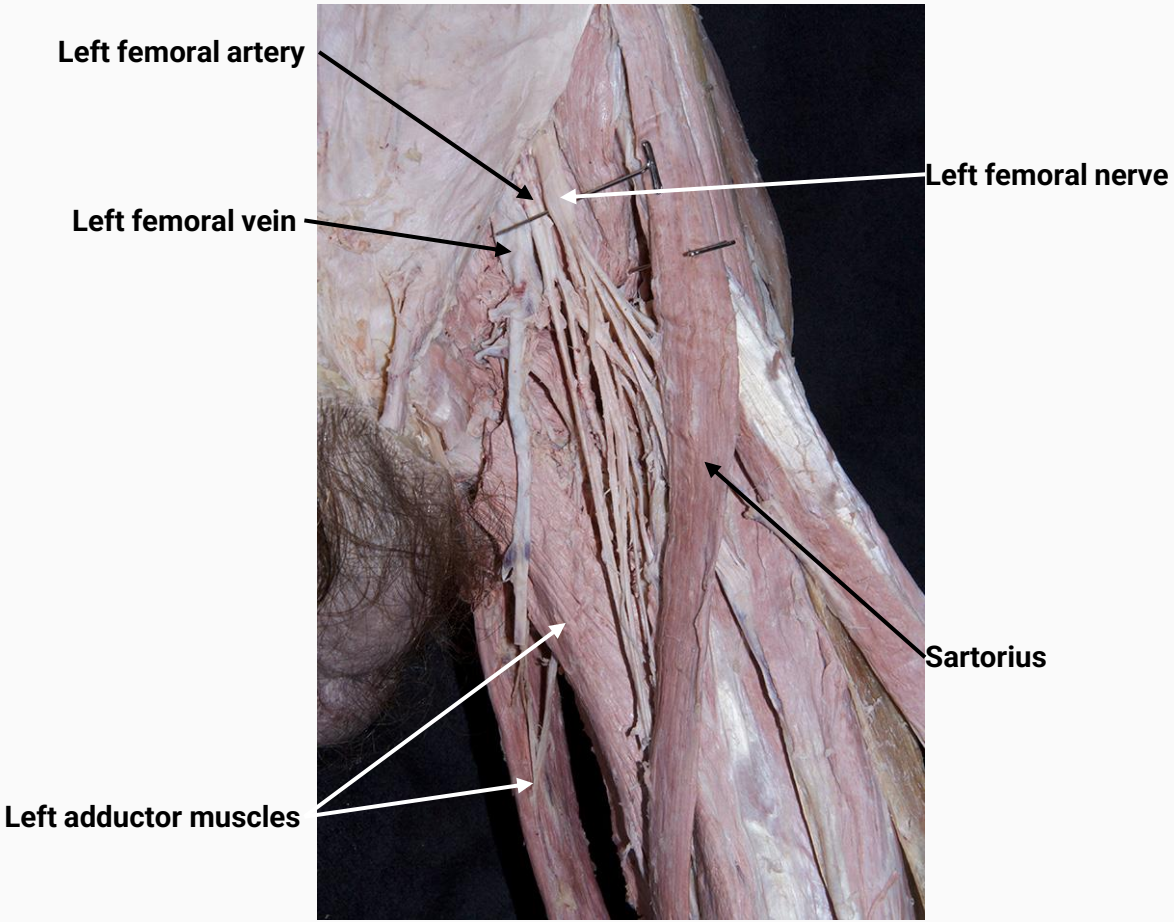




Cardiovascular System – Arteries

Femoral artery: large arteries on both sides of the body carrying oxygenated blood to the lower limb as continuations of the external iliac arteries





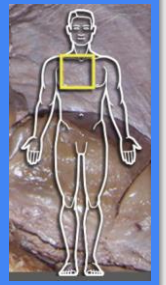
Respiratory System

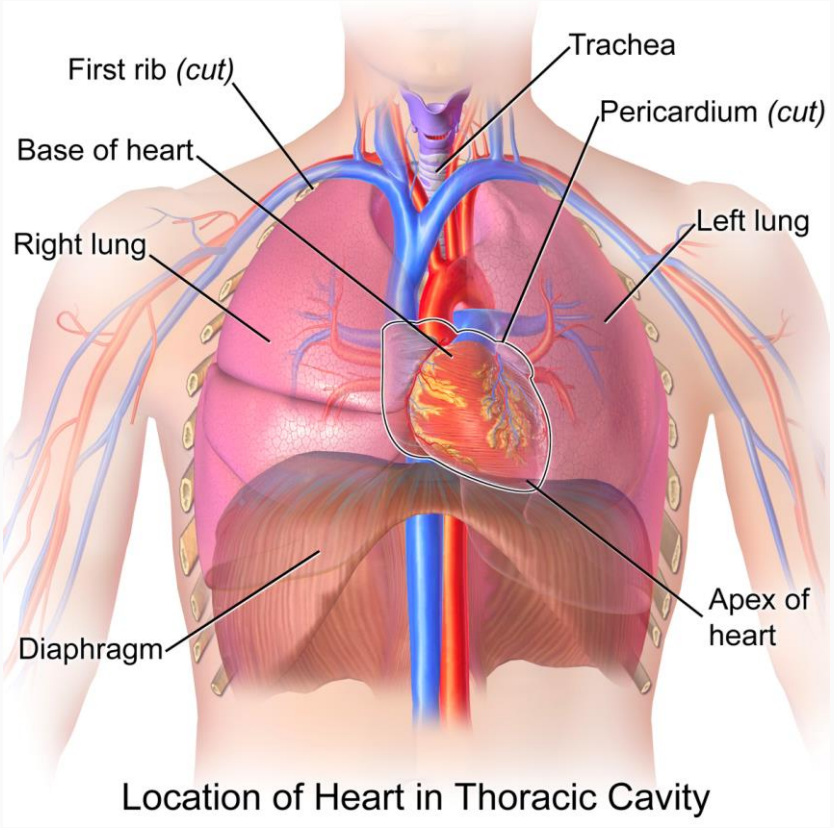
Overview:

- Trachea
- Lungs
  - Left and Right

Respiratory System – Trachea

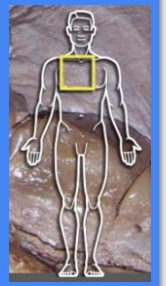
Use this image to orient yourself to the gross structure of the respiratory system

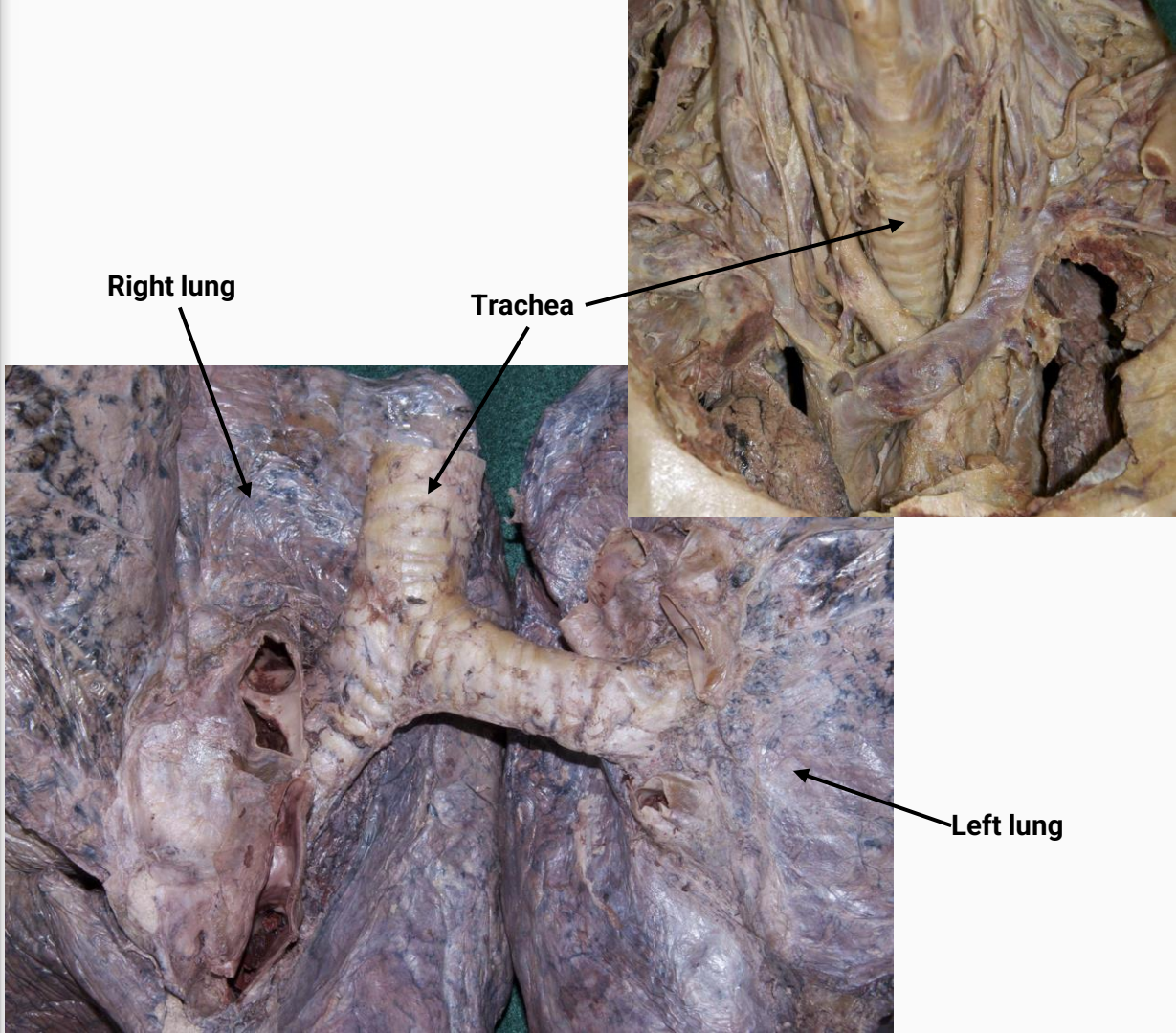




Respiratory System – Trachea

Trachea: Large airway made of cartilaginous “C” shaped rings transmitting air from the mouth to the lungs



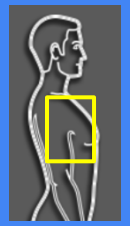


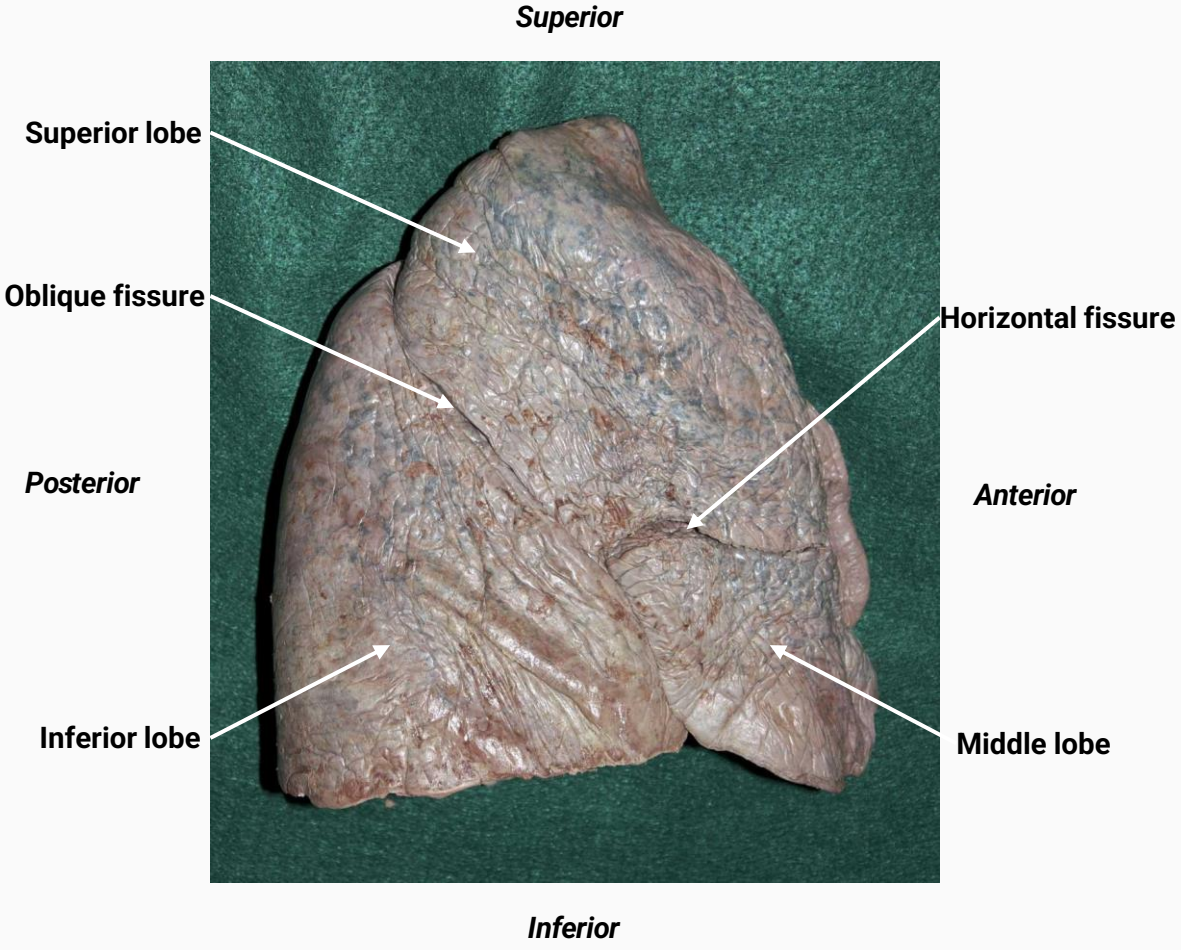
Respiratory System – Trachea

Right lung: seated on the right side of the thorax and protected by the ribs

- Right has 3 lobes divided by oblique and horizontal fissures

Orientation: this is a <u>lateral</u> view of the right lung



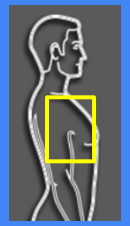


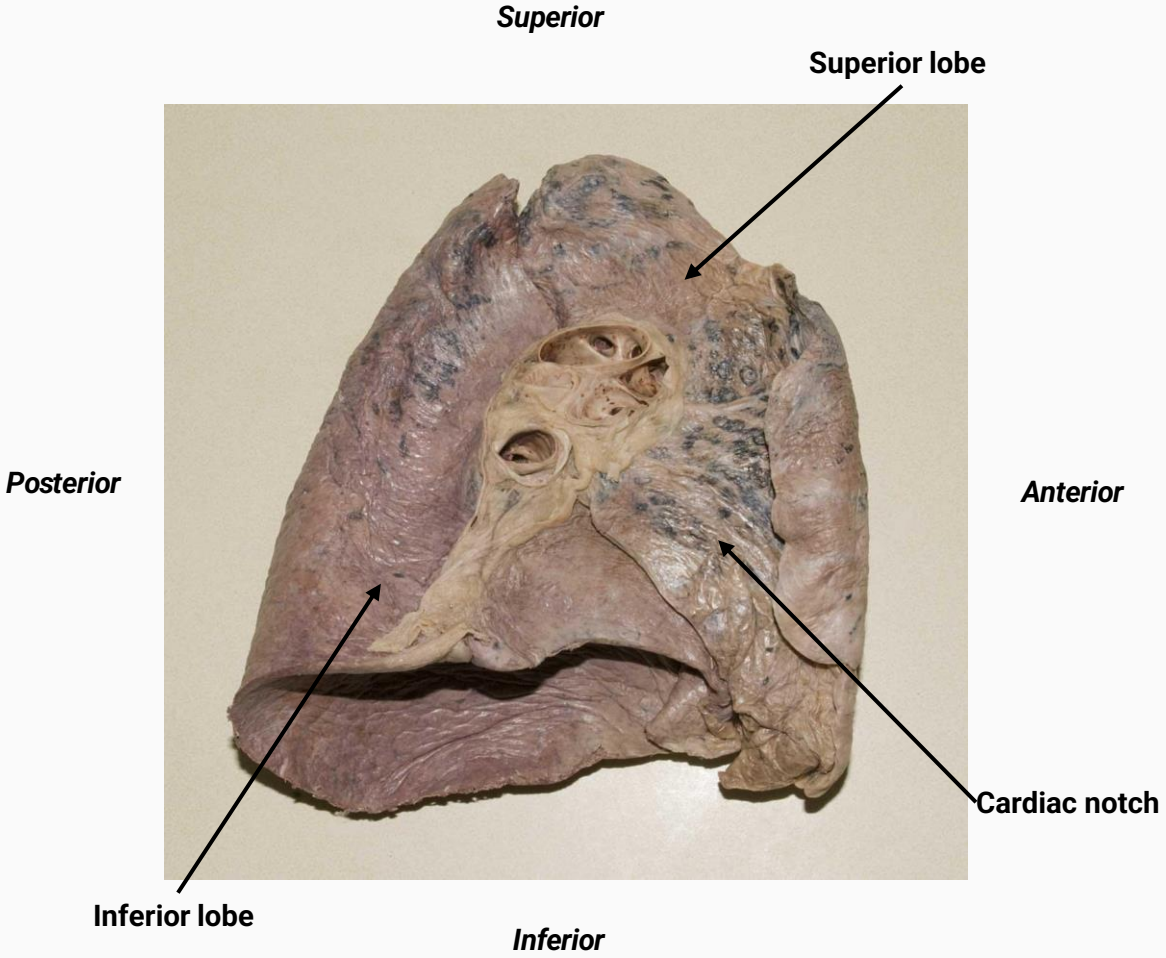
Respiratory System – Trachea

Left lung: seated on the left side of the thorax, protected by the ribs, contains indentation (cardiac notch) where the heart lies

- Left has 2 lobes divided by oblique fissure

Orientation: this is a <u>medial</u> view of the left lung





Digestive System

Digestive organs:

- Esophagus
- Stomach
- Small Intestine
- Large Intestine
- Rectum

Accessory digestive organs:

- Liver
- Pancreas

Esophagus

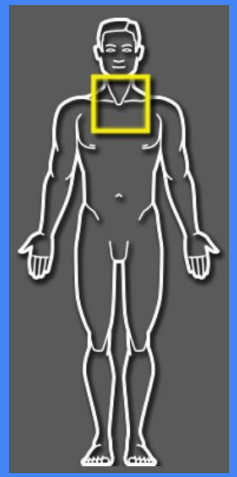
Key points:

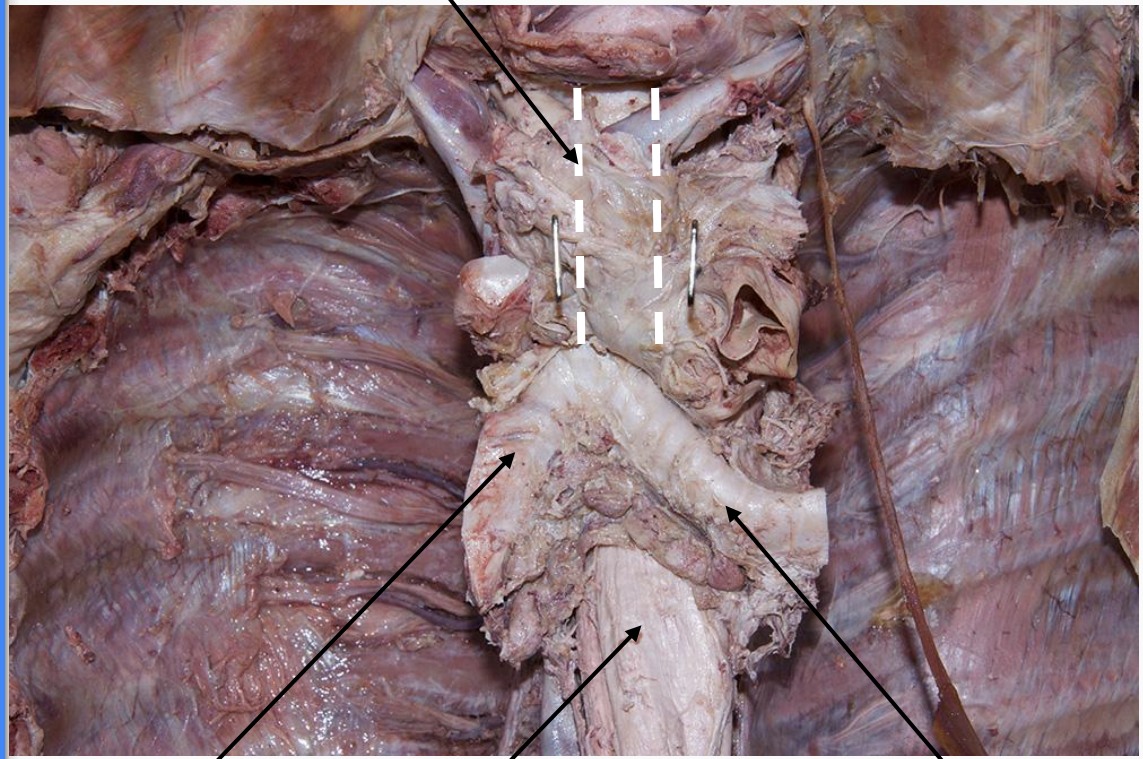
- The esophagus is positioned **posterior** to the trachea.
- The esophagus passes **posterior** to the left main bronchus.
- The esophagus is positioned **posterior** to the pericardial sac.
- Near the diaphragm, the esophagus is positioned **anterior** to the thoracic aorta.

Esophagus

Orientation:

Anterior view of the thoracic cavity above the position of the heart

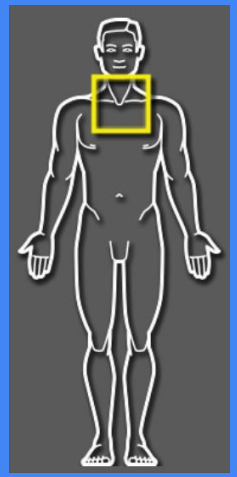


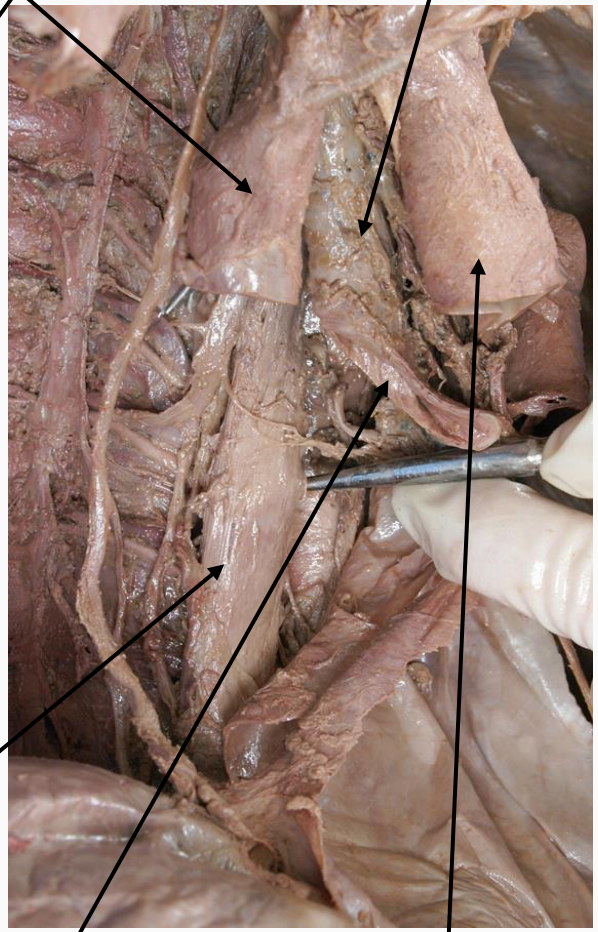


Esophagus

Orientation:

Right anterolateral view of the thoracic cavity

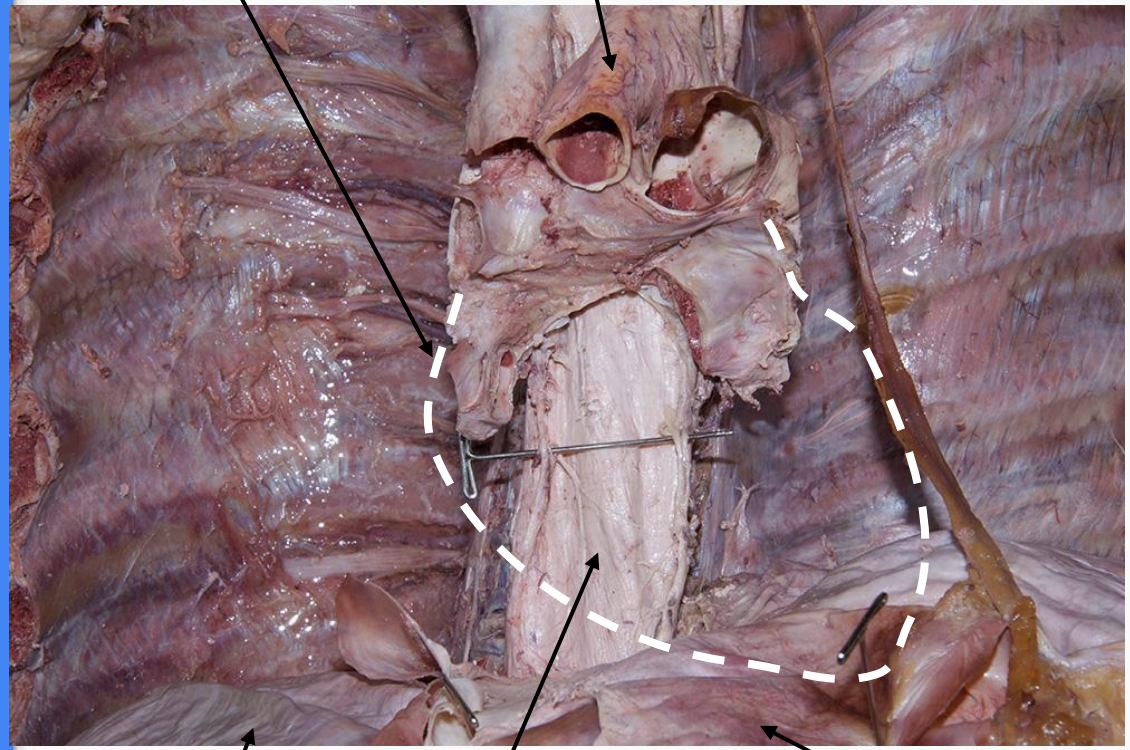




Esophagus

Orientation

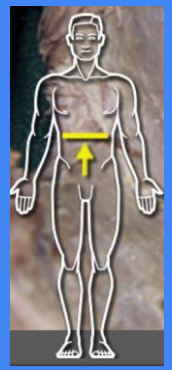
Anterior view of the thoracic cavity looking at the esophagus directly behind where the heart would normally be located

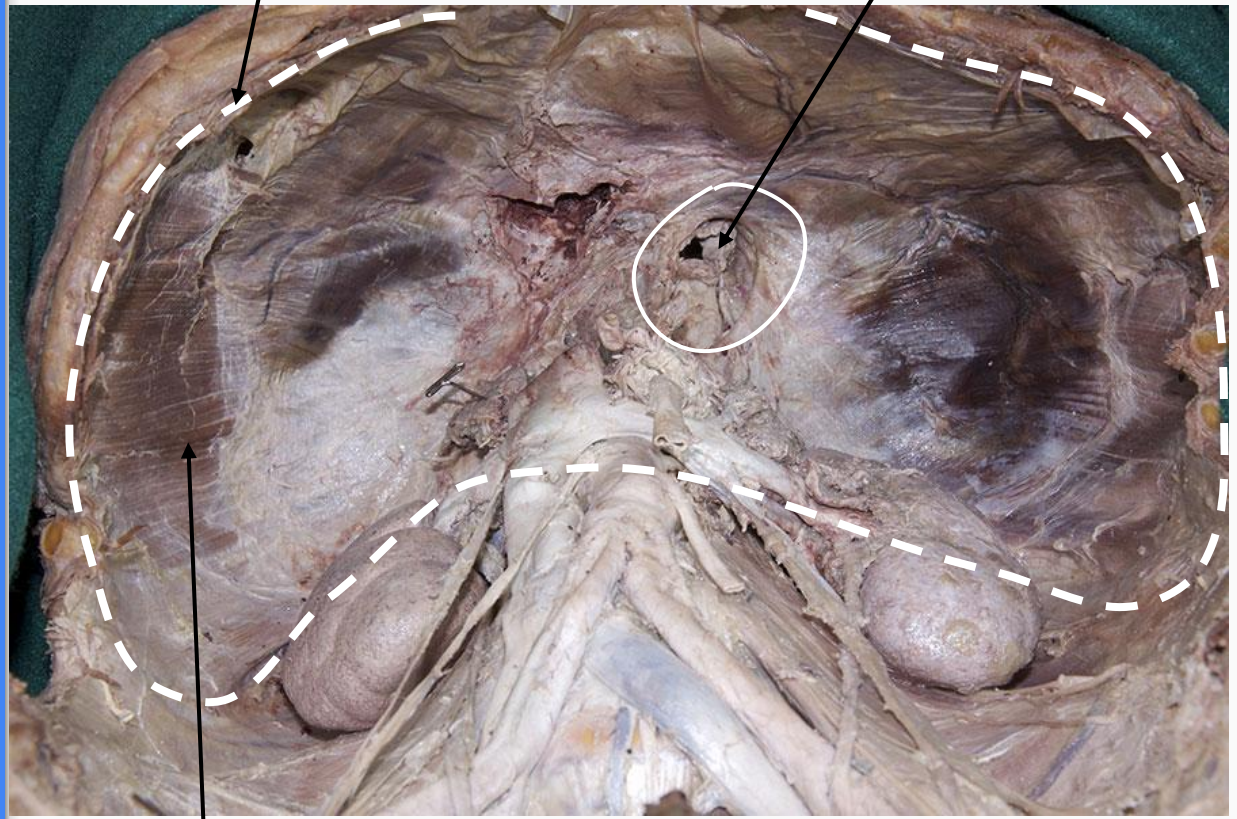


Esophagus

Orientation

Inferior view of the diaphragm separating the thoracic cavity from the abdominal cavity. All abdominal organs for digestion have been removed.





Stomach

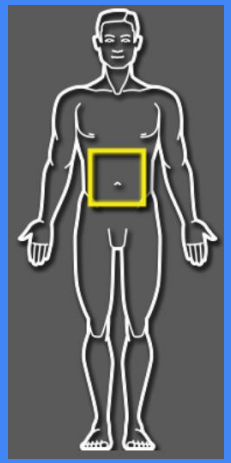
Key points:

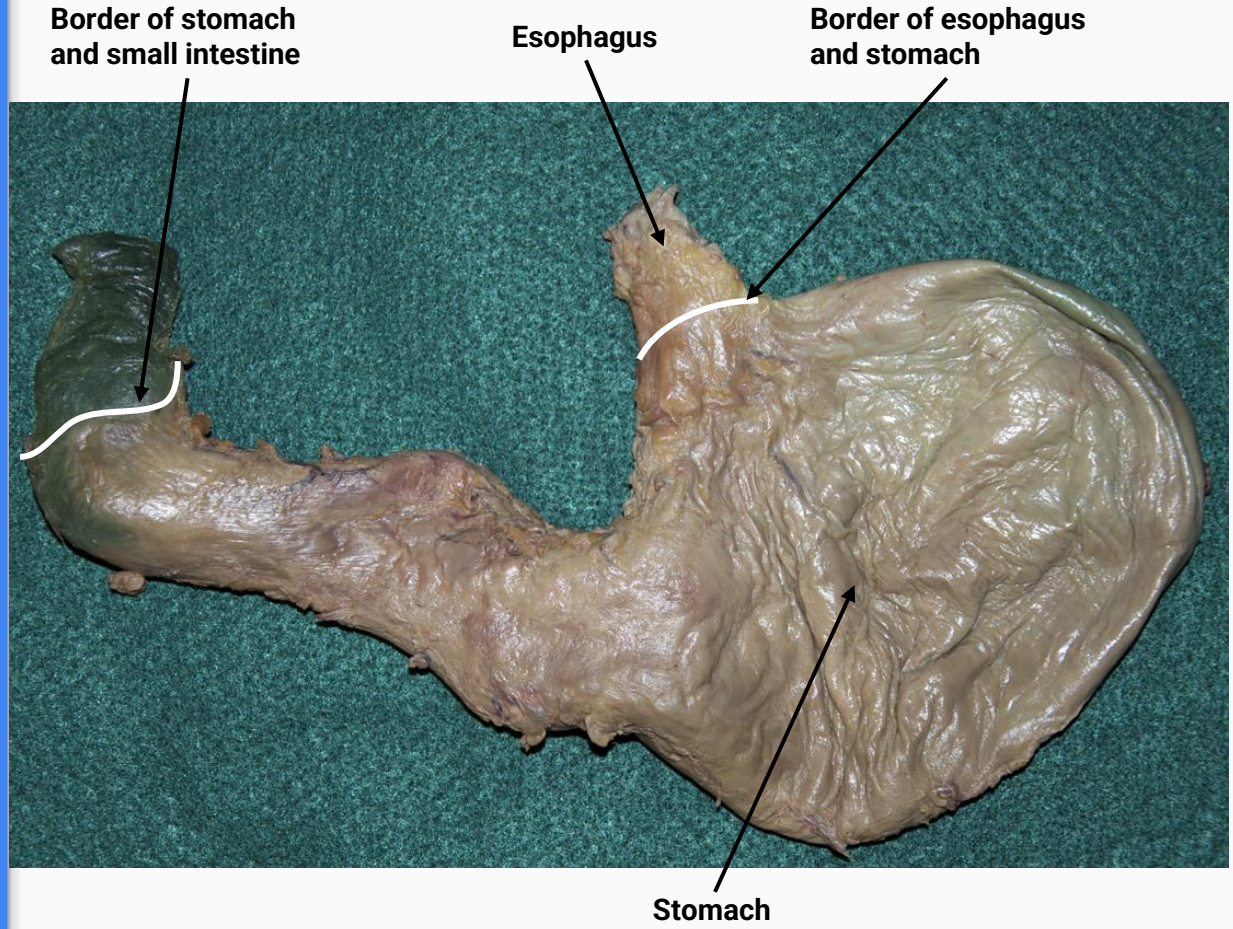
- After entering through an opening in the diaphragm, the esophagus **continues directly** into the **stomach**.
- The stomach **continues directly** as the **small intestine.**

Stomach

Orientation:

Anterior view of a stomach that has been removed from the donor

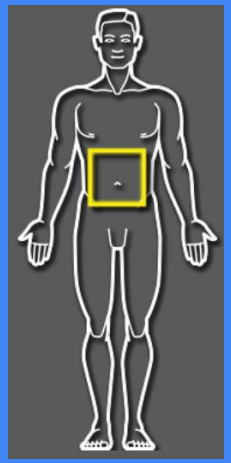


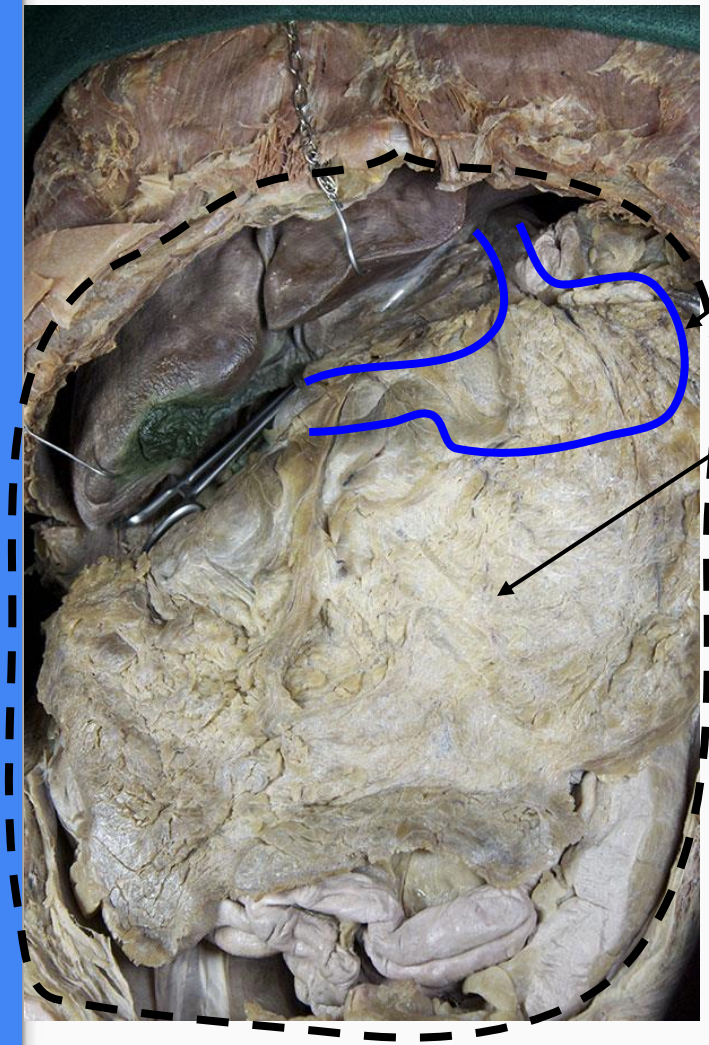


Stomach

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs.





Approximate location of where stomach is located.

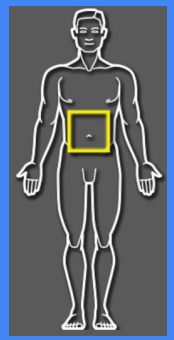
The bottom part of the stomach has peritoneal tissue attached to it called the greater omentum. This structure is obstructing our view of the stomach in this image.

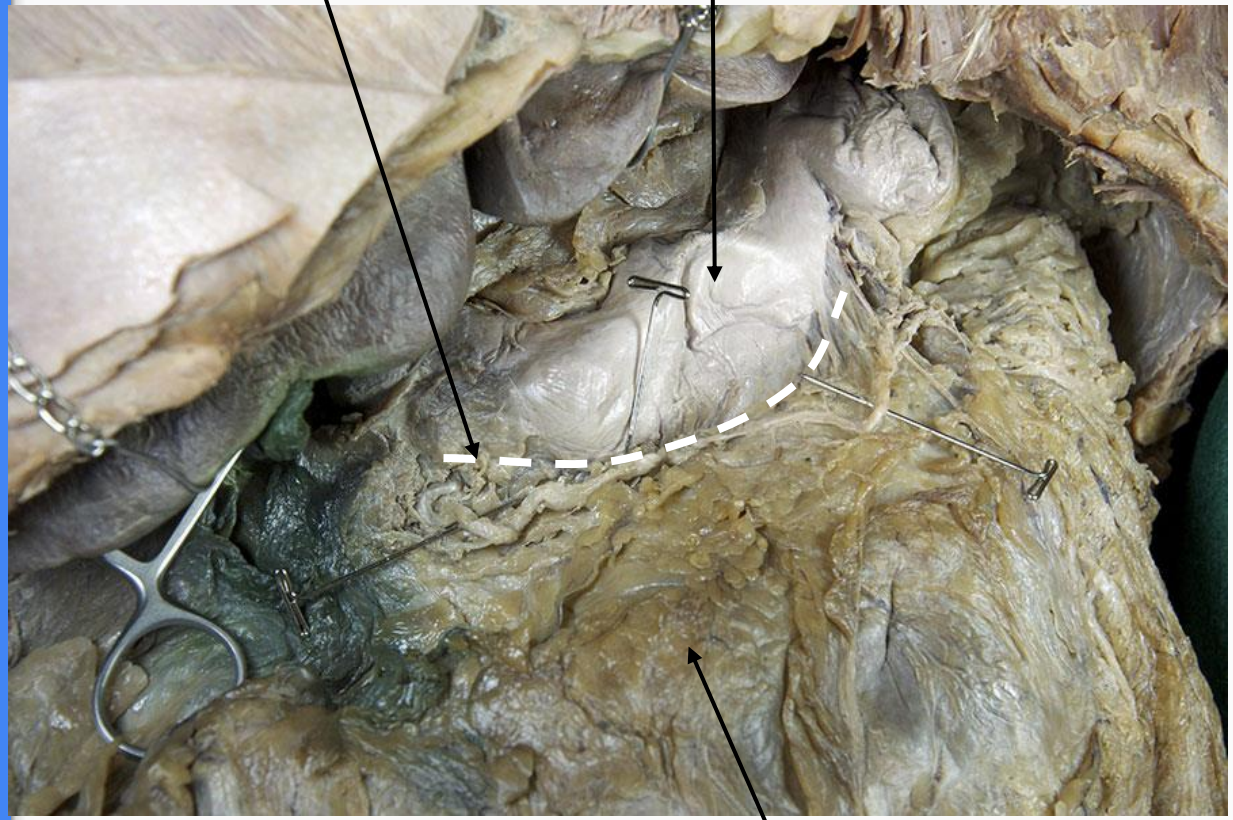
Outline of peritoneal cavity

Stomach

Orientation:

Anterior view of the peritoneal cavity that is zoomed in on the bottom part of the stomach. We can clearly see the top part of the greater omentum is attached to the bottom part of the stomach.

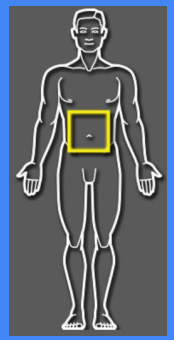


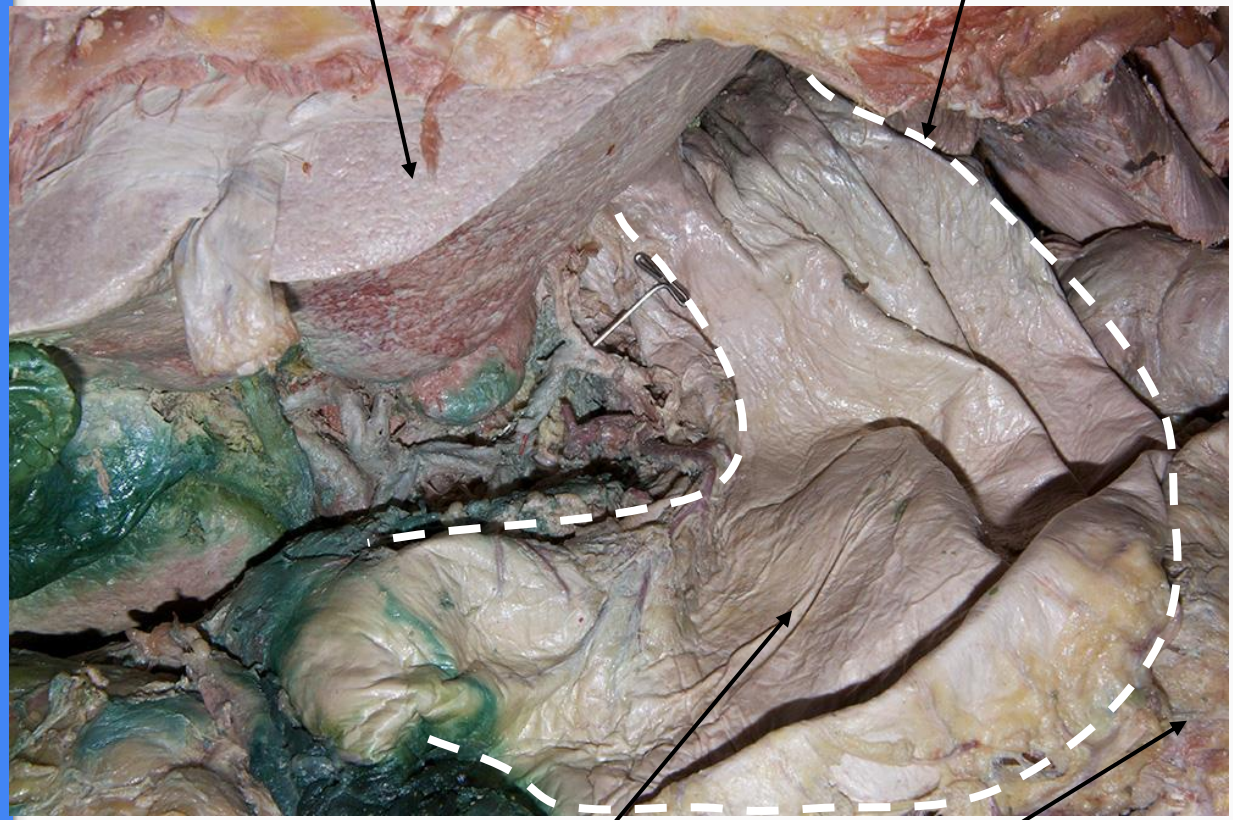


Stomach

Orientation:

Anterior view of the stomach with the surrounding structures, such as the greater omentum, dissected off the stomach so that almost the entirety of the stomach is in view.

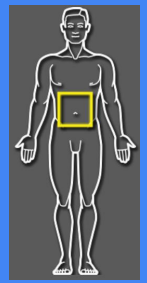




Stomach

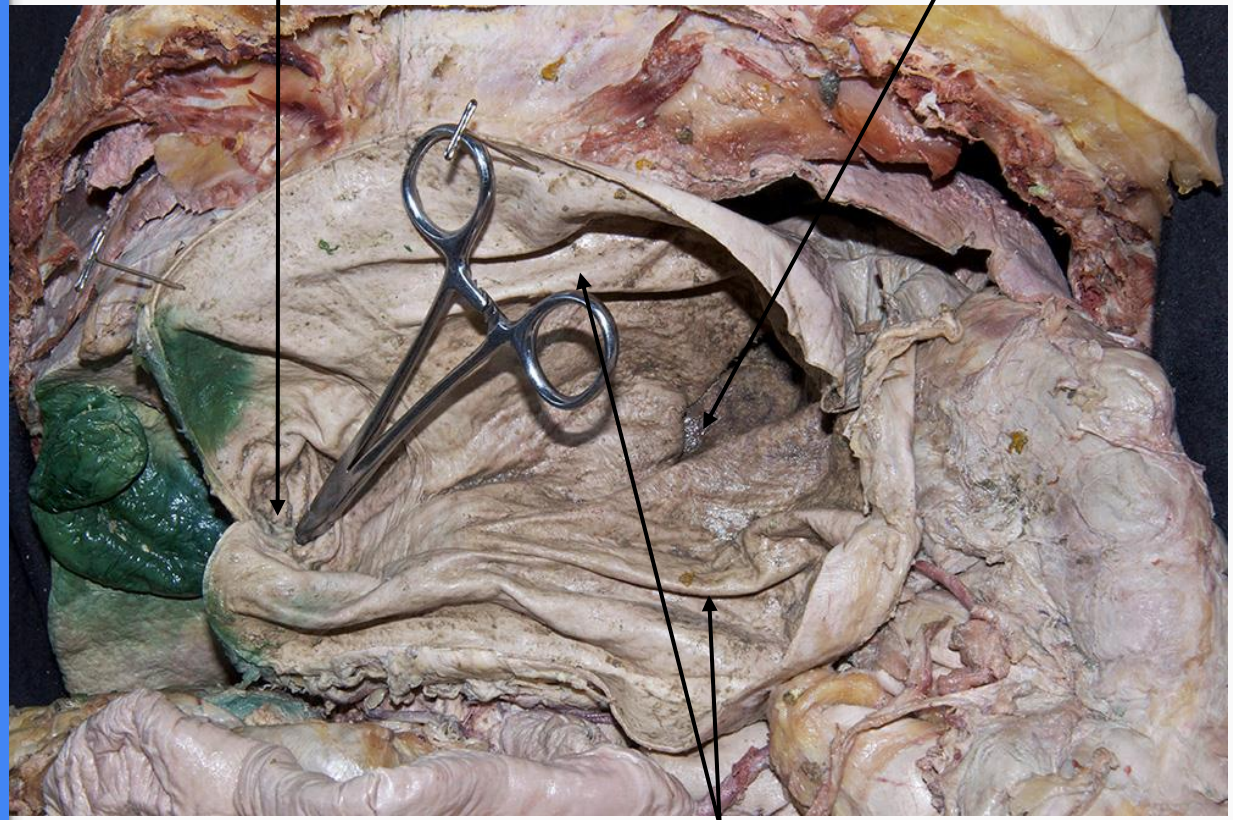
Orientation:

Anterior view of the inside of the stomach. The stomach has been cut along the bottom border, with the individual flaps being reflected upwards and downwards so that you can see inside the stomach.



This is the end of the stomach where it starts to become the small intestine.

Inside of the stomach



These folded parts on the inside of the stomach are known as “gastric folds.”

Small Intestine

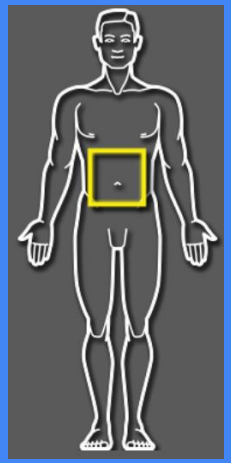
Key points:

- The end of the stomach directly continues as the **small intestine**.
- The small intestine is separated into **three parts** in the following order:
  - **Duodenum**
  - **Jejunum**
  - **Ileum**
- The **exact position** of the **three parts** of the small intestine are challenging to delineate and are not of any concern for this competition.
- The **large intestine** surrounds the small intestine.

Small Intestine

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs.



Outline of where stomach is located but covered by greater omentum

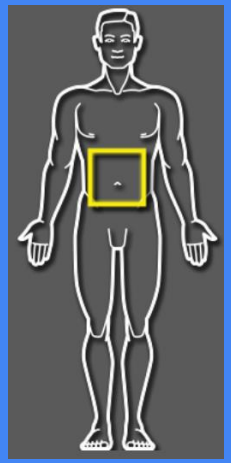
Outline of peritoneal cavity

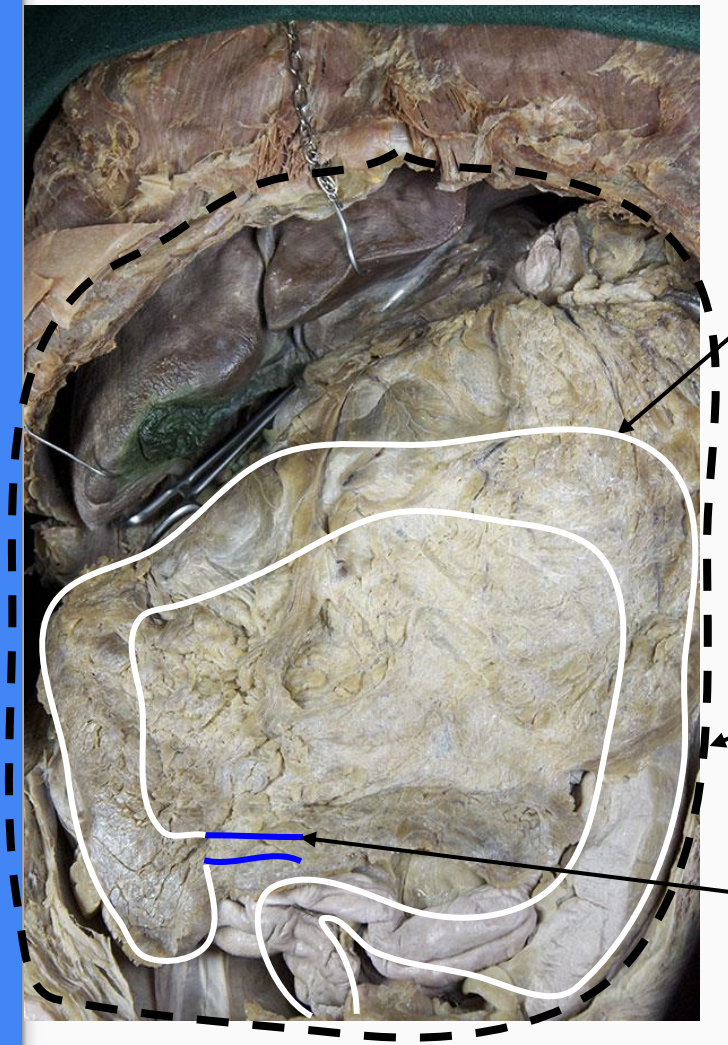
Outline of where small intestine is located but covered by greater omentum

Small Intestine

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs.





Outline of where the large intestine is located but is covered by greater omentum in this image. The large intestine completely surrounds the small intestine. In fact, the connection between the stomach and the small intestine goes underneath the large intestine to get to the center of the abdominal cavity. It is important to understand this relationship so that you can clearly distinguish the small intestine from the large intestine.

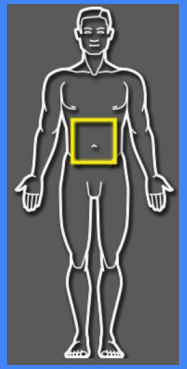
Outline of peritoneal cavity

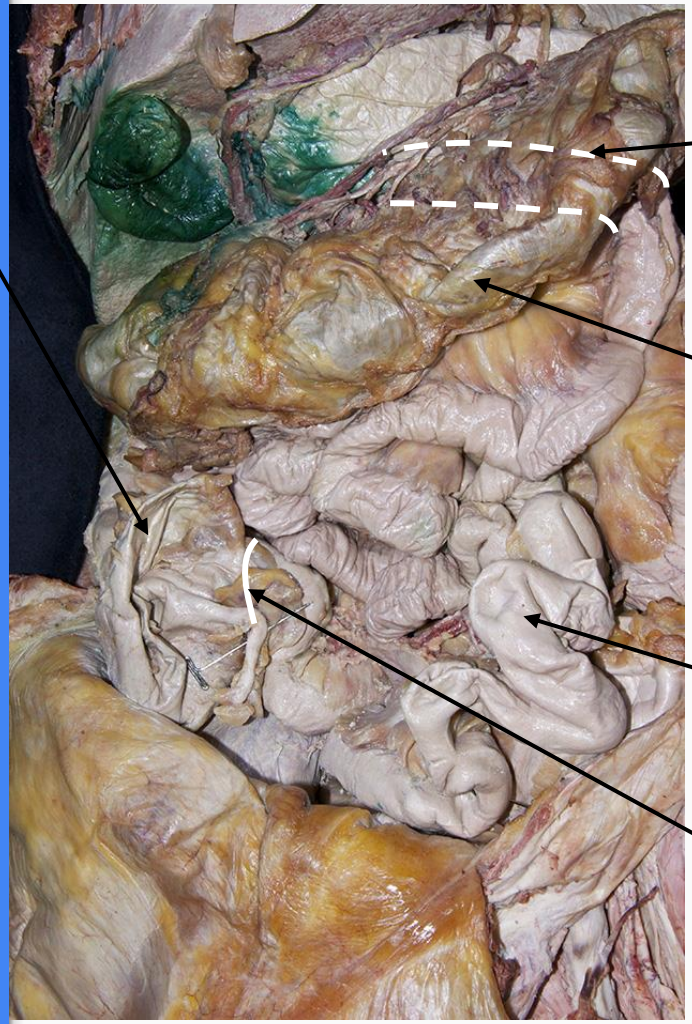
Outline of where small intestine ends and connects to the large intestine. Covered by greater omentum

Small Intestine

Orientation:

Anterior view of the abdominal cavity with the greater omentum dissected away so that we can see the small intestine and the large intestine.





Large Intestine

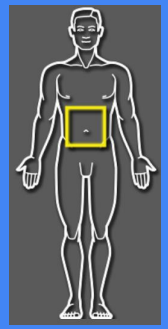
Key points:

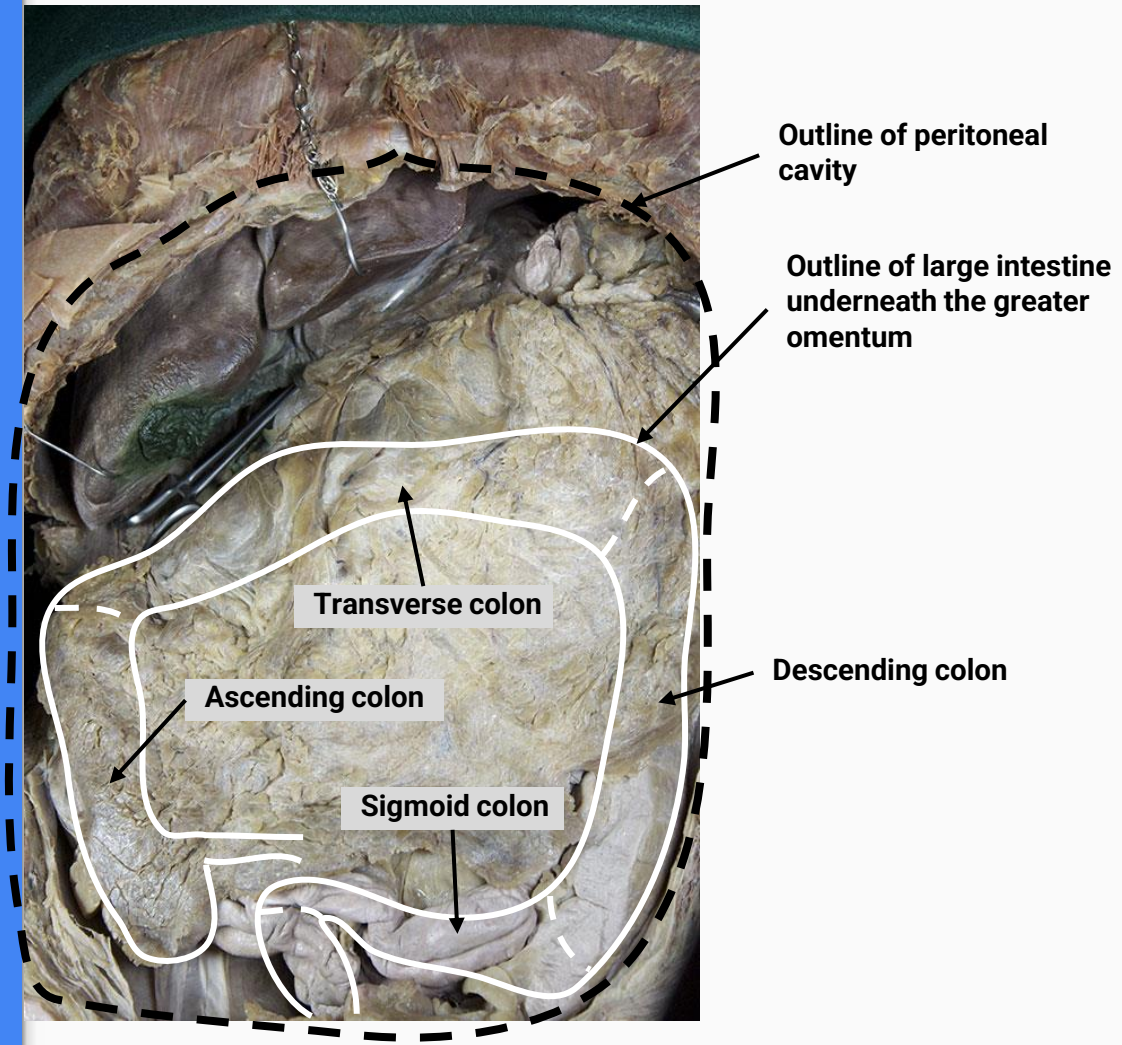
- The **large intestine** is also known as the **colon.**
- The end of the small intestine directly continues as the **large intestine**.
- The large intestine is separated into **four parts** in the following order:
  - **Ascending colon**
  - **Transverse colon**
  - **Descending colon**
  - **Sigmoid colon**

Large Intestine

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs. Labels are pointing to the position of the organ underneath the greater omentum.

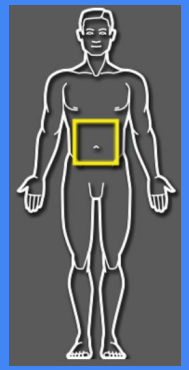




Large Intestine

Orientation:

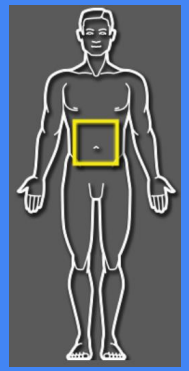
Anterior view of the abdominal cavity with the greater omentum dissected away so that we can see the small intestine and the large intestine.



Large Intestine

Orientation:

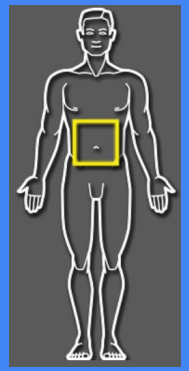
Anterior view of the abdominal cavity with the small intestine pushed towards the donor's left side.

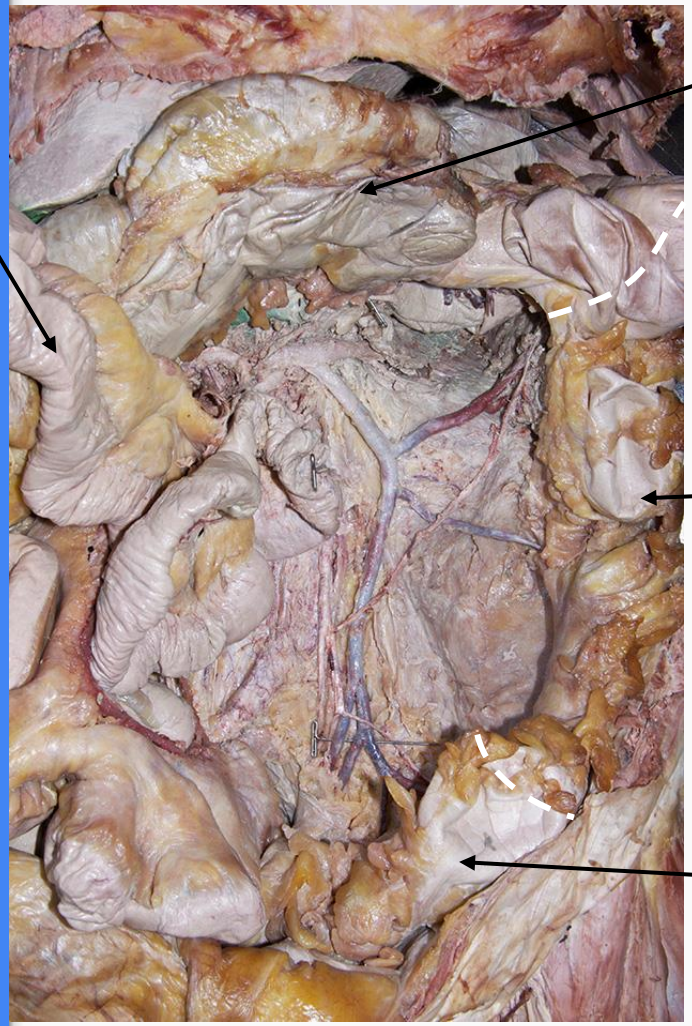


Large Intestine

Orientation:

Anterior view of the abdominal cavity with the small intestine pushed toward the donor's right side.





Rectum

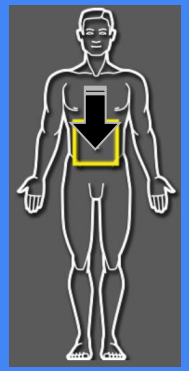
Key points:

- The end of the large intestine, specifically the sigmoid colon, directly continues as the **rectum**.
- The rectum connects directly to the **anal canal** and **anus**, the locations where fecal matter exits the body.

Rectum

Orientation:

Anterosuperior view of the end of the sigmoid colon continuing as the rectum down into the pelvic cavity.



Liver

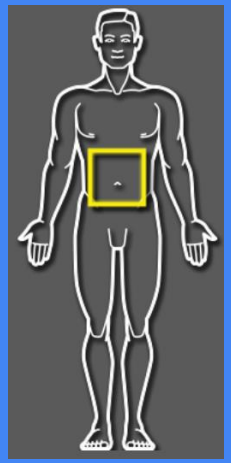
Key points:

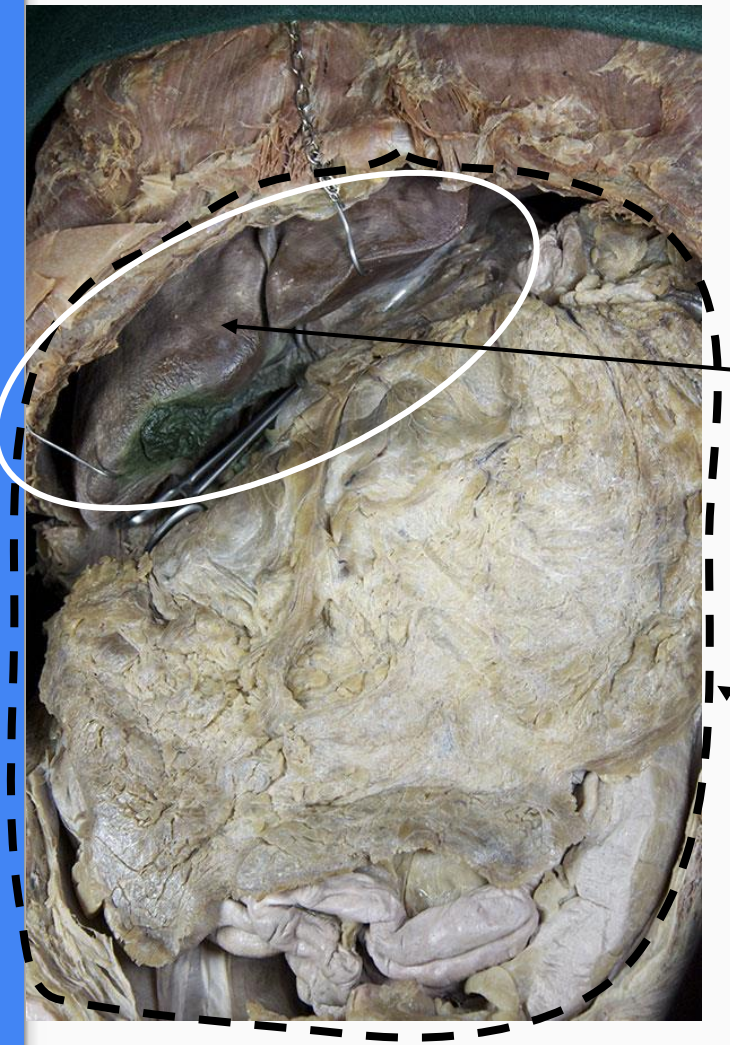
- The liver is located in the **right upper quadrant** inside the abdominal cavity.
- The liver **connects to the digestive system** via two ways:
  - **Bile duct**
  - **Portal vein system**
- The **bile duct** is a tube that allows the liver to put bile in the small intestine to help digest food.
- The **portal vein system** is made up of veins that connect the intestines and the liver. The blood traveling through these veins **carries absorbed nutrients from digested food** to the liver for processing, filtering, and storage.

Liver

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs.





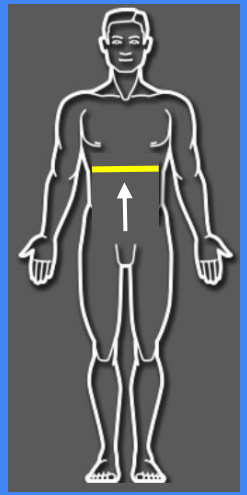
We have seen this view before when looking at the stomach and intestine. The liver was visible then. It is circled here now.

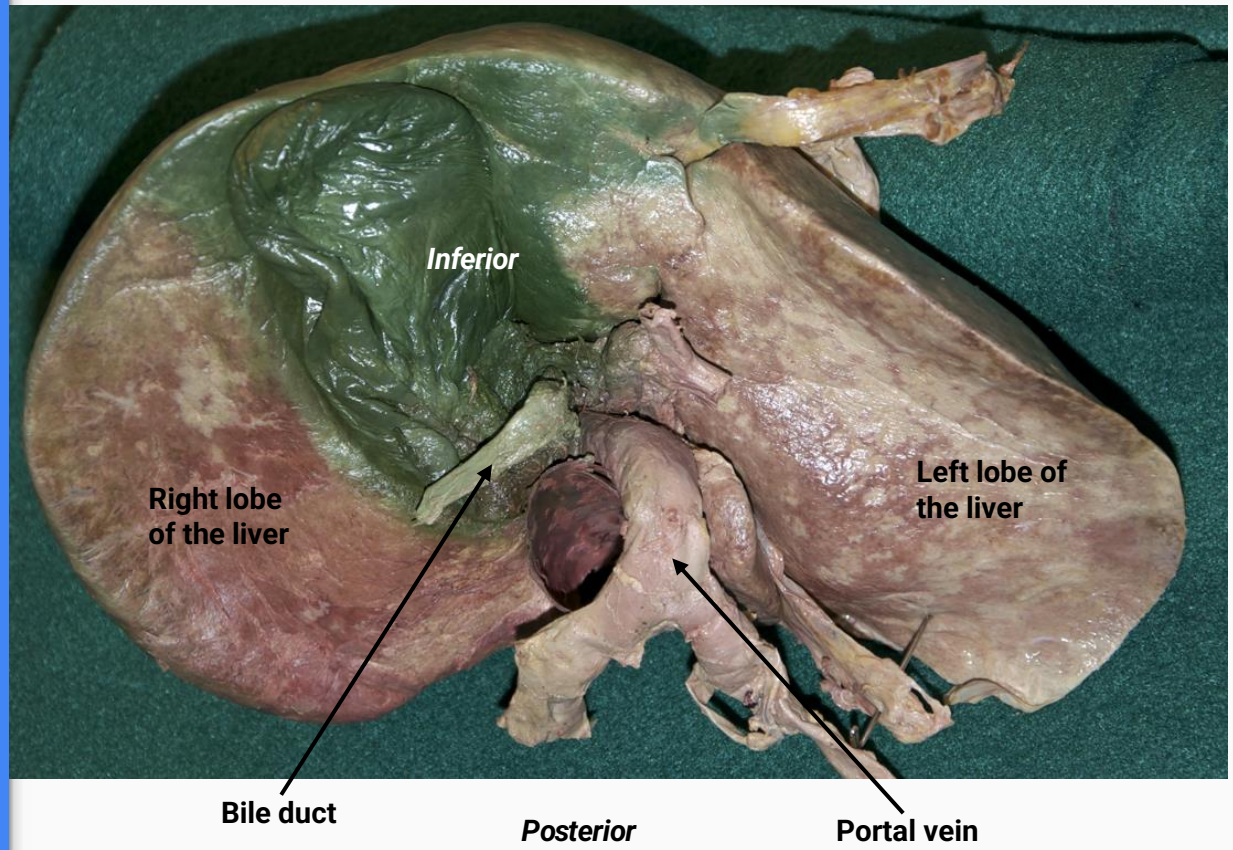
Outline of peritoneal cavity

Liver

Orientation:

Inferior view of a liver that has been removed from the donor.

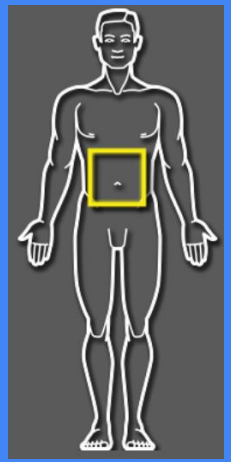




Liver

Orientation:

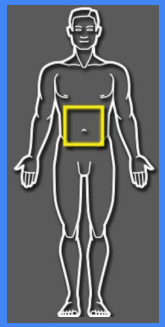
Anterior view of the abdominal cavity showcasing the stomach, liver, and start of the small intestine.

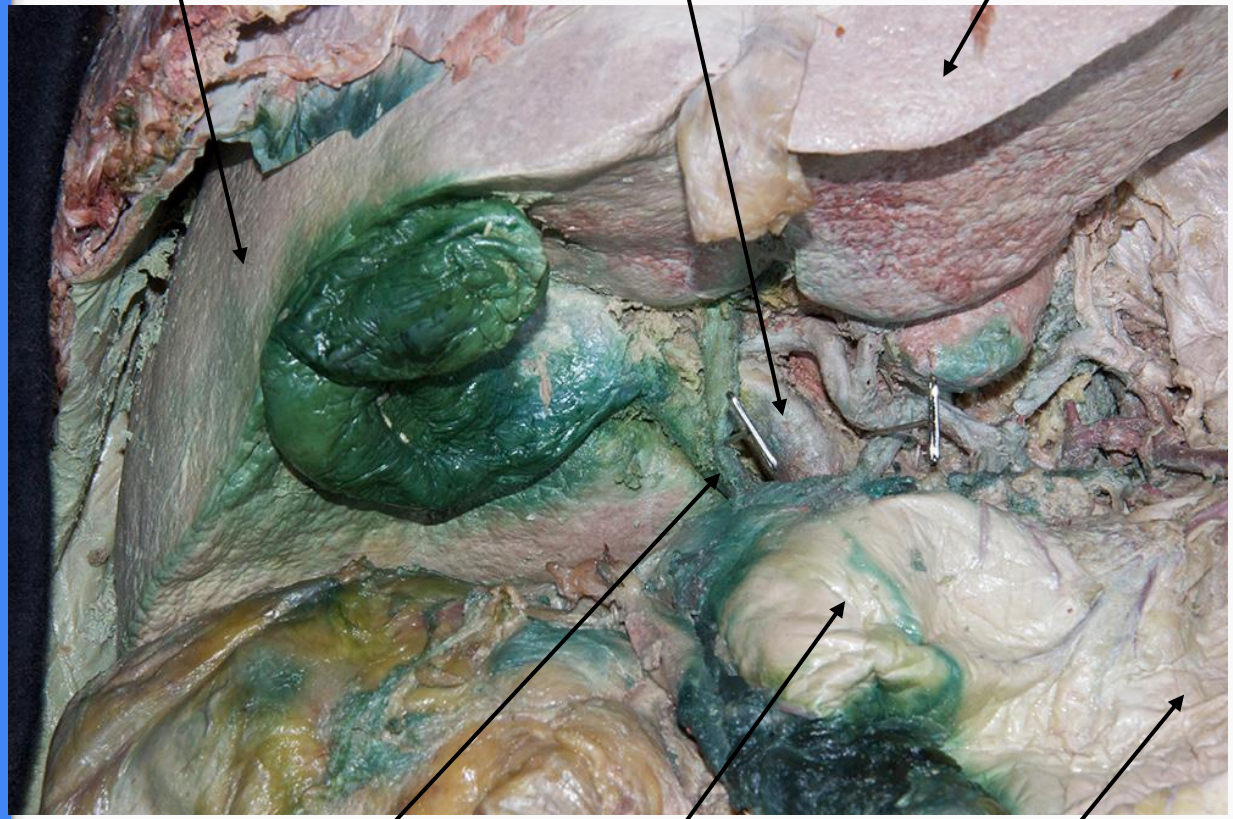


Liver

Orientation:

Anterior view of the abdominal cavity showcasing the stomach, liver, and start of the small intestine. This is similar to the previous image except the view is slightly shifted to the donor's right side.

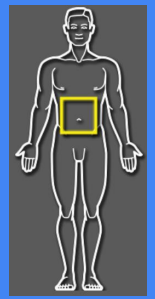


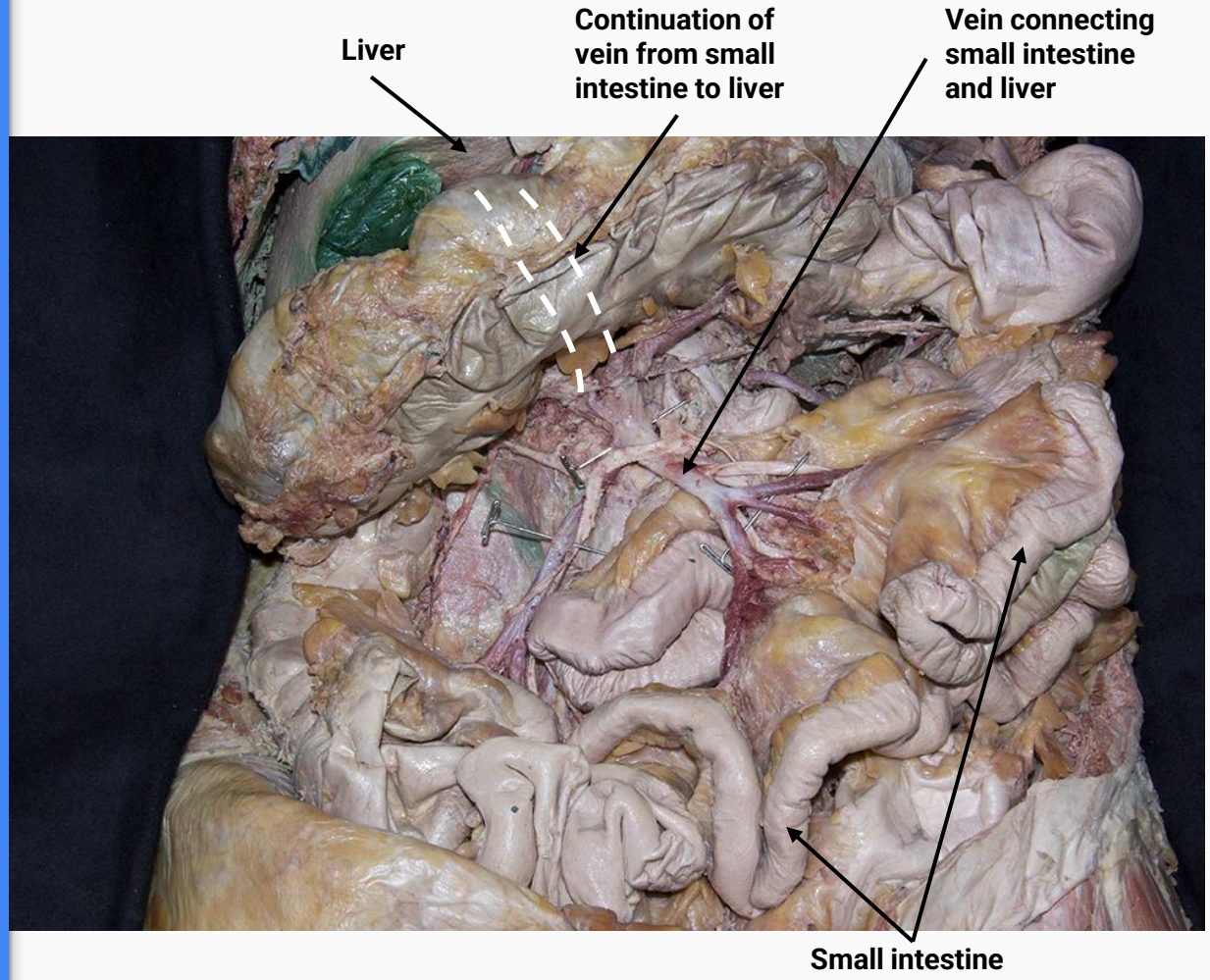


Liver

Orientation:

Anterior view of the abdominal cavity showcasing the veins that connect to the portal vein. This is an example of the connection between the small intestine and the liver. The large intestine has a similar connection to the liver.





Pancreas

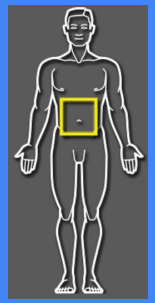
Key points:

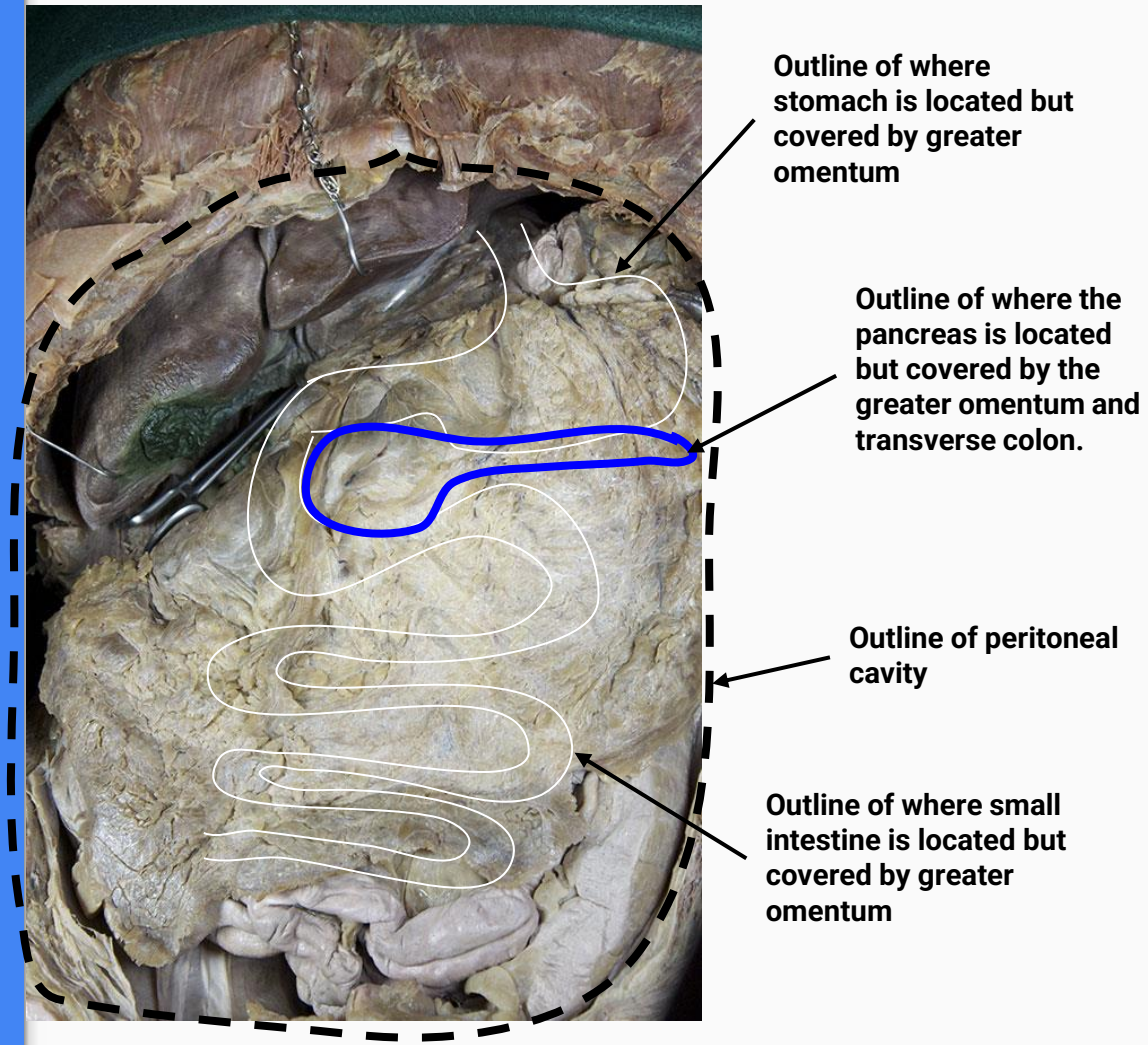
- The pancreas is located **below the stomach** and **posterior to the transverse colon**. It is tucked in a nook of the small intestine, specifically the first part of the small intestine.
- The actual pancreatic tissue is quite **friable** in a donor. It often looks **grainy** and like it could easily break apart into pieces.
- The pancreas **connects to the digestive system** via the **pancreatic duct**.
- The **pancreatic duct** allows the pancreas to secrete digestive enzymes into the small intestine to help digest food.

Pancreas

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs. We have seen this image before when looking at the small intestine section. This has been updated to show where the pancreas would be as well.

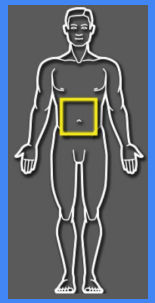


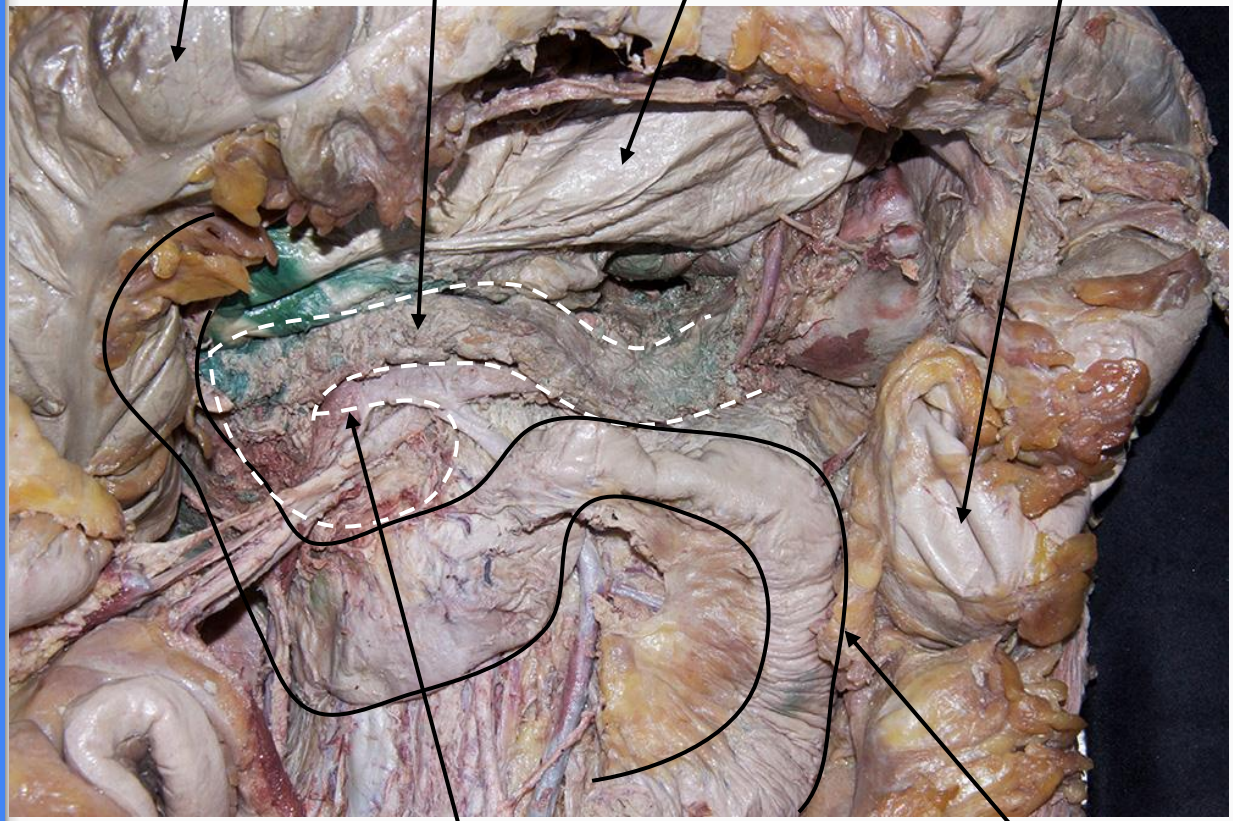


Pancreas

Orientation:

Anterior view of the abdominal cavity. The greater omentum has been dissected away. The transverse colon has been retracted upwards, and the small intestine has been retracted downwards and to the right. This allows us to see the pancreas.

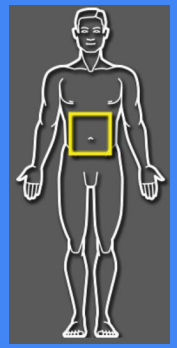


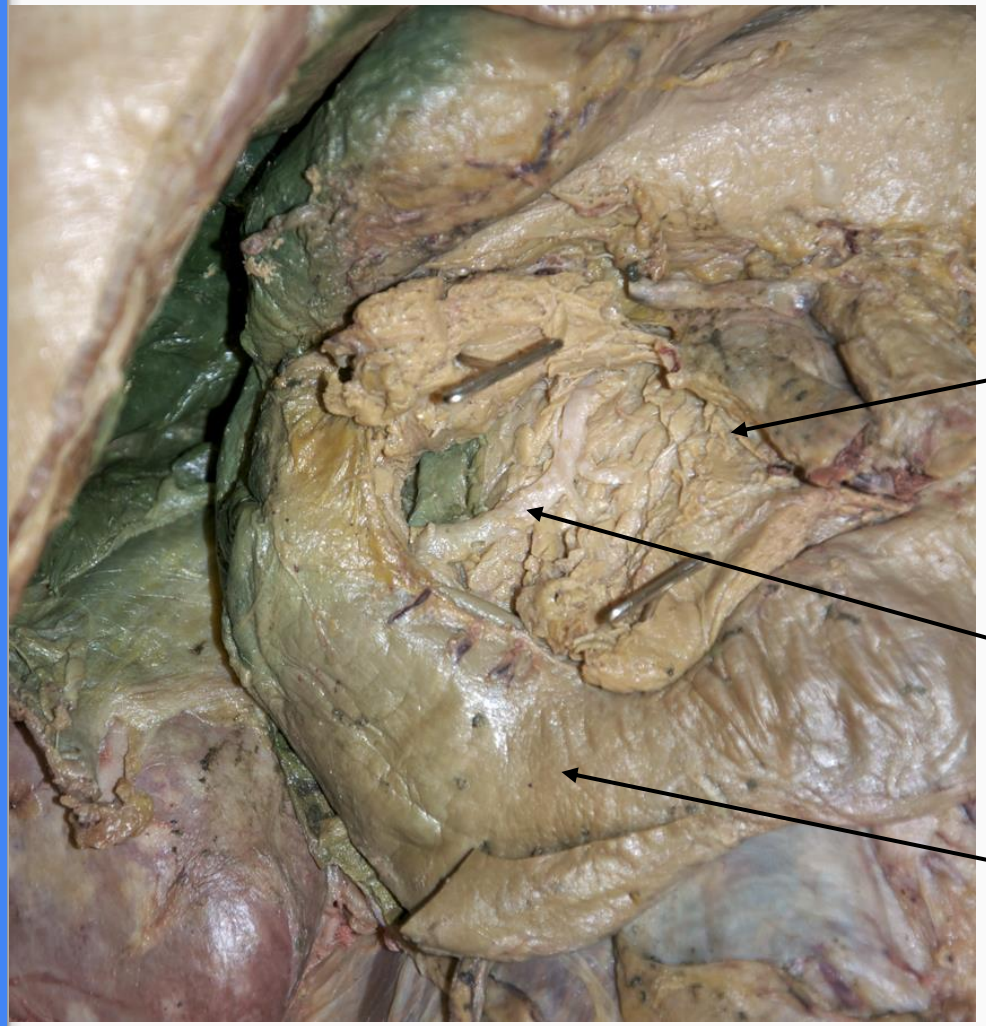


Pancreas

Orientation:

Anterior view of the pancreas in the “nook” of the start of the small intestine. This is a very zoomed in view so that we can see the pancreatic duct connected to the small intestine.





Urinary & Reproductive Systems

Urinary viscera:

- Kidneys
- Bladder

Reproductive viscera

- Prostate
- Uterus

Kidneys

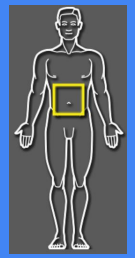
Key points:

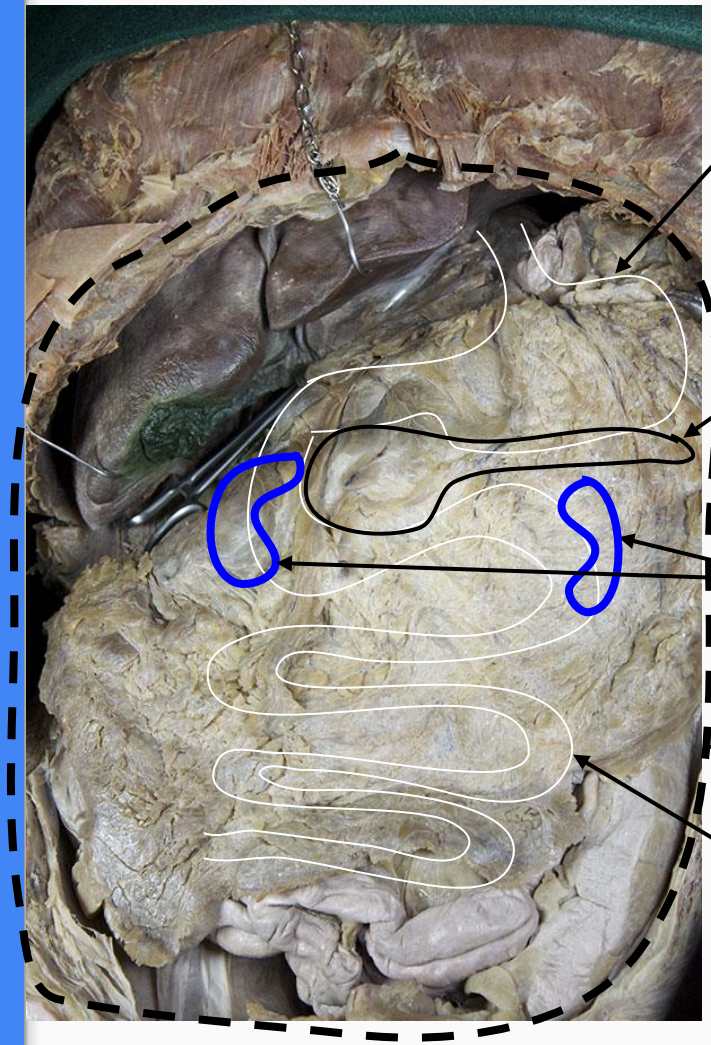
- The kidneys are part of the abdominal cavity, but they sit **behind (posterior)** all of the digestive system organs.
- Each kidney has its own **ureter** that drains urine to the **bladder**.
- Each kidney also has its own main **artery** and main **vein**. They are called the **renal artery** and **renal vein**.

Kidneys

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs. We have seen this image before when looking at the small intestine, stomach, and pancreas. This has been updated to show where the kidneys would be as well.

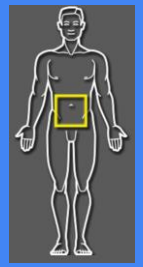


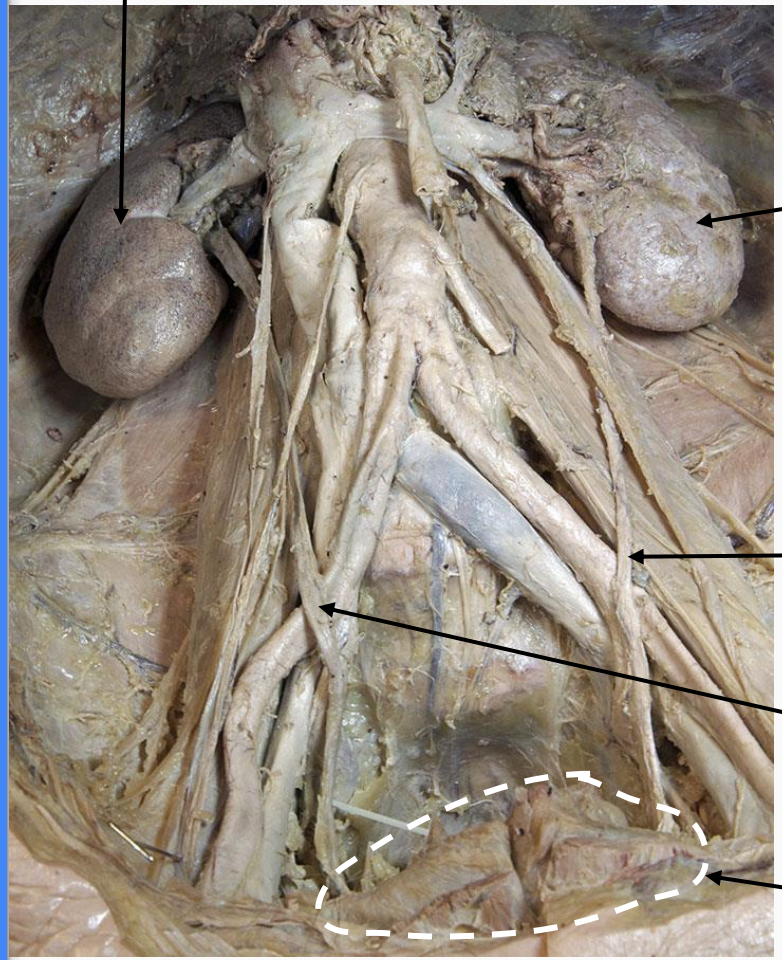


Kidneys

Orientation:

Anterior view of the lower portion of the abdominal cavity again with the digestive organs removed. We can clearly see the two kidneys and the ureters. The ureters travel down into the pelvic cavity where they drain urine into the bladder.

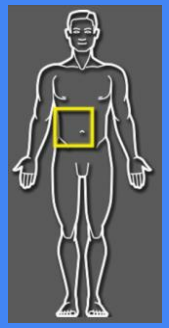


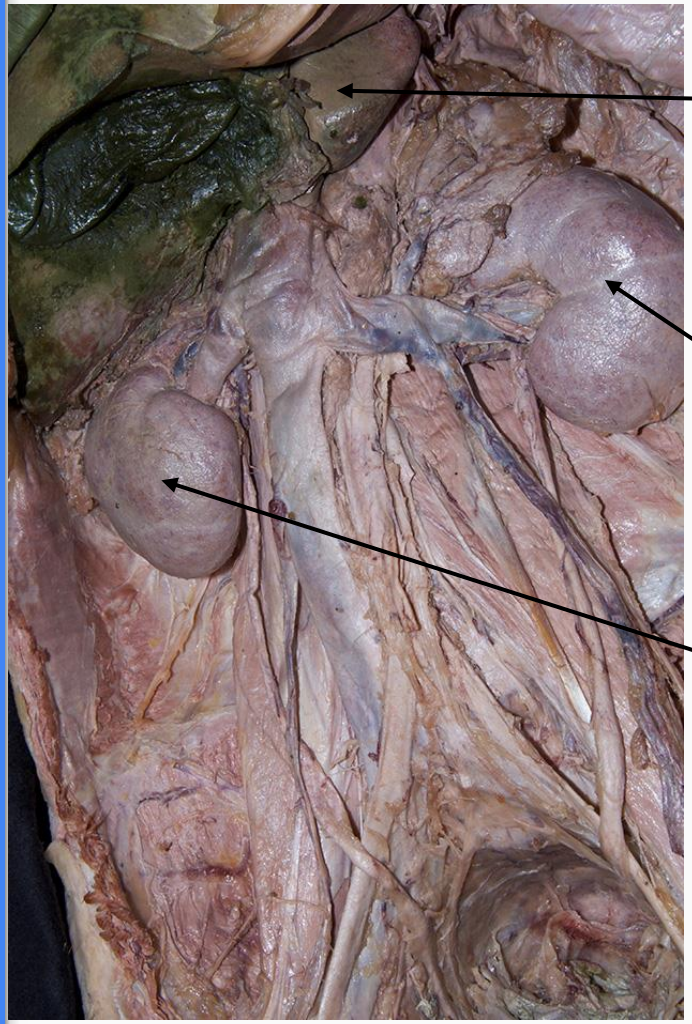


Kidneys

Orientation:

Anterior view of the abdominal cavity without most of the digestive system organs in the donor (the liver was kept). The image is slightly shifted to the donor's right side, but we still can see both kidneys here.

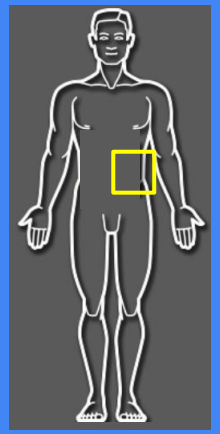




Kidneys

Orientation:

Anterior view of the left kidney. We can clearly see the renal artery and renal vein for this kidney.

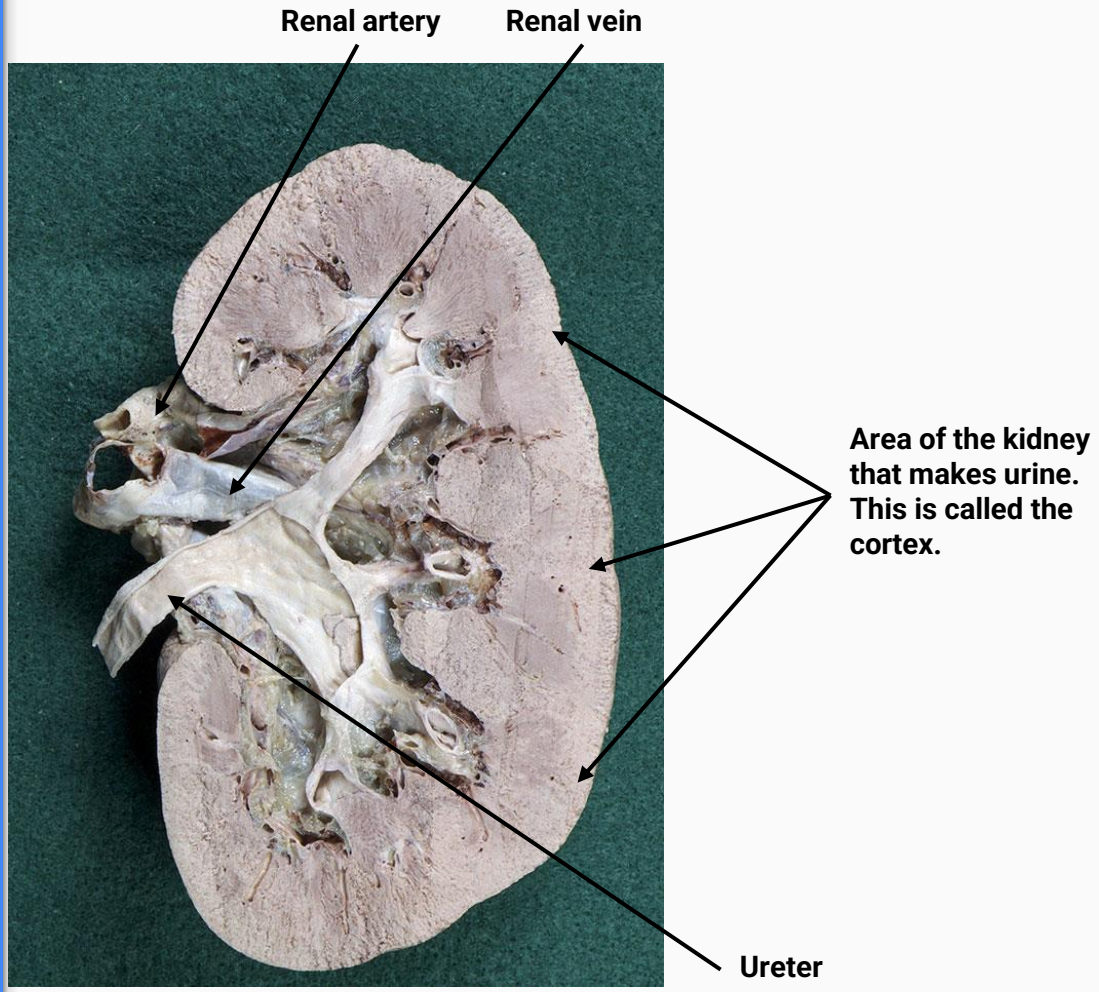


Kidney

Orientation:

This a right kidney that has been cut in half lengthwise. Specifically, this is a *coronal* section/plane of the kidney.

This image shows a posterior view of the sliced kidney. We can clearly see the ureter and how it connects to multiple parts of the kidney that are producing urine.



Bladder

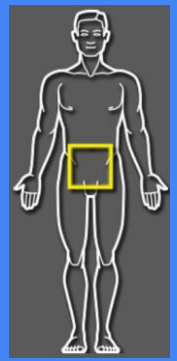
Key points:

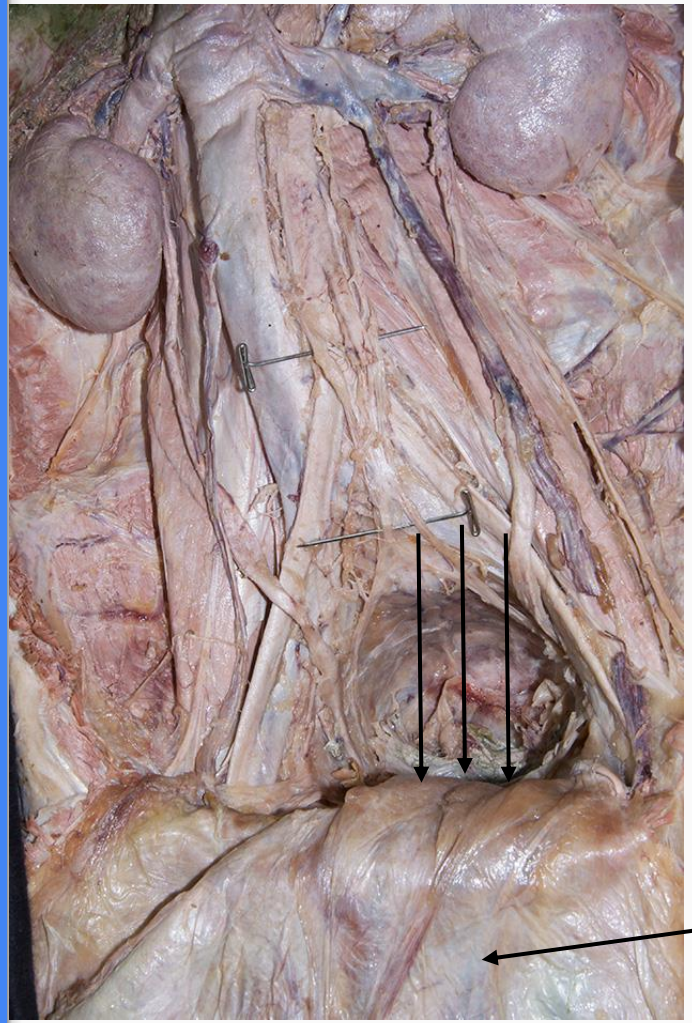
- The bladder is part of the **pelvic cavity**.
- The bladder **stores urine** that was drained from the kidney via the ureters.

Bladder

Orientation:

Anterior view of the lower part of the abdominal cavity with a slight superior view looking into the pelvic cavity.





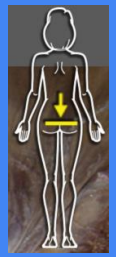
The arrows point to the general area where the bladder is located

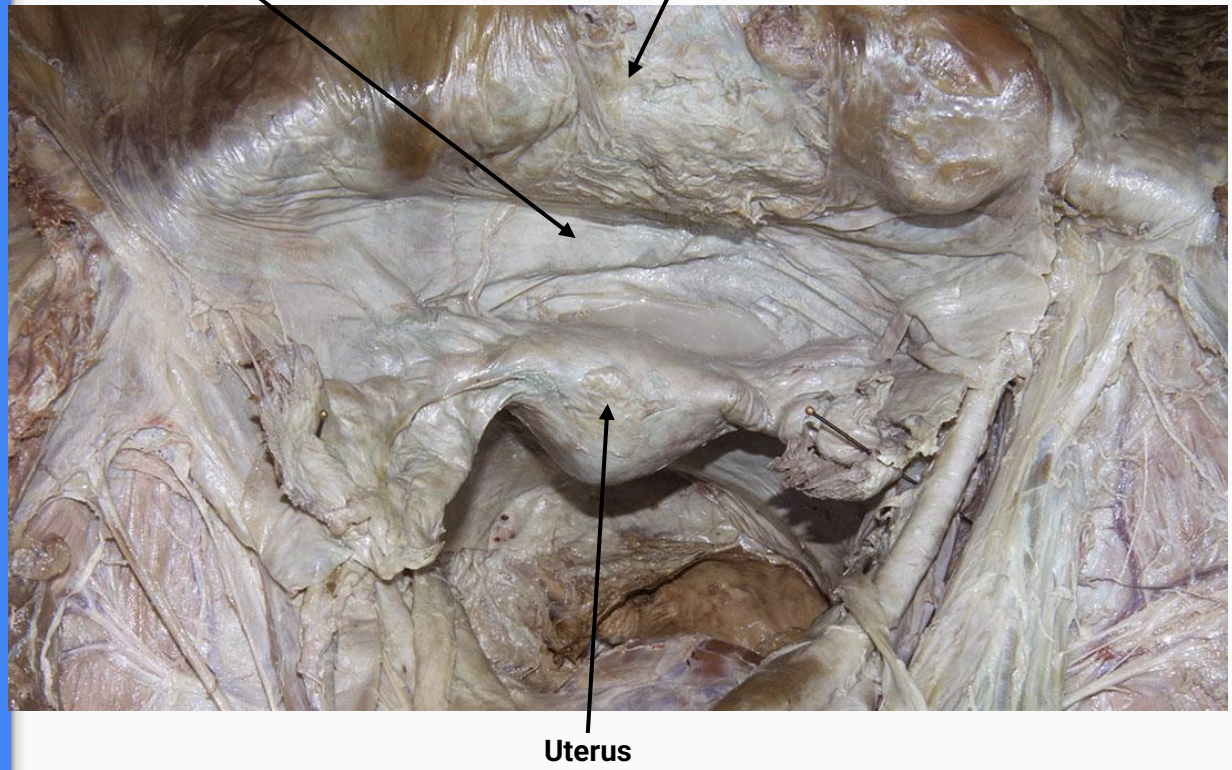
This is the anterior abdominal wall (where the rectus abdominis muscles are). It is reflected towards the viewer.

Bladder

Orientation:

Superior view of the pelvic cavity in donor with estrogen-driven anatomy. The bladder is a challenging structure to see in this view because it is usually very flattened. It looks as if it is within the anterior abdominal wall, but it is in fact behind it. This can be more easily seen on a “hemisected” view shown later on.

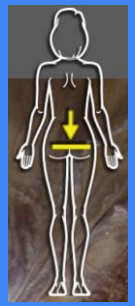


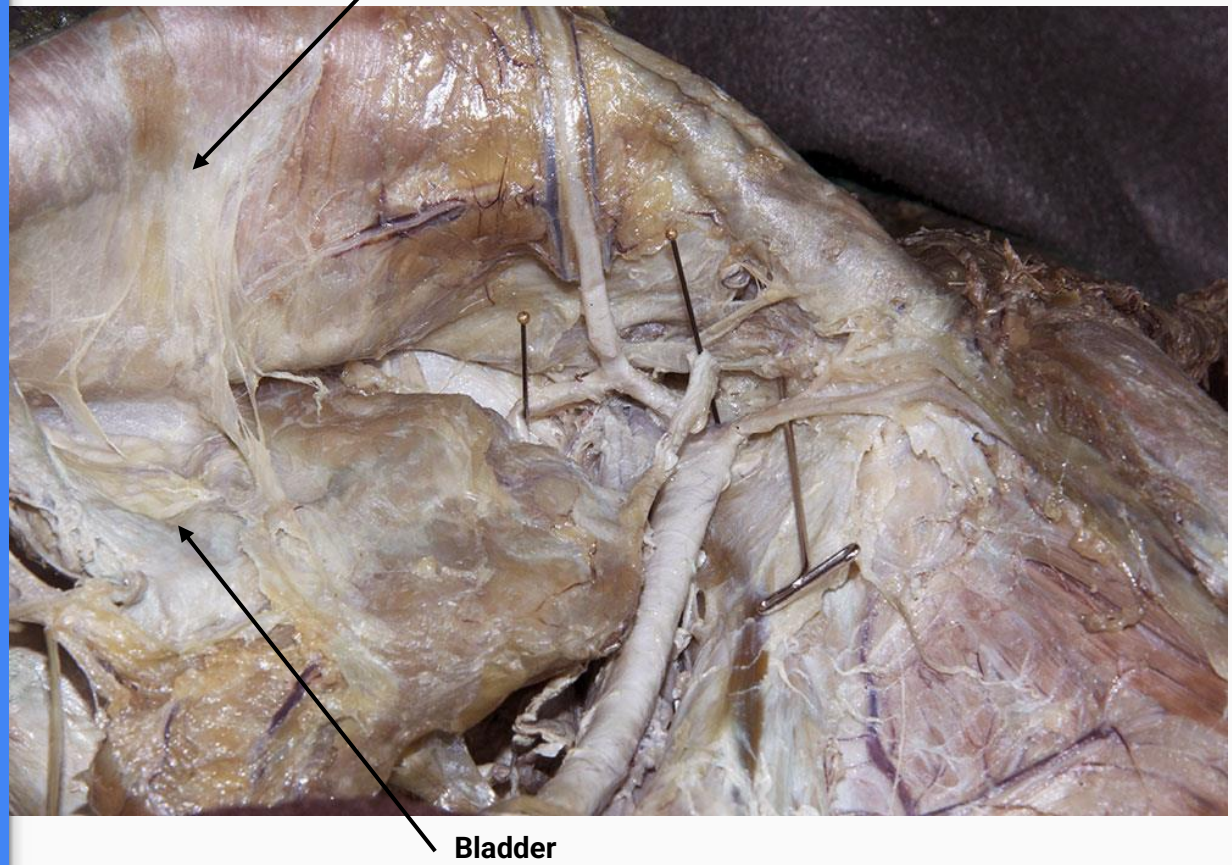


Bladder

Orientation:

Another example of a superior view of the pelvic cavity. This time the bladder has been dissected more to show the actual structure. You can clearly see it is separate from the anterior abdominal wall.

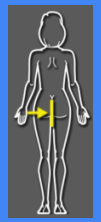




Bladder

Orientation:

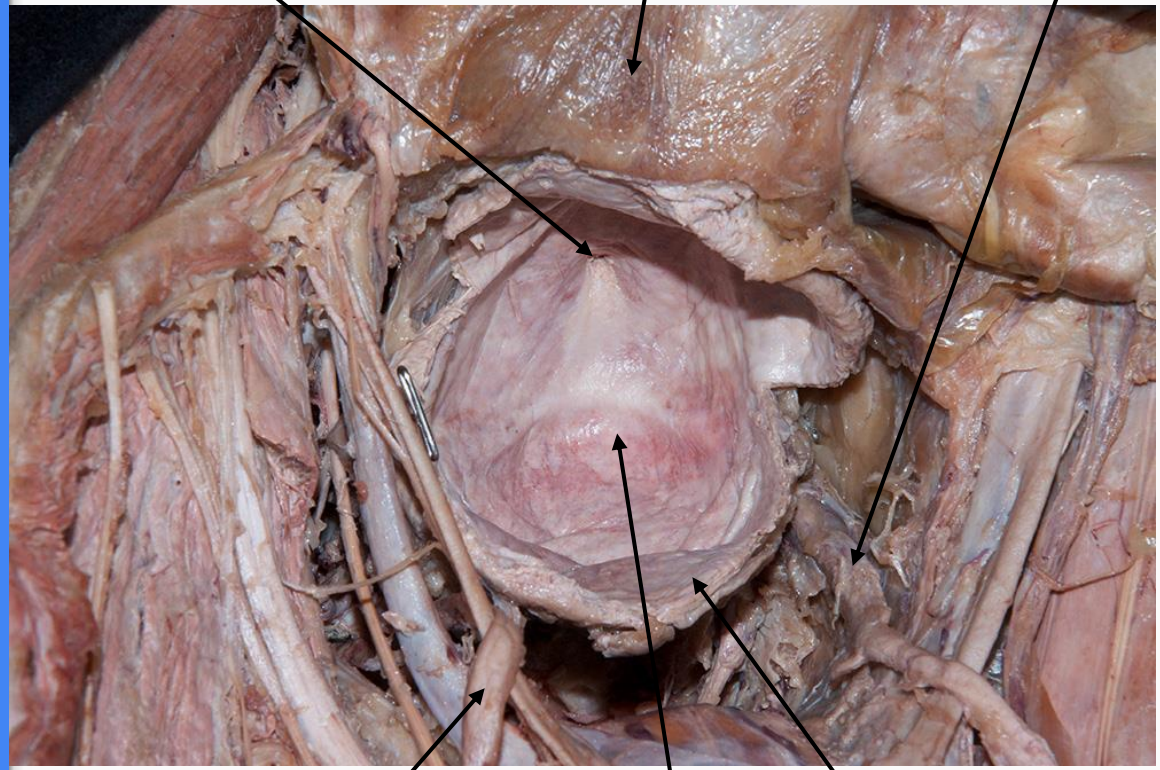
This is a view of a “hemisected” donor with estrogen-driven anatomy. “Hemisected” means the pelvis has been cut directly in half down the middle so that we can see all the organs and their locations a bit easier. In anatomical terms, this is a cut in the *median/midsagittal* plane. We are looking at the right half of the donor’s pelvic cavity.



Bladder

Orientation:

Superior view of the pelvic cavity in donor with testosterone-driven anatomy. The top portion (“roof”) of this bladder has been cut and reflected towards the viewer so that we can see inside the bladder.



Prostate

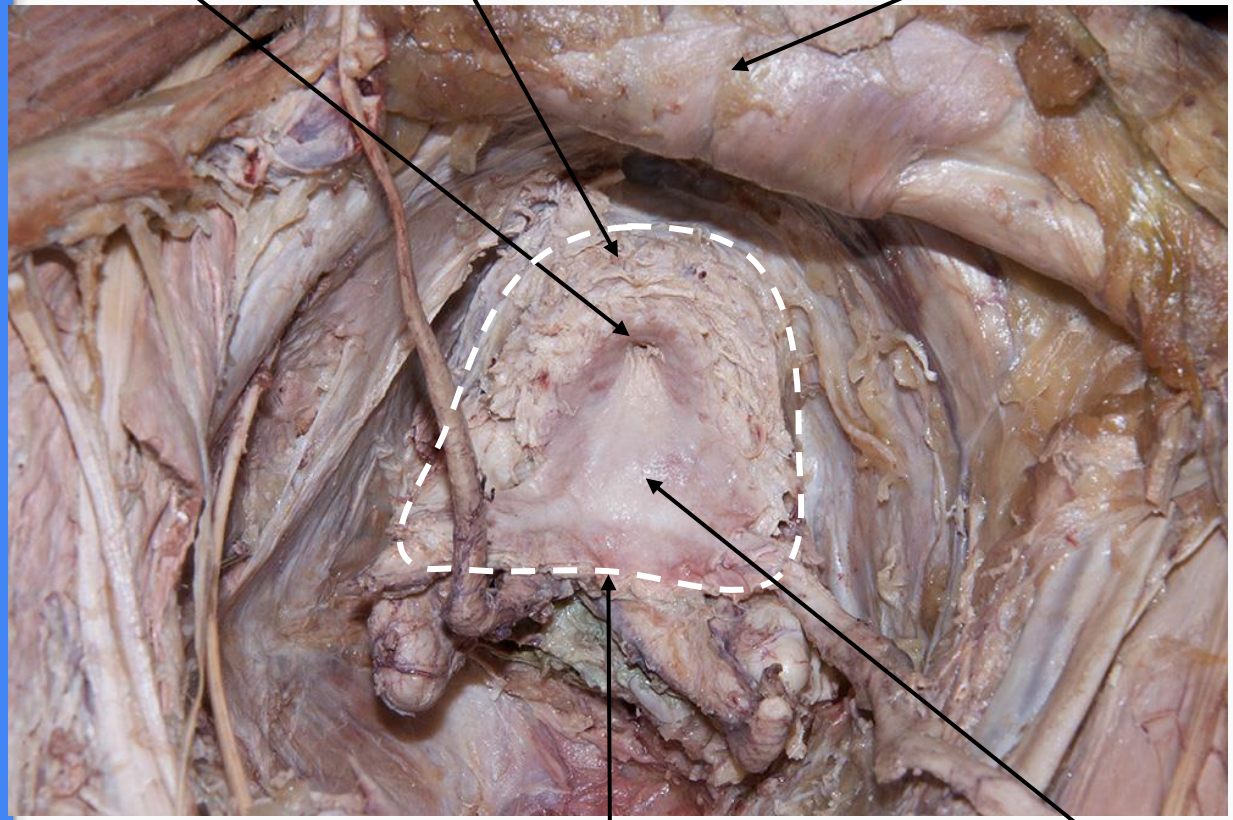
Key points:

- The prostate is a structure that **only exists in humans with testosterone-driven anatomy**.
- The prostate is **directly below** the bladder.
- The prostate **wraps completely around** the urethra, the structure that allows urine to drain from the bladder out of the body.

Prostate

Orientation:

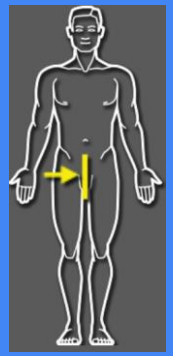
Superior view of the pelvic cavity in donor with testosterone-driven anatomy. Most of the top portion (“roof”) of this bladder has been dissected and removed (compared to the final bladder image in this atlas). This allows us to see the beginning of the prostate wrapping around the urethra.

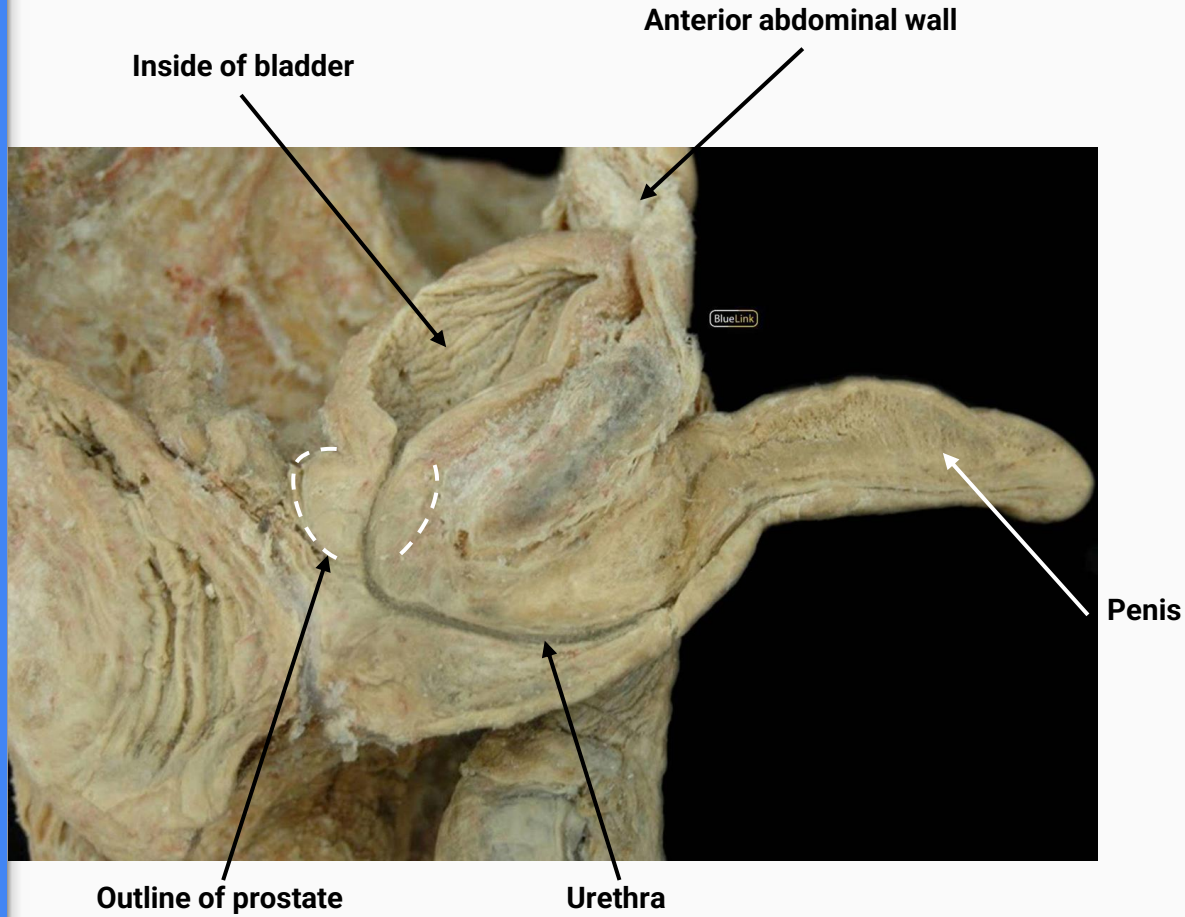


Prostate

Orientation:

Median/midsagittal hemisection of donor with testosterone-driven anatomy. We are looking at the left half of the donor's pelvic cavity.



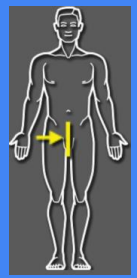


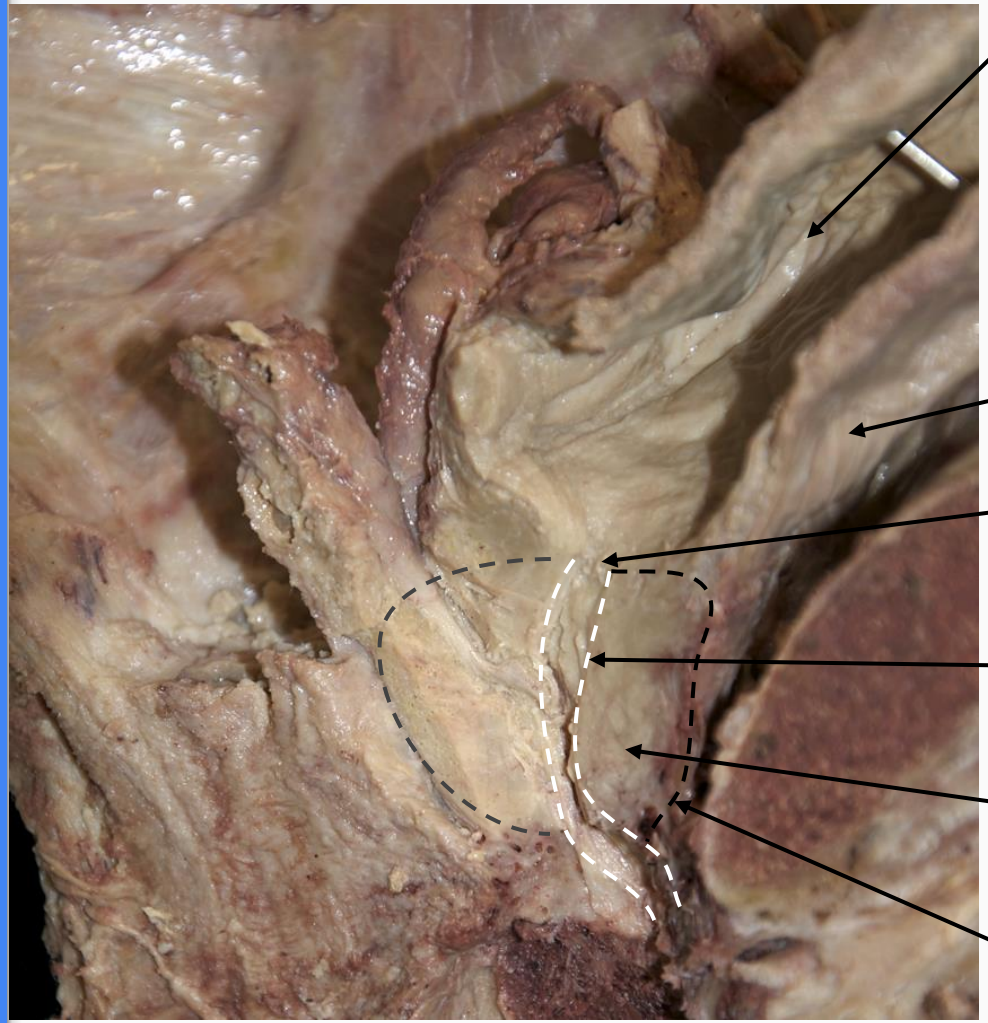
Alsup BK, Fox GM. UL Pelvic Cavity 15. BlueLink, University of Michigan Medical School. https://sites.google.com/a/umich.edu/bluelink/resources/bluelink/unlabeled-pelvic-cavity-images#h.6a152a614d28437f_27033. Published Jun 4, 2018. Accessed Dec 17, 2023.

Prostate

Orientation:

Median/midsagittal hemisection of donor with testosterone-driven anatomy. We are looking at the left half of the donor's pelvic cavity. This picture is quite zoomed in to where we just see the prostate, bladder, and urethra.





Uterus

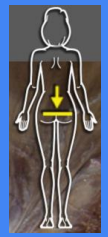
Key points:

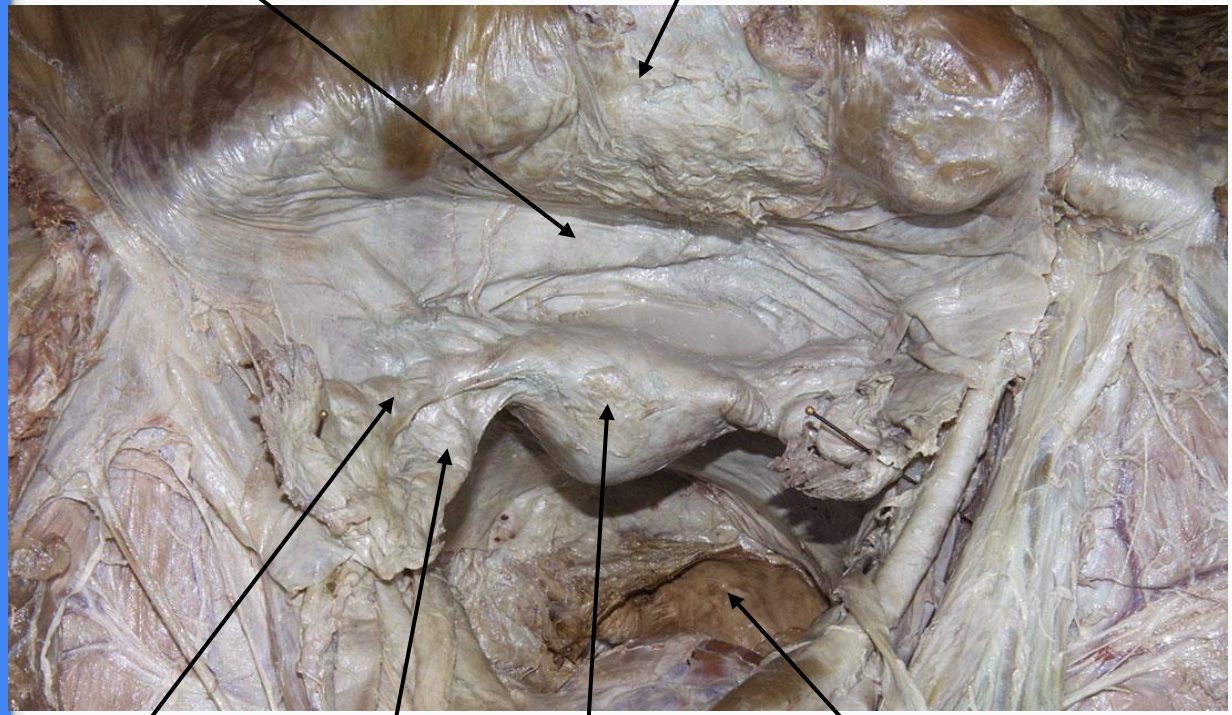
- The uterus is a structure that **only exists in humans with estrogen-driven anatomy**.
- The uterus is located within the **pelvic cavity**.
- The uterus is **directly behind (posterior)** to the bladder.
- The uterus is **directly in front of (anterior)** to the rectum.
- The uterus is the **location at which a fetus grows**.
- The uterus **directly connects** to the **vagina** via the **cervix**.

Uterus

Orientation:

Superior view of the pelvic cavity in donor with estrogen-driven anatomy. The uterus is the bulbous structure in between the bladder and the rectum. It is “suspended” in the pelvic cavity. You can also see the uterine tube and the ovaries attaching to the uterus. These are a bit challenging to discern because they are covered by other tissue.

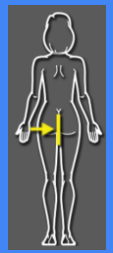


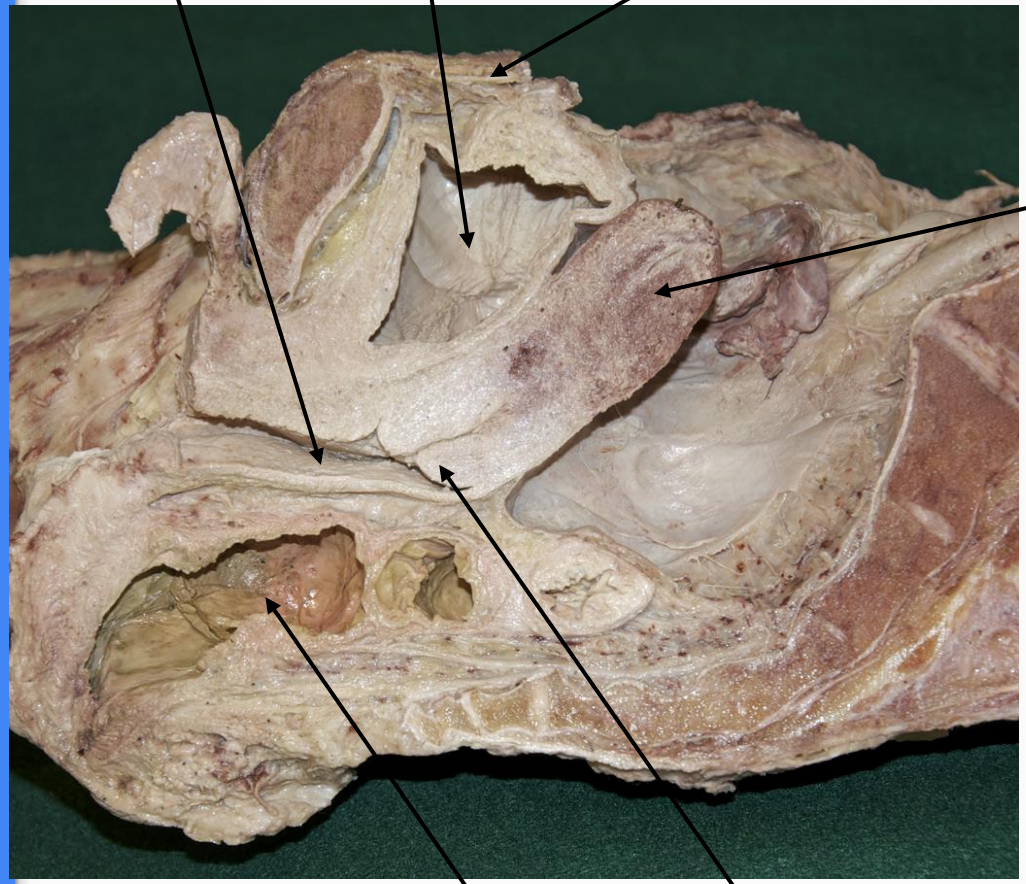


Uterus

Orientation:

This is a view of a “hemisected” donor with estrogen-driven anatomy. We are looking at the right half of the donor’s pelvic cavity. You can clearly see the uterus is behind (posterior) the bladder and in front of (anterior) the rectum. We can also see the uterus directly connecting to the vagina.





Immune & Endocrine Systems

- Spleen
- Thyroid gland
- Adrenal glands

Spleen

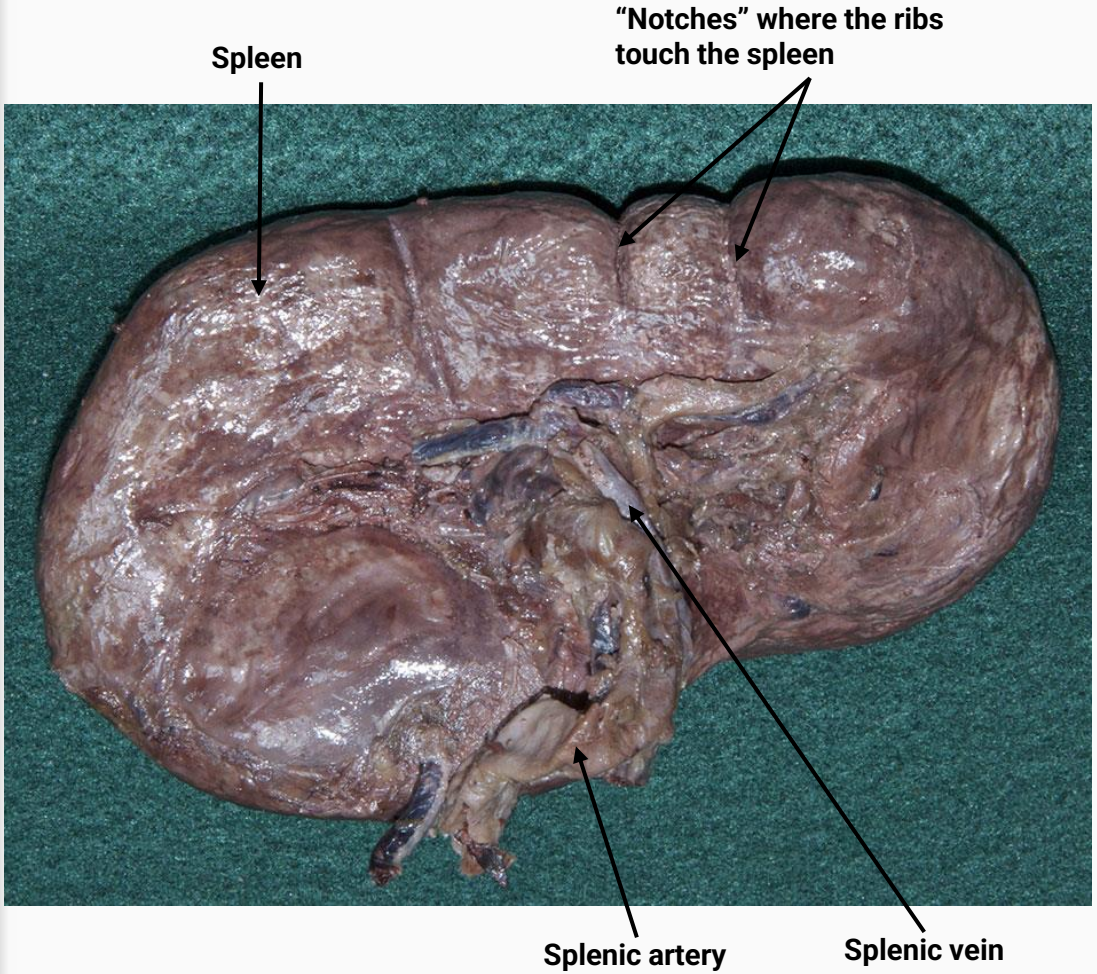
Key points:

- The spleen is located in the **abdominal cavity** in the **left upper quadrant**. It is sort of hidden (protected) by the lower ribs.
- The spleen is directly to the **left** of the end of the pancreas (known as the tail of the pancreas).
- The spleen is slightly **below and to the left** of the stomach.
- The spleen is directly next to the location where the **transverse colon** becomes the **descending colon**.
- The spleen has a main artery and main vein called the **splenic artery** and **splenic vein**.
- Humans normally only have **one** spleen.

Spleen

Orientation:

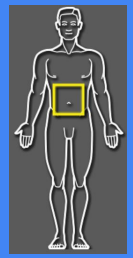
This is a spleen that has been removed from the donor. The top portion where there are “notches” is where the ribs touch the spleen. We can also see the splenic artery and splenic vein in this view. Lastly, the spleen can sometimes be confused for the kidney. They typically have different colors; the spleen is more red/purple.

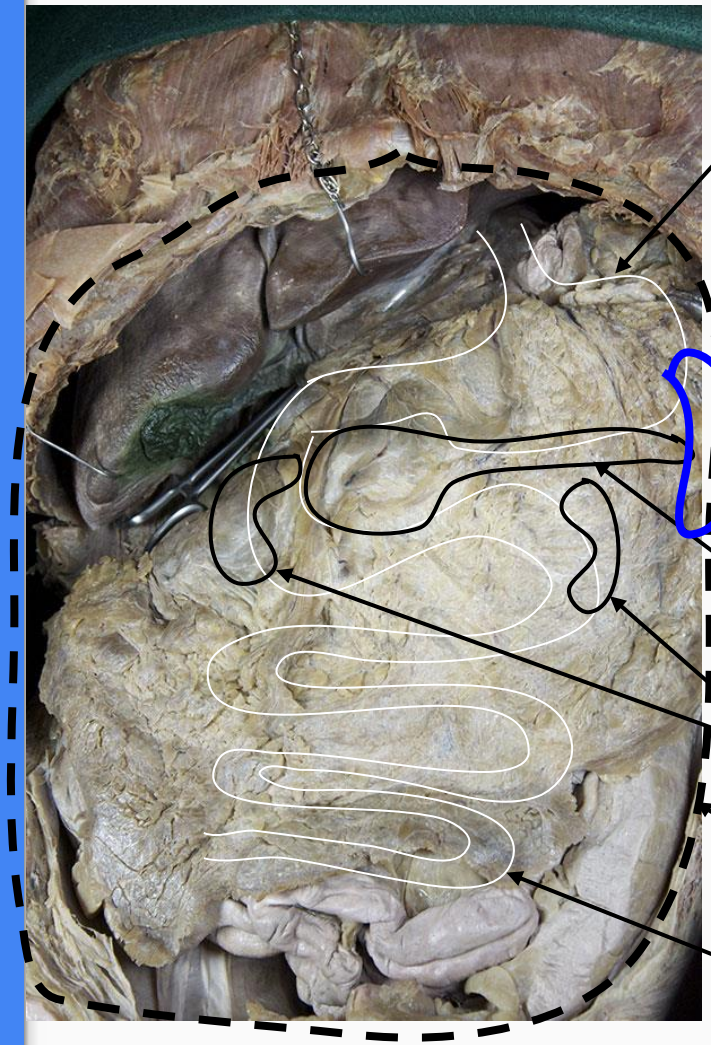


Spleen

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs. We have seen this image before when looking at the small intestine, stomach, and pancreas. This has been updated to show where the spleen would be as well.

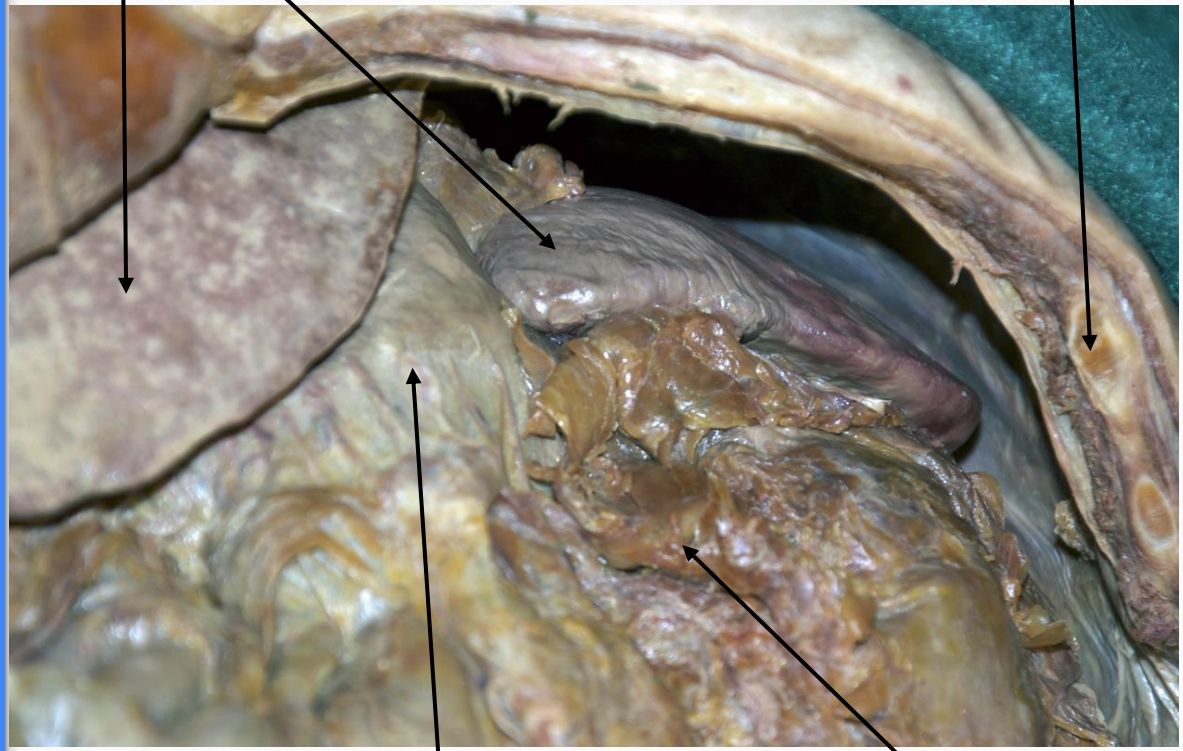




Spleen

Orientation:

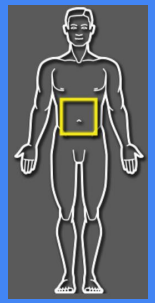
This is another interesting view of the spleen. It is sort of like a “hemisected” view of the left side of the abdominal cavity. This image gives a good example of how the spleen sits underneath the ribs. Note that it appears that it isn’t touching the ribs. This may be due to the view of the picture or just due to the fact that it is not from an alive person.

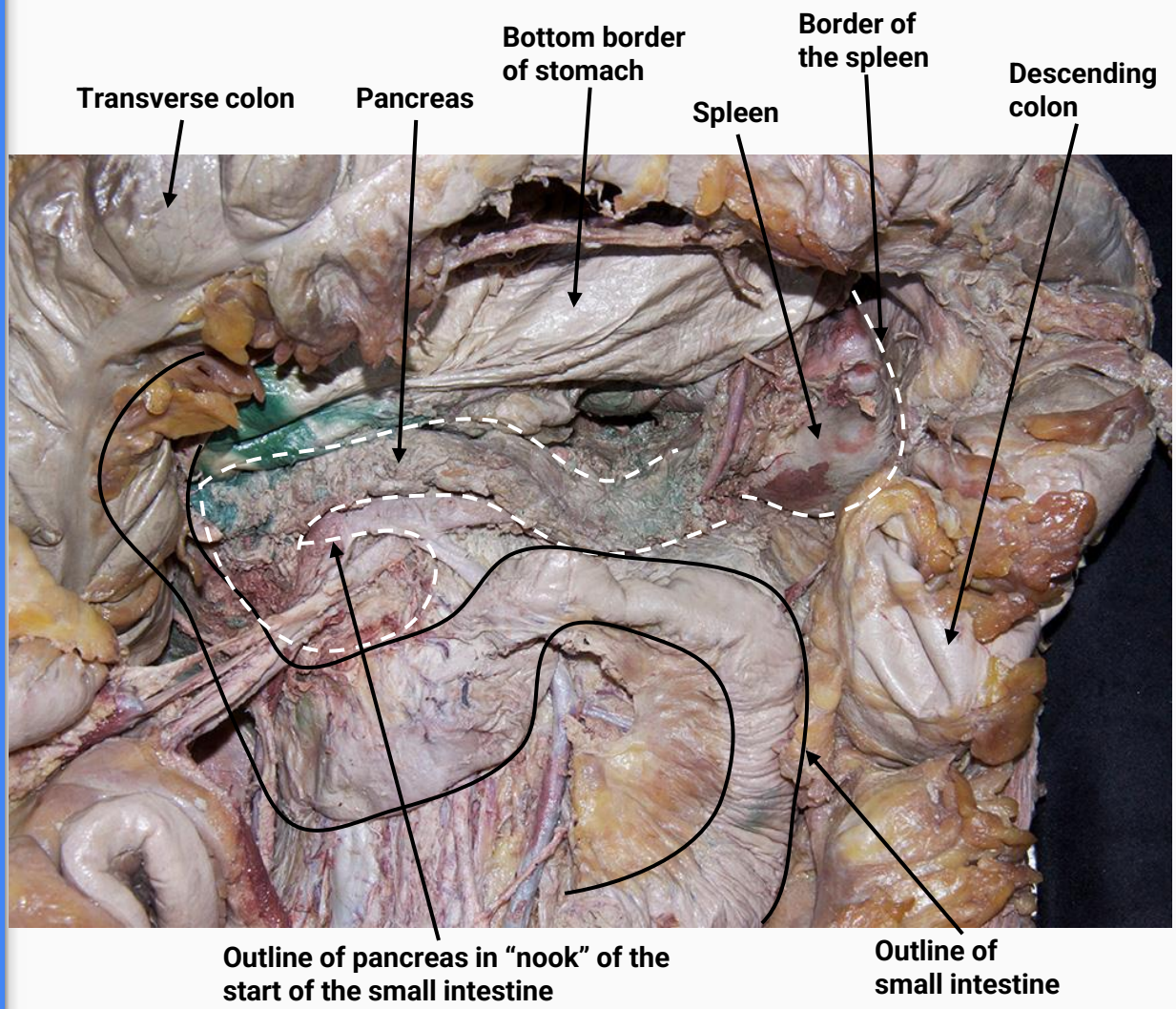


Spleen

Orientation:

Anterior view of the abdominal cavity. The greater omentum has been dissected away. The transverse colon has been retracted upwards, and the small intestine has been retracted downwards and to the right. This allows us to see the pancreas and the spleen.





Thyroid gland

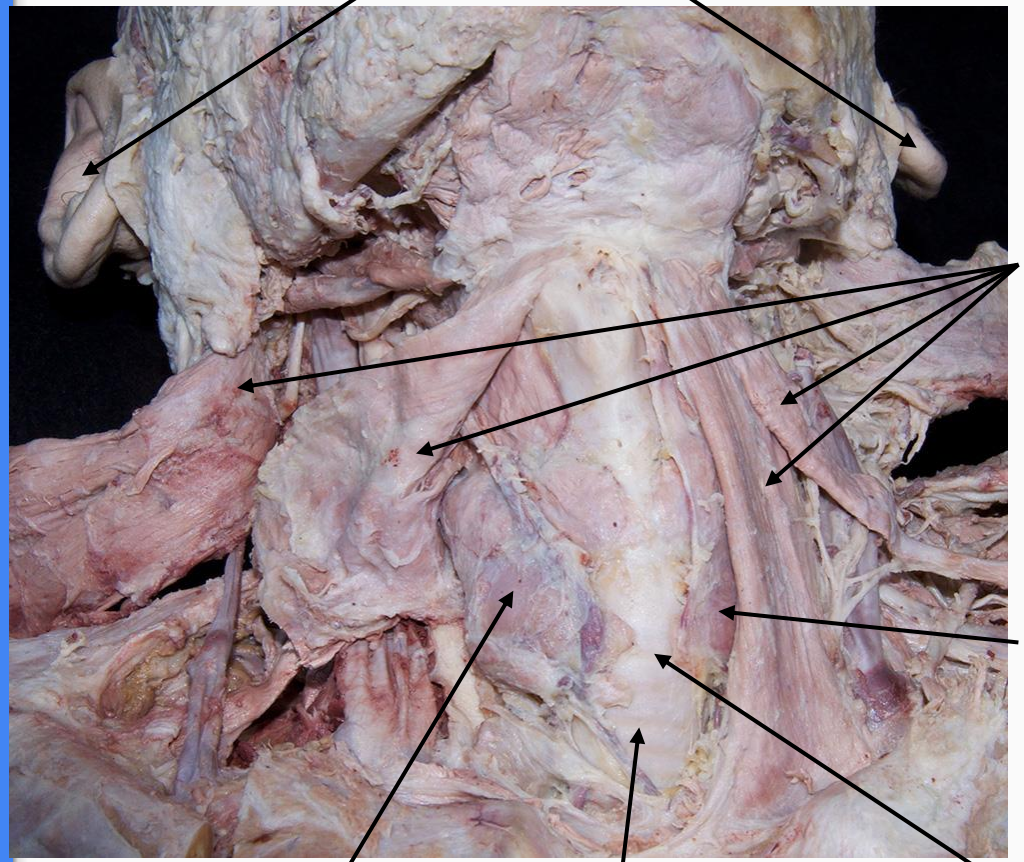
Key points:

- The thyroid gland is located in the **neck**.
- The thyroid gland has **two lobes**, one on each side of the trachea, and a portion that connects the two lobes called the **isthmus**.
- The **isthmus** portion is positioned **directly in front of (anterior)** to the trachea.
- The **lobes** are positioned **directly on the left and the right (lateral)** to the trachea.
- About **50% of people** have an additional lobe that comes **directly off the isthmus** called the **pyramidal lobe**.[3]
- Some people have no **isthmus** and **two completely separate lobes**.[3]

Thyroid

Orientation:

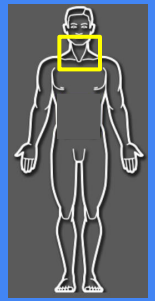
Anterior view of the neck. This picture shows a deep dissection all the way down to the location of the thyroid and trachea. Various neck muscles are visible but will not be covered.

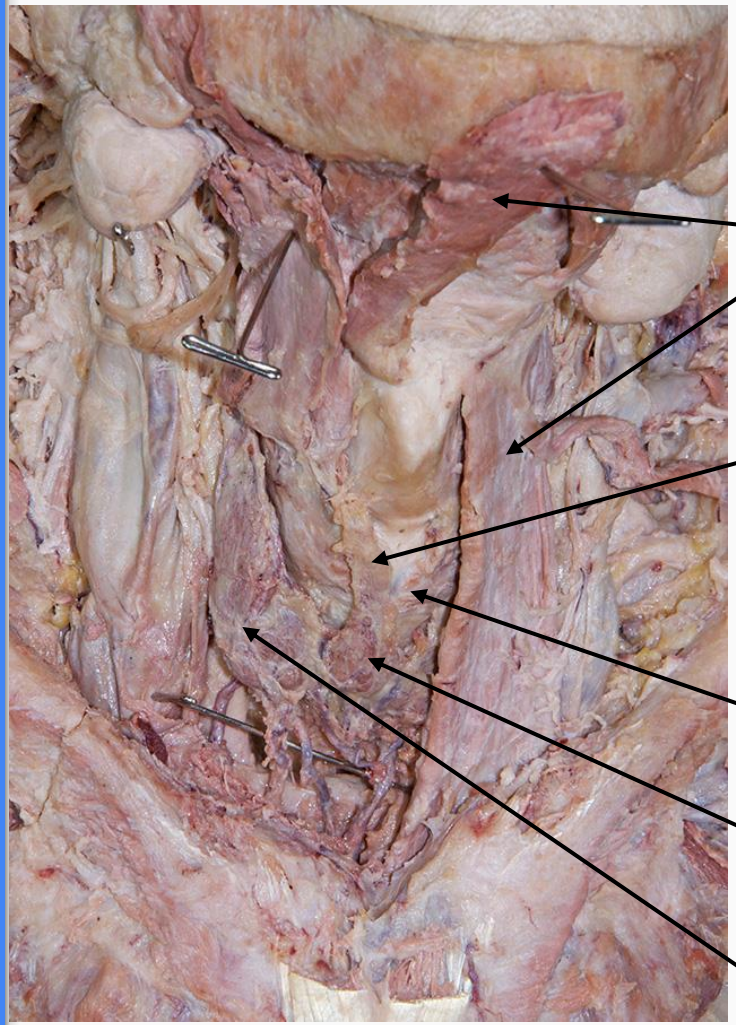


Thyroid

Orientation:

Anterior view of the neck. Again, this is a deep dissection all the way down to the thyroid and trachea.

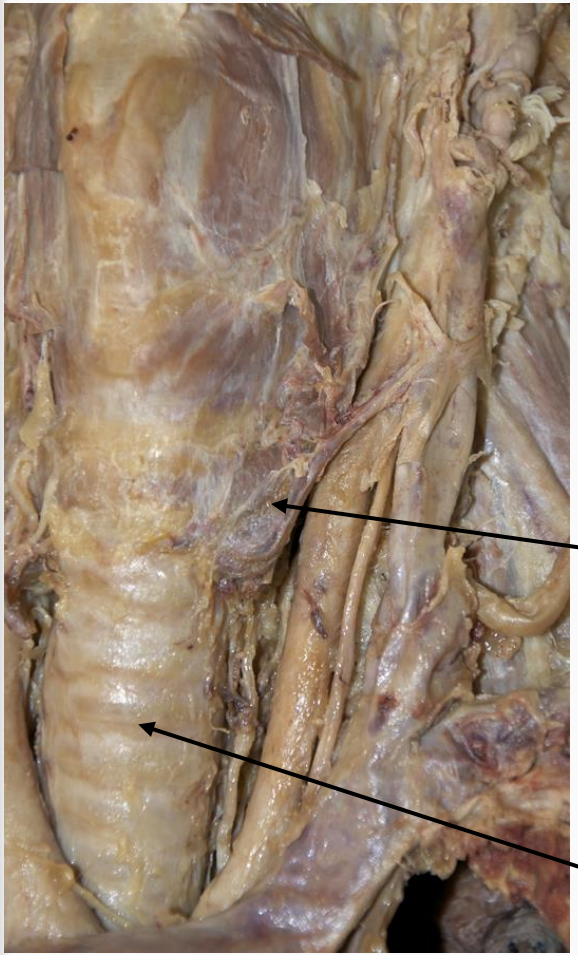




Thyroid

Orientation:

Anterior view of the neck. Again, this is a deep dissection all the way down to the thyroid and trachea. The view is slightly to the donor's left side of the neck. We only see the left lobe of the thyroid gland. This patient also doesn't have an isthmus or pyramidal lobe.



Adrenal glands

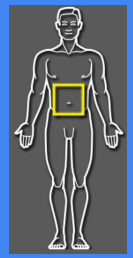
Key points:

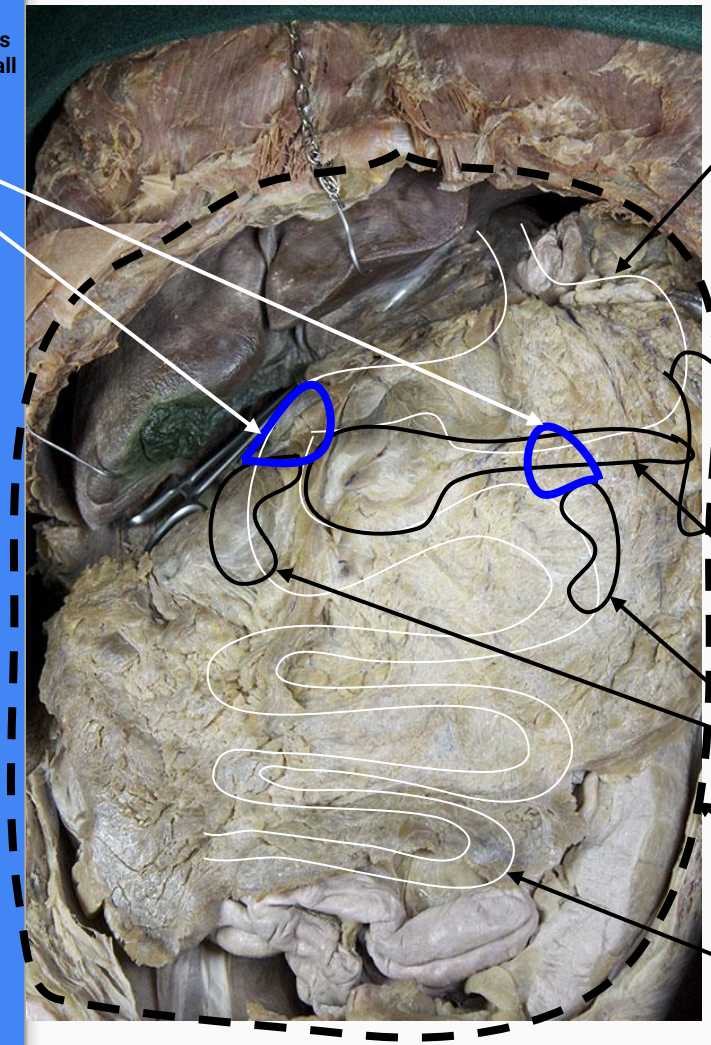
- The **right adrenal gland** is positioned **directly on top of** (**superior)** to the **right kidney**.
- The **left adrenal gland** is positioned **directly on top of the left kidney** but slightly closer to the **midline of the body (superior-medial)** than the **right adrenal gland**.
- The adrenal glands are shaped somewhat like a rounded **triangular prism**.
- Another name for the **adrenal glands** is the **suprarenal glands**. The prefix **supra-** essentially means “on top of,” which makes sense for this organ name considering the location **on top of the kidneys**.

Adrenal glands

Orientation:

Anterior view of the peritoneal cavity without any dissection of the abdominal organs. We have seen this image before when looking at the small intestine, stomach, spleen, pancreas, and kidneys. This has been updated to show where the adrenal glands would be as well.





Adrenal glands

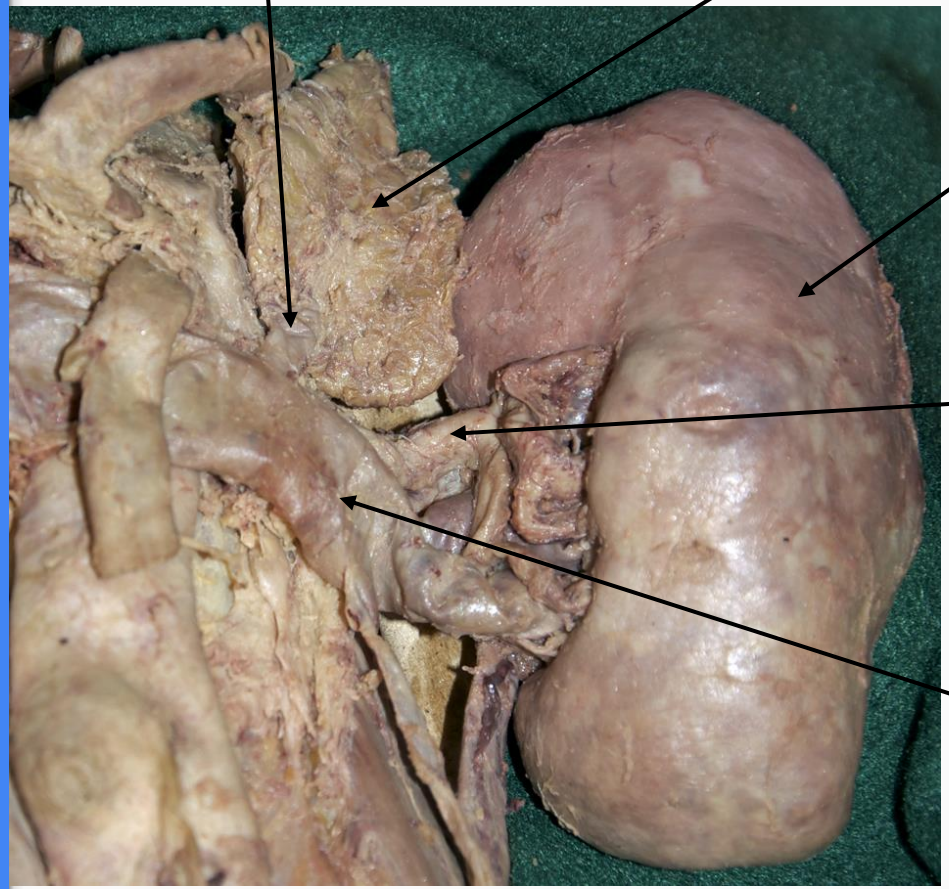
Orientation:

Close up view of the bottom (inferior) part of the left adrenal gland. It has been dissected off the top part of the left kidney. The adrenal glands look like fatty (adipose) tissue.

Adrenal glands

Orientation:

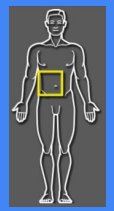
Another view of the left adrenal gland but slightly zoomed out to show the difference in size between it and the left kidney.

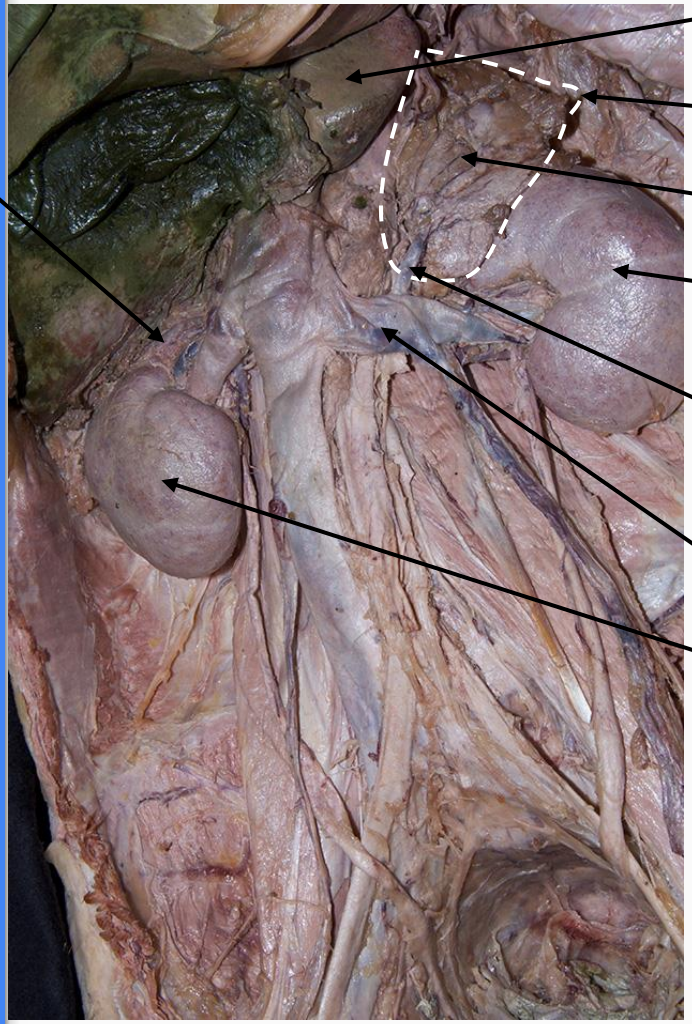


Adrenal glands

Orientation:

Anterior view of the abdominal cavity without most of the digestive system organs in the donor (the liver was kept). The image is slightly shifted to the donor's right side. The adrenal glands can be seen on top of the kidneys. The left adrenal gland is much more visible than the right adrenal gland.





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1. *VH Dissector Pro* [Computer Software]. Version 6.3.10. Aurora, CO: Touch of Life Technologies Inc; 2023.
2. Dalley AF II, Agur AMR. *Moore's Clinically Oriented Anatomy*. 9th ed. Wolters Kluwer; 2023. Accessed December 26, 2023. https://premiumbasicsciences-lwwhealthlibrary-com.eu1.proxy.openathens.net/content.aspx?sectionid=252430405&bookid=3187#dalley9-dalley-9-dalley-ch002-topic003
3. Agur AMR, Dalley AF II. *Grant's Atlas of Anatomy*. 15th ed. Wolters Kluwer; 2021. Accessed December 12, 2023. https://meded-lwwhealthlibrary-com.eu1.proxy.openathens.net/content.aspx?sectionid=239848695&bookid=2827#239848803