Heart Anatomy Lab

When dealing with the heart it is important to know the general anatomy of the heart, it is best to start where blood returns from the body to the right atrium. The Right atrium has two major veins draining into it, the superior and Inferior Vena Cavas. Within the right atrium is the tricuspid valve which separates the right atrium from the right ventricle. On the muscle wall shared with the left atrium we see the atrial septum.

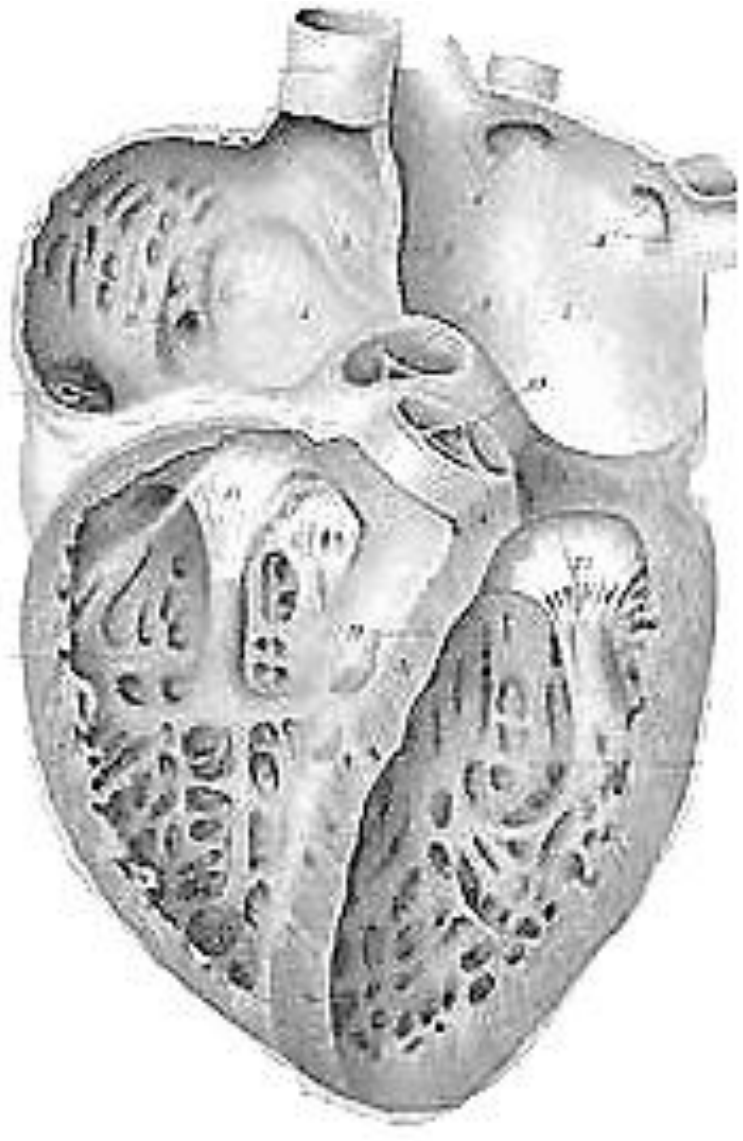
Closer observation of the septum reveals an oval impression called the fossa ovalis. This was at one time a flap that allowed blood to be shunted to the left side of the heart to bypass the pulmonary system.

If we follow the flow of blood, we will go through the tricuspid valve and enter the right ventricle. Paying more attention to the Atrioventricular tricuspid valve, we can see that off the three leaflets there are tendon-like cords attached to raised muscles within the ventricles. These cords are called the Chordae Tendineae. The Muscles that pull on the valves to open them are the Papillary Muscles.

We can see the ventricle wall has a muscular wall with cavities. This is called the Trabeculae Carinae. Following the path of blood, we will leave the right ventricle through the pulmonary valve. This leads to another vessel named the pulmonary trunk. This trunk will divide into the pulmonary arteries. These arteries bring deoxygenated blood to the lungs.

From the lungs the blood returns to the heart via the Pulmonary Veins. These veins have oxygenated blood and drain into the left atrium. Within the left atrium we can see the other part of the impression of the fossa ovalis. The left atrium sends blood through the mitral or bicuspid valve to the left ventricle.

The left ventricle has many of the same structures as the right. It pushes blood through the Aortic Valve to the aorta that feeds blood to the rest of the body. This blood will return to the right side of the heart via the Vena Cavas.



1. On the picture provided label the following:
    a. Right atrium
    b. Left atrium
    c. Right ventricle
    d. Left ventricle
    e. Interventricular septum
    f. Interatrial septum
    g. Fossa ovalis
    h. Trabeculae carnae
    i. Chordae Tendonae
    j. Papillary muscles
    k. Bicuspid AV valve
    l. Triscupid AV valve
    m. Pulmonary valve
    n. Aortic valve

2. What chamber of the heart receives blood from the body?

3. What valve separates the chamber in one to the next chamber?

4. Where does the blood from the right ventricle go to?

5. Where does the blood from the left ventricle go to?

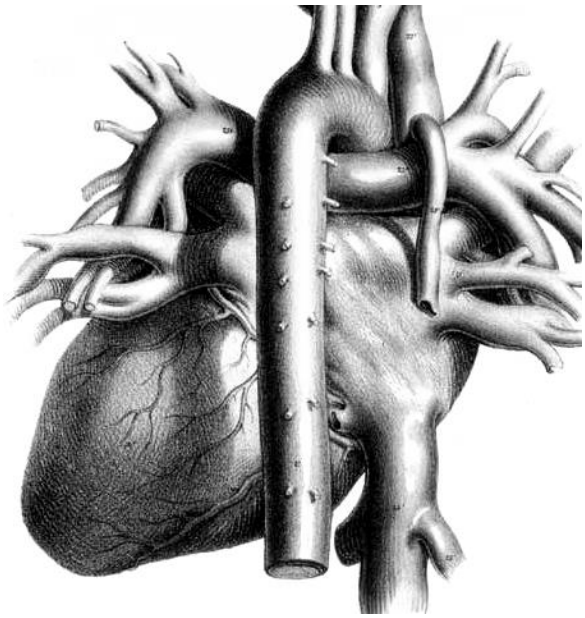
Now with a familiarity with the gross structure of the heart we can begin to look at the outer aspect of it. Immediately, we can see that it has a few valleys in it called Sulcus. These sulci are named for the area they are at or what they divide. You can also see ear-like projections coming off the atriums, these are called auricles.

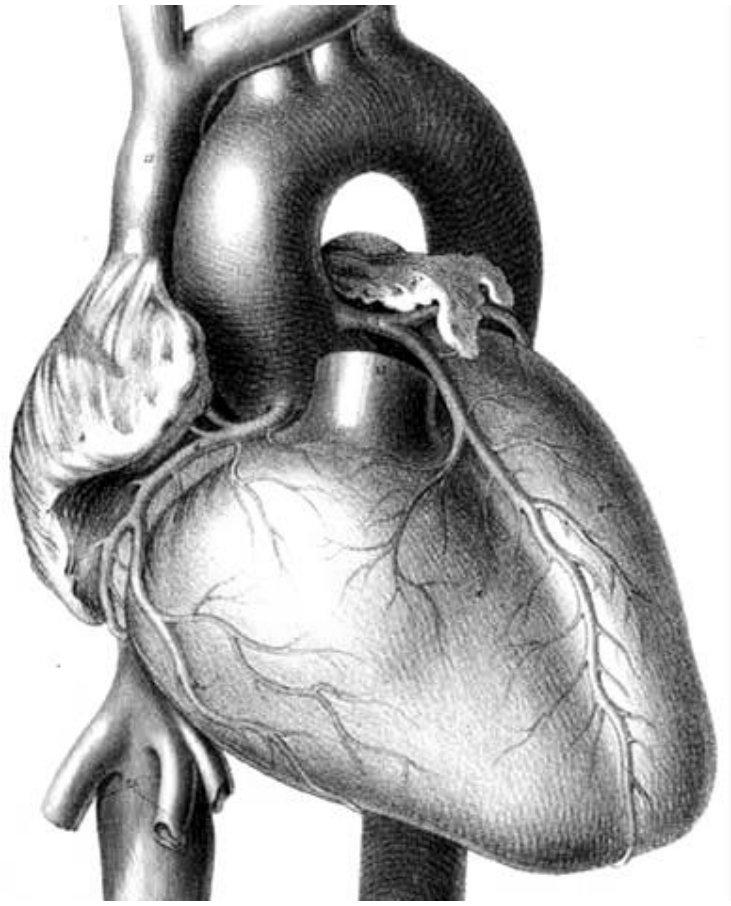
There is another part to the heart called the conducting system of the heart. The conducting system of the heart allows it to be auto-depolarizing. In physiology you will learn that this means it can excite itself but for now it is important to understand where it is and how it can be found.

The conducting system usually starts in the right atrium near the superior vena cava at a node called the Sinoatrial node (SA node). This sends a pulse through both atriums causing contraction of the striated cardiac muscle tissue. This charge is stopped temporarily so that the ventricles can fill then the Atrioventricular node (AV node) fires.

The AV node is located between the right atrium and ventricle near the interventricular septum. The charge is sent to the Bundle of His found in the interventricular septum. It splits into two bundle branches, called the right and left bundle branches. The bundle branches then take the charge to the Purkinje fibers that will cause the heart to depolarize and contract.

6. On the two images provided of the outer area of the heart label the following then describe the position of each sulcus
    a. anterior interventricular sulcus
    b. anterior atrioventricular sulcus
    c. Right atrium and auricle
    d. Left atrium and auricle
    e. Left ventricle
    f. Right ventricle
    g. Posterior interventricular sulcus
    h. Posterior atrioventricular sulcus





7. Draw a cross-section heart with all the pace-maker nodes and electrical conduction portions.

Stethoscope introduction:

The stethoscope is one of the most used and powerful tools in clinics. It is use as a primary diagnostic tool and is as varied as the clinicians. By looking at it one can see the clinicians' side where you will find the earpieces and the patient side, with the bell and diaphragm.

This tool has many uses, it can be used to listen to the different heart valves, listen to turbulence within the arteries during the taking of blood pressure, listening to the lungs and bronchial tree, and listening to bowel sounds.

Objectives:

1. Learn how to use a stethoscope to listen to different heart sounds.
2. Learn to listen to the different valves in the heart.
3. Find anatomic landmarks to detect normal areas of the heart.

Materials:

Stethoscope with bell and diaphragm.

Intro:

As blood moves form one chamber to another, cardiac valves must open and close. This causes sounds that are audible by stethoscope. In this lab, you will listen to them and listen for the possibility of a murmur. Murmurs are caused by several factors such as valve insufficiency, stenosis and anemia.

As you should be aware, the heart has four valves each can be heard at different anatomical locations with different parts of a stethoscope.

Methods:

For the first part, take your stethoscope with the diaphragm ready to work and listen to your partner's chest in four locations. First, find the Sternal angle and go to your partner's right to find the second intercostals space. Place your stethoscope there and tell them to hold their breath.

Right now you should be listening to the Aortic valve. You should hear a snapping sound (The second heart sound) if not you will be listening to a murmur (This will occur in diastole, after the second heart sound (S2)).

Now move to your partner's left, to the second intercostals space. Place the stethoscope there and ask them to hold their breath. You are now listening to the pulmonary valve. It should also make a click sound if not you may have a pulmonary murmur (Also after S2).

Take your stethoscope and turn it so that the bell is ready to function and find the xyphoid process. Follow it to sixth rib and move up to the fifth inter costal space just adjacent to the sternum. There you will hear the Tricuspid valve (S1). Any sound other than a bump is not normal.

If your make a horizontal line from where you are and go left to the area below the nipple (Approximate) you will find the fifth inner costal space. Place the bell at that point and listen to the Mitral valve as it closes, this is also called the S1 sound.

8. What bony landmark is used to find the second intercostals space?

9. What valve is heard on the left second intercostals space?

10. What valve is heard next to the sternum on the sixth intercostals space?

11 ARTERIES, VEINS, AND CAPILLARIES

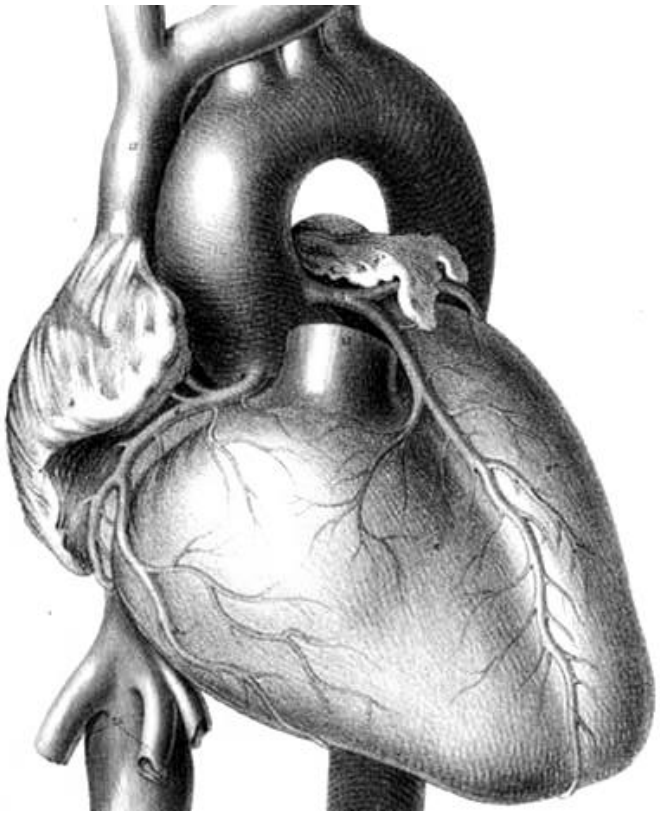
Arteries and Veins tend to be named after the bones they follow or the area that they are around. Before doing this exercise, you should already have some idea to where arteries and veins are located. Arteries are under constant pressure from the direct beating of the heart and so a pulse can be taken when feeling the vessel.

Vessels dealing with the heart directly:

Starting with the heart, we can see the major vessel leaving the left ventricle called the Aorta. To deal with the arteries of the heart we will want to start with the first arteries off the aorta called the right and left Coronary arteries.

The right Coronary artery comes directly off the aorta and branches into the marginal branch of the right Coronary artery and the Circumflex artery. This circumflex artery will feed the back of the heart. While the Marginal branch of the right coronary artery will feed the anterior portion of the right ventricle.

Coming from the left Coronary artery we see the first branch that follows the interventricular sulcus. This artery is the interventricular artery and feed both ventricles as well as the apex of the heart (point of the heart). The left Coronary artery also gives rise to the Circumflex artery that will anastomose with the Circumflex artery of the right coronary artery. The Circumflex artery will feed the posterior portion of the heart.



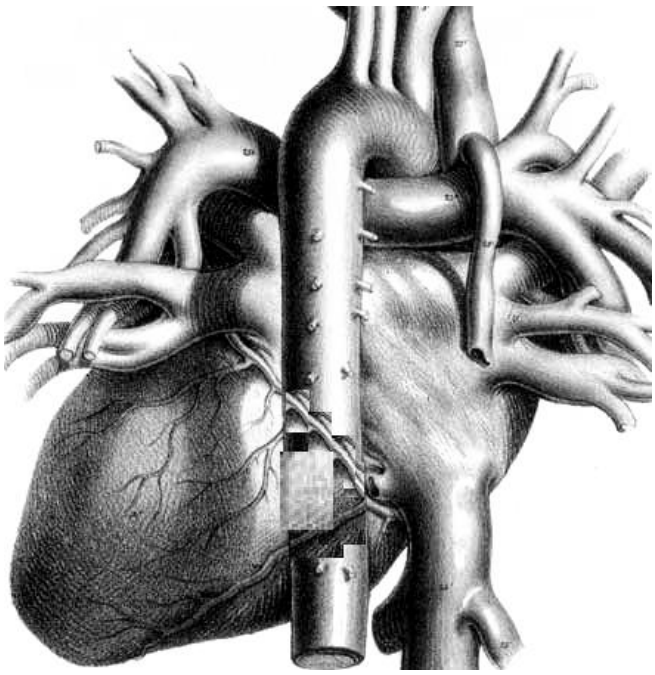
There are many veins that take blood from the muscles of the heart to the chambers. For the most part these are named the same as the arteries that they follow there are few exceptions. Following the interventricular artery, we find the Great Cardiac Vein. It will drain into a structure on the posterior portion of the heart called the Coronary sinus.

1. Label the following on the picture:
    a. Aortic arch
    b. Right and left coronary arteries
    c. Anterior Interventricular artery
    d. Anterior cardiac arteries
    e. Circumflex artery
    f. Great cardiac vein

Two other veins drain into the Coronary sinus. The Small Cardiac vein takes blood from the anterior portion of the right ventricle to the Coronary sinus. The last great vein is the Middle Cardiac vein. It follows the Posterior interventricular artery. The coronary sinus will then drain into the right atrium near the inferior vena cava.

As we look at the largest artery of the heart, the Aorta, we can see that it has three regions, the ascending Aorta, the Aortic arch, and the descending Aorta. At the Aortic Arch three branches come can be found which you can follow the ABC's. That means you have the Aortic Arch (A) the Brachiocephalic (B) and the Common Carotid (C).

2. Label the following on the picture.
    a. Posterior interventricular artery
    b. Coronary sinus
    c. Small Cardiac Vein
    d. Middle Cardiac Vein
    e. Great Cardiac Veins
    f. Ascending Aorta
    g. Aortic arch
    h. Descending aorta
    i. Brachiocephalic artery
    j. Common Carotid arteries
    k. Subclavian arteries



Continuing down the descending aorta, which is also called the thoracic aorta, we can find branches which would run between the ribs. These are called the intercostals arteries and run in the costal groove of your ribs.

The at the end of the thoracic Aorta, at the level of T12, there is the Aortic hiatus which is where the aorta passes through the diaphragm. At that point, the Aorta is called the Abdominal aorta.

3. Label the following on the image of the aorta and its branches
    a. Ascending Aorta
    b. Aortic arch
    c. Descending aorta
    d. Brachiocephalic
    e. Common Carotid arteries
    f. Subclavian arteries
    g. Intercostal arteries
    h. Thoracic Aorta.

Just prior to the aorta entering the abdominal cavity there are two arteries that come off to feed the diaphragm called the superior phrenic arteries and as the aorta emerges on the abdominal side, a second set of phrenic arteries come off called the inferior phrenic arteries.

Arterial branches of the Abdominal Aorta are simple to name as they are going to the organs that the feed for the most part. Still there are trunks that must be named such as the Celiac trunk (Celiac means abdominal) at the lower part of T12. The Celiac trunk then gives rise to three arteries, going right is the hepatic artery which feed the liver, going to the left is the Splenic artery for the spleen, and branching superiorly we find the left gastric artery which feed the part of the stomach.

As mentioned most arteries are named for the organs, they feed so we can find two arteries going to the adrenal gland so those are the right and left suprarenal artery. Below these, going to the kidneys are the renal

arteries. There is a long artery just which branches just superior to the renal artery is an artery which will feed the intestines from the lower part of the duodenum of the small intestine to the first two thirds of the transverse colon and the pancreas. That artery is embedded inside the mesentery, so it is the superior mesenteric artery

Inferior to the renal arteries are the two gonadal arteries which develop there during embryology as the gonads descend during development. Near L3 we can see another vessel that will be embedded in the mesentery which is called the inferior mesenteric artery. Finally, near the iliac crest, at L4, the Aorta ends where it bifurcates to form the common iliac arteries.

4. On the picture provided, label the following:
    a. Inferior Phrenic Arteries
    b. Celiac Trunk
        i. Hepatic artery
        ii. Splenic artery
        iii. Left gastric Artery
    c. Adrenal artery
    d. Renal artery
    e. Superior Mesenteric artery
    f. Gonadal arteries
    g. Inferior Mesenteric Artery
    h. Common Iliac
    i. Internal Iliac
    j. External Iliac

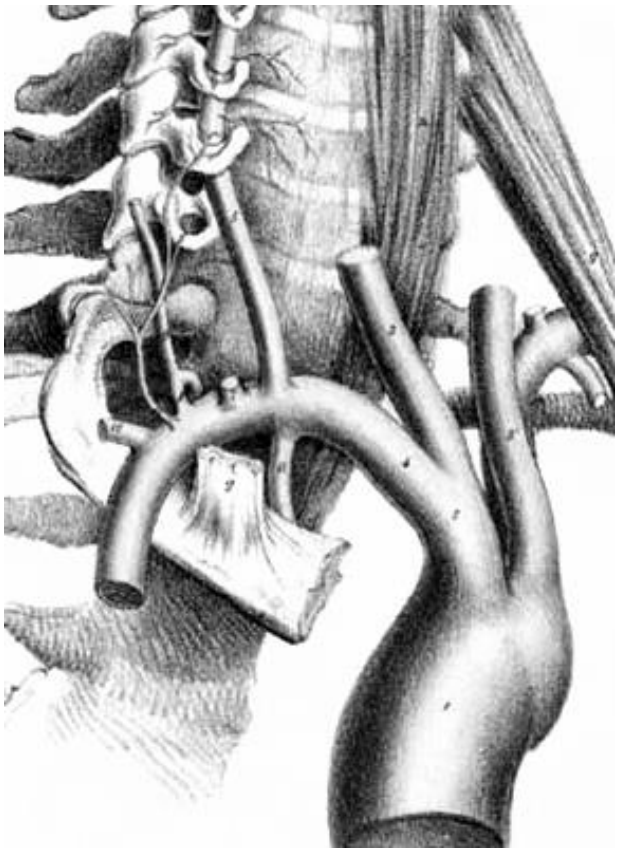
Moving back up to the head and neck region, we can begin to look at some of the arteries that feed the head. Many of these will be covered in more detail when we reach the brain as some arteries will not make sense without a review of the brain and naming the brain sections.

First, look again at the Aortic arch, and again find the Brachiocephalic Artery (Brachio= arm, Cephalic=head) Common Carotid Artery, and Subclavian artery. You should remember the ABC'S but there is a second way the ABC's can be used. If we start at the Aortic arch as our A, then find the Brachiocephalic arteries as our B. The next branch of the Aortic Arch is the Common Carotid Artery. The Brachiocephalic artery also has two branches, the right Common Carotid and the Subclavian artery. Off of the Aortic arch, we can also find the left Subclavian Artery. This ensures we have two ABC'S for our mnemonic.

From the Subclavian Arteries, you will see a branch that flows through the transverse foramen of the cervical vertebrae. This is the vertebral artery which will enter the skull via the foramen magnum of the Occipital bone and anastomose with the vertebral artery of the other side of the body to form the Basilar.

Distal to the vertebral artery is the Thyrocervical trunk which will branch into the Inferior Thyroid artery that delivers blood to the thyroid gland, then the costocervical artery, a thin artery feeding the cervical bones

and the ribs. Finally, we find the Dorsal scapular artery.



5. On the image provided, label the following
    a. Aortic arch
    b. The Right Brachiocephalic Artery
    c. The Right Common Carotid artery
    d. Right Subclavian artery.
    e. Vertebral artery
    f. Thyrocervical trunk

Some arteries can be felt in specific areas so rather than just labeling pictures it is helpful to feel them on a partner or yourself. I will include both activities to help re-enforce learning.

When feeling the pulse, there are many important things to remember. First, this is one of the most common procedures done in clinic and hospitals. For this you will want to use your index (2) and middle (3) phalanges. The reason is the thumb has an artery that run nearer to the pad.

6. Why should you not use your thumb when taking a pulse?

Looking first at the neck area, you should remember the Carotid triangle made up of the Sternocleidomastoid, the stylohyoid, and the Omohyoid muscles. Within this triangle, you can see the Common Carotid artery.

The first place you will take the pulse is over the External Carotid Artery, found in what is called the Carotid triangle (Sternocleidomastoid, stylohyoid, and omohyoid) of the neck.

7. Label the following in the picture provided:
    a. Sternocleidomastoid
    b. Omohyoid
    c. Stylohyoid
    d. Common Carotid Artery
        i. Internal Carotid Artery
        ii. External Carotid Artery
        iii. Superior Thyroid Artery

The next place to take a pulse is under

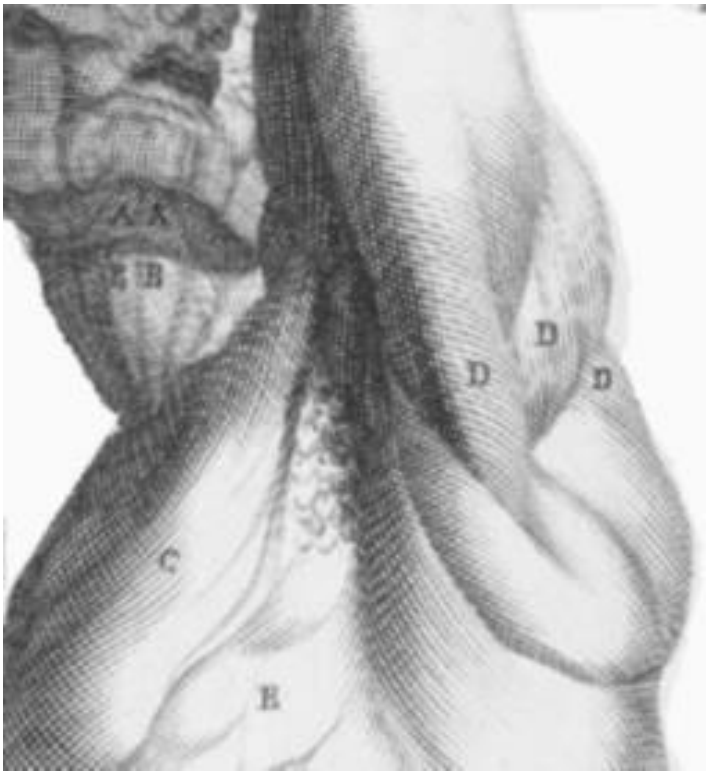
the armpit, the Axillary region just posterior to the pectoralis major and minor, lateral to the Serratus Anterior, and Anterior to the Teres Major and subscapularis is the Axilla. In this region, you will find the Axillary artery.

Once you find this area, you can feel your own axilla. As the Subclavian artery passes into the axilla, the name changes to the Axillary Artery. If you got to the lateral most angle of the axilla, you will see that the Biceps Brachii and the coracobrachialis for a small sulcus. In this area, you will find the Axillary artery.

8. What artery is found in the axilla?

While the Axillary Artery has many branches, based on your knowledge of regions, you should be able to understand what each branch feeds.

One of the branches travels around the Humeral head and anastomose with an artery behind it. As these two arteries encircle the humoral head, they are called the Anterior and Posterior circumflex humoral arteries.



9. On the image provided label the following:
    a. Serratus Anterior
    b. Pectoralis major and minor
    c. Teres Major and subscapularis

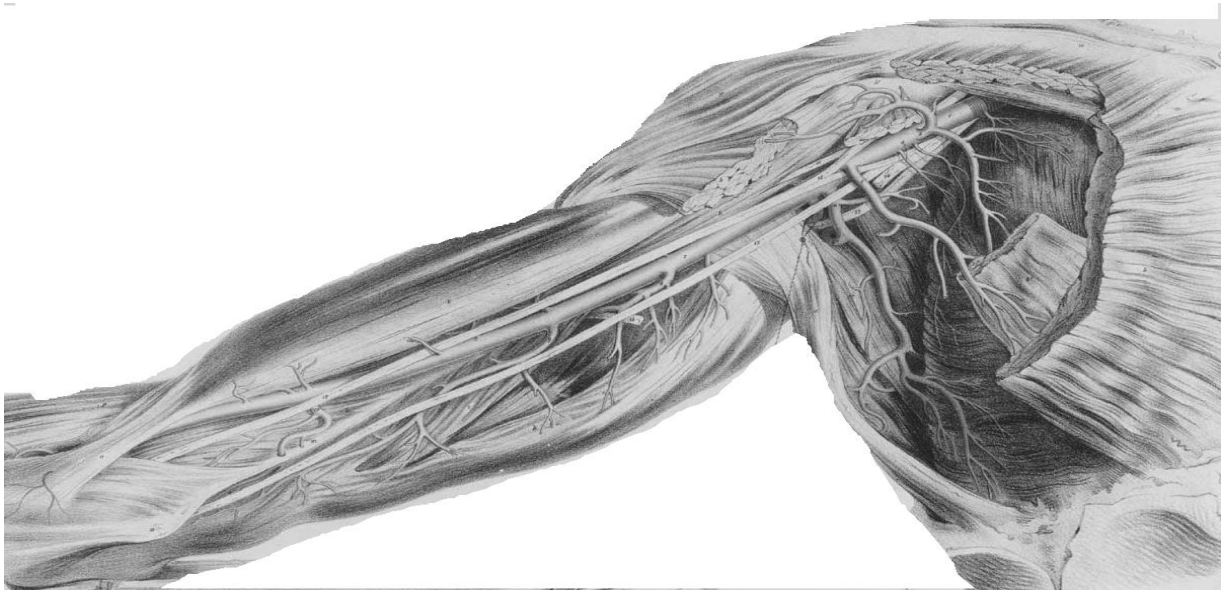
Another artery branches to the pectoralis muscles and feeds the thorax. That artery is called the Superior Thoracic Artery. There is another artery off the axillary artery which feeds the breast area called the lateral thoracic artery.

There is a branch of the Axillary artery heads towards the subscapular muscles. This artery is the subscapular artery. It feeds the subscapular muscle.

Following the vessel, you find it as it travels to the brachial region. In the Medial Biceps Groove which is formed by the Biceps brachii anteriorly and the Triceps Brachii posteriorly. In this region, the main portion of the Axillary artery becomes the Brachial Artery.

10. Determine what each branch of the Axillary artery feeds and label on the image provided when possible:

Anterior circumflex artery	Subscapular
Posterior circumflex:	Brachial:
Superior thoracic:	Radial:
Lateral thoracic:	Ulnar:



11. Look at the depression where the Triceps Brachii and the Biceps Brachii would come to contact. What artery is palpated there?

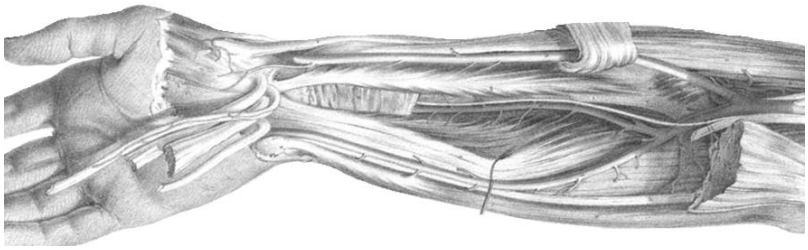
The Brachial artery can be found in the antecubital region which is made up of the Pronator teres, the Brachioradialis, and a line connecting the two epicondyles of the Humerus. From there we have a major split in the Brachial artery. We can see that one of the arteries will follow the path of the Radius and the other will follow the Ulna. There is a third artery which can be seen between both bones which is called the interosseous artery.

Looking at the Radial artery from the Antecubital fossa, it follows the radius to the scaphoid bone. If you Abduct your thumb, you can see the tendons of the abductor pollicis longus and the extensor pollicis brevis. This area is called you anatomical snuff box. From the tendon of the Abductor Pollicis Longus move superior and medial over to end on the anterior distal end of the radius.

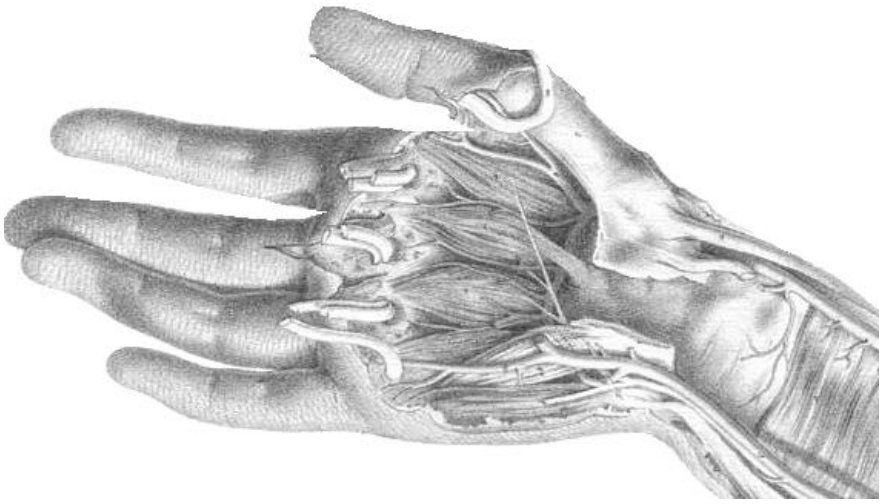
The Ulna is a little harder to find but it can be found from the Antecubital fossa all the way to the medial side of the Pisiform bone. These two arteries will anastomose via two arch-like arteries in the palm of the hand. These are the Superficial and deep palmar arches. These arches will have branches that feed the fingers so are called the digital arteries.

Become familiar with the anatomical landmarks then find the Flexor Carpi Ulnaris at the wrist and move just lateral to it and feel the pulse. After finding the Radial and Ulnar artery, ask your partner to make a tight first and compress on both arteries. You will know if you are doing this because the fingers on the palmar side should be pale. Now release the radial artery and watch the fingers, repeat, this time release the Ulnar artery instead. This is called the Allen's test.

12. On the picture provided, label the following:
    a. Radial artery
    b. Ulnar artery
    c. Innerosseus artery
    d. Brachioradialis
    e. Pronator Teres



13. When performing the Allen's test on a normal individual, why do the fingers regain color if either artery is released?

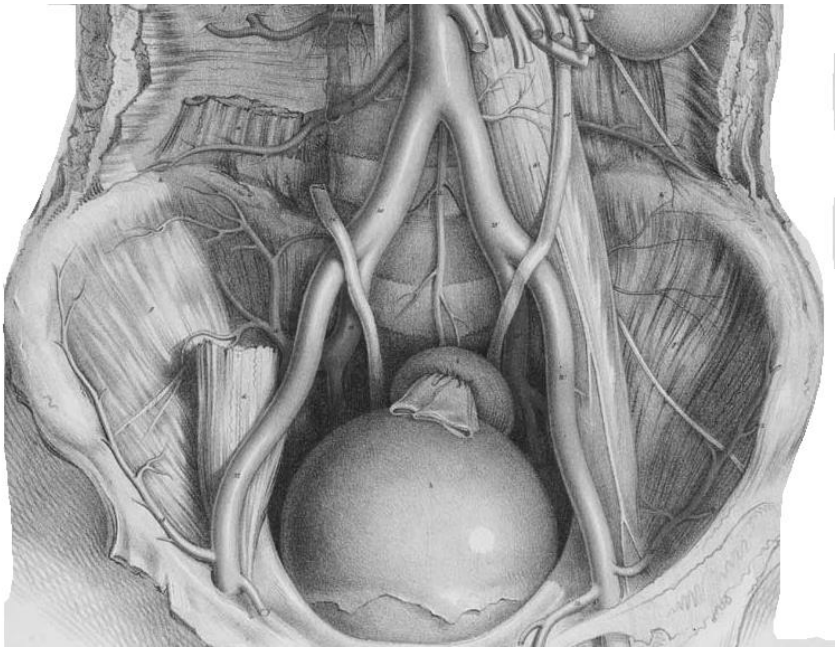


14. On the image provided label
    a. Radial artery
    b. Ulnar artery
    c. Superficial Palmar arch
    d. Deep palmar arch

Lower limb:

When one looks at the common Iliac artery you will notice that this artery branches into two arteries, one is the internal iliac artery, the other the external iliac artery. The Internal Iliac Artery will feed the gluteal region and the pelvis region. The External Iliac Artery travels through the inguinal canal that is a hole posterior to the inguinal ligament.

After exiting the inguinal canal, the External Iliac artery is called the Femoral artery. It is found and easily palpated at the femoral triangle. The Femoral artery then branches to give the deep femoral artery and the Femoral artery.



15. Label the following arteries on the picture provided:
    a. Abdominal aorta
    b. External iliac artery
    c. Internal iliac artery
    d. Femoral artery

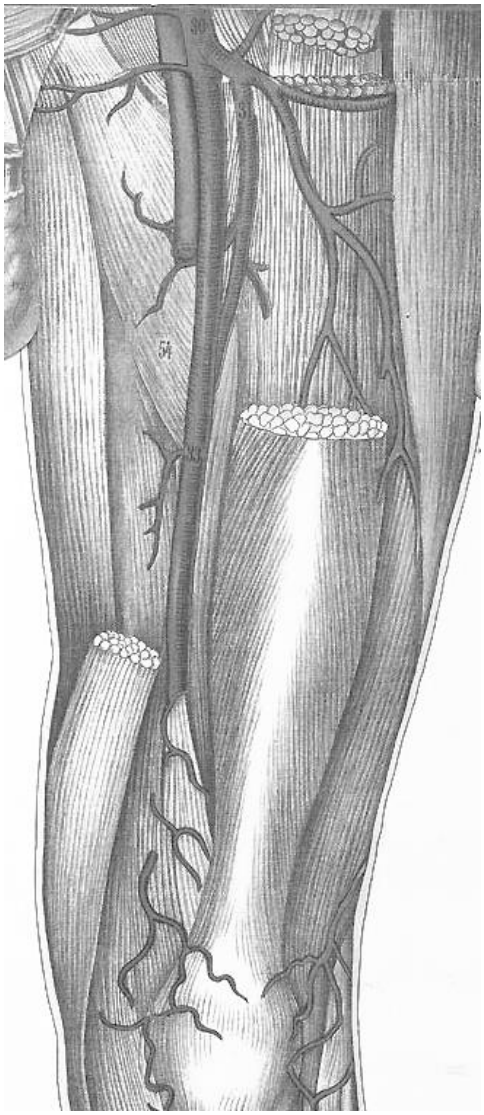
16. What are the borders of the femoral triangle?

The femoral artery courses the anterior aspect of the thigh then going deep giving many branches including the Genicular branches which feed the knee.

Within the Popliteal region, the Femoral artery changes names to the Popliteal artery. It will have a few branches in this area that feed the anterior aspect of the knee called the Genicular arteries which were mentioned previously.

While the Popliteal artery can be palpated and a pulse can be felt over it, usually it is too deep to properly feel a pulse. The importance of the Popliteal artery clinically is in cases of trauma when it must be used to control blood flow. If the muscles around and near the popliteal fossa are removed, we can see that the Popliteal artery branches into an Anterior Tibial Artery and a the Tibial-Fibular trunk. The Tibial-Fibular trunk will then divide into the Fibular artery and the Posterior Tibial Artery.

17. Label the branches of the femoral artery on the picture provided:
    a. Femoral
    b. Deep femoral
    c. Lateral circumflex
    d. Genicular arteries



18. On the pictures provided label the following:
    a. Femoral artery
    b. Popliteal artery
    c. Anterior Tibial artery
        i. Popliteal artery
    d. Tibial-fibular Trunk
        i. Posterior tibial artery
        ii. Fibular artery

19. Define the following words

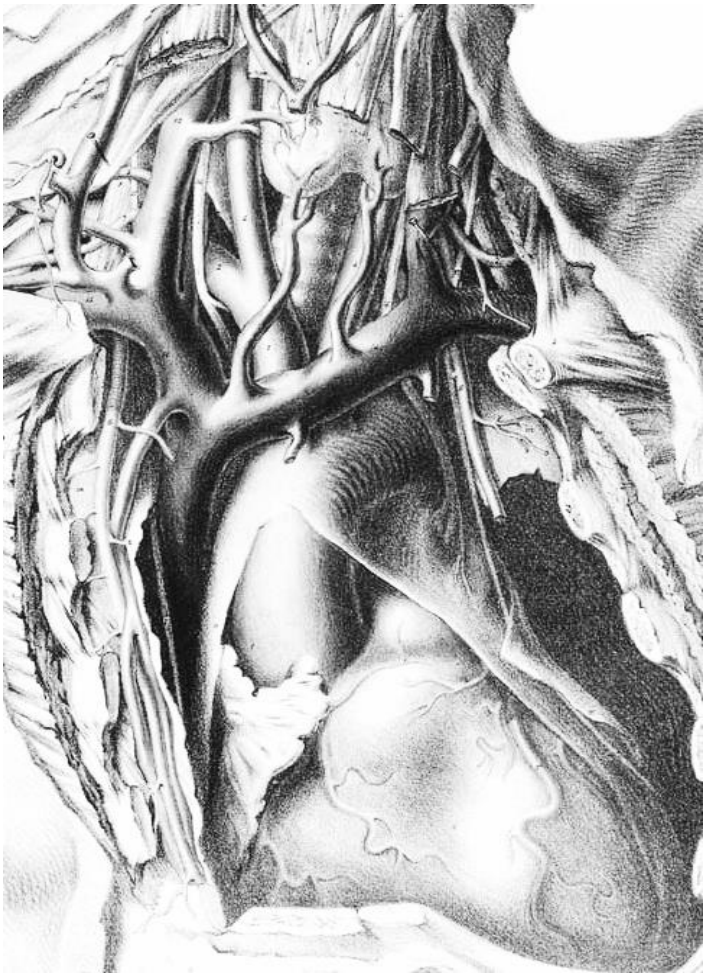
    Pedis:

    Dorsalis

Veins:

Knowing all the arteries of the human body help in learning the veins as, with a few exceptions, they carry the same name as the veins the follow. While blood will go from small capillaries to the venules to veins. Eventually most large veins will drain into either the Superior or Inferior Vena Cavas which are connected to the Right Ventricle of the heart. As veins are draining into larger and larger vessels, the pressure within veins drops as they get closer to the heart.

Of the tributaries to the superior vena cava the largest are two Brachiocephalic Veins which with the inferior thyroid vein draining into them. The two Brachiocephalic veins have two main tributaries, the internal jugular vein, which drains blood from the brain, and the Subclavian Vein.



20. Label the following
    a. Superior Vena Cava
    b. Brachiocephalic veins
    c. Internal jugular vein
    d. External Jugular Vein
    e. Subclavian Vein

The Subclavian Vein has three main tributaries. The Cephalic Vein which can be found superficially between the deltoid and pectoralis muscles going down the lateral side of the arm. The Basilar vein will follow the medial side of the arm. At the cubital fossa, it connects with the Cephalic Vein via the Median Cubital vein. As the Median Cubital vein is superficial it is one of the preferred veins for venipuncture.

Following the Brachial Artery is the Brachial Vein which drains into the subclavian Vein. The Brachial artery has two vessels draining into it, the Radial and Ulnar veins. The radial and ulnar veins run next two the artery of the same name.

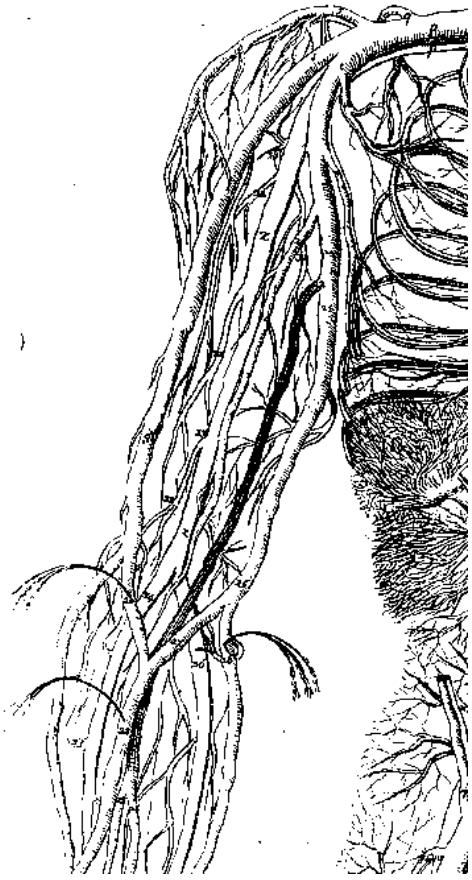
Veins can be easy to see at times because they are superficial. You should remember that they have valves to keep the blood flowing in one direction. Veins can be named after either the bone they are next to or the region that they are in. In Clinics of hospitals, veins are where most blood samples will be taken from.

21. Why would you take blood from veins instead of arteries?

To see veins better, you must strangulate the area. In clinic, this is done by use of a tunicate, an elastic band that is wrapped around the arm.

22. Why will using a tourniquet on veins increase their visibility?

23. On the image of the veins of the arm, label the following
    a. Cephalic Vein
    b. Basilic Vein
    c. Brachial veins
    d. Medial Cubital Vein
    e. Lateral Cubital vein



As most abdominal veins share the same name as the concomitant artery, we will only talk about those that are different. This is mainly seen in the Hepatoportal vein system. This venous system is of major clinical importance specially to understand how the body works.

Blood from the spleen, stomach, pancreas and inferior mesenteric enters the hepatoportal vein via the Splenic veins. This is joined by the superior mesenteric veins to drain into the liver via the hepatic portal vein.

The Spleen is the main site where old or worn red blood cells are destroyed which produces un-conjugated bilirubin. Unconjugated Bilirubin is a yellow-colored fat-soluble substance which must be sent to the liver for conjugation which makes it water soluble.

Few things can be absorbed in the stomach, whatever is, will be sent to the liver directly via the gastric veins which enter the splenic vein. This is the reason that many Non-steroidal Anti-inflammatory medications can rapidly cause liver damage when they are taking in a high dosage.

The Mesenteric veins begin in the intestines, where they pick up nutrients such as sugars and amino acids. These substances reach the liver directly via the hepatic portal vein before nutrients have a chance to enter any other circulation. This is the reason that the liver does not need hormones like insulin to absorb glucose but rather does it via concentration after a meal.

24. Label the following on the image provided:
    a. Liver
    b. Spleen
    c. Intestines
    d. Hepatic Portal vein
        i. Splenic vein
        ii. Superior mesenteric vein
        iii. Inferior Mesenteric Veins

As all these vessels drain directly into the liver, there are many problems of circulation that can present when the liver is scarred or damage. One symptom is the filling of the abdominal cavity with fluid. This condition called Ascites occurs for a few reasons, but one is that the build-up of pressure within the hepatic portal vein causes fluid to leak out of the vessel and into the abdominal cavity.

Another sign can be the formation of hemorrhoids which are dilated torturous veins of the rectum. This

again occurs because of the increase in pressure within the hepatic portal venous system which leads to a backup in flow. The extra pressure overstretches the veins causing them to become visible at the rectum. In pregnant women, this can also occur as the growing fetus might compress the Hepatic portal vein system.

When we look at the veins of the legs, they tend to follow the arteries and share the names. The one which is of most clinical importance which does not share the name with an artery is the -Great Saphenous vein. Its course is superficial appearing on the medial side of the leg and thigh then draining into the External Iliac Vein.

There are two reasons why that vein is important. It is the vein used when someone needs a vessel for a cardiac bypass, as well as being the vein that can become a varicose vein. By definition, a varicose vein is a torturous dilated vein. Based on that, any vein can become a varicose vein.

As mentioned, the veins have valves to maintain flow in one direction but as the legs tend to be under more pressure, there needs to be a secondary way to pump blood back. This is accomplished by two muscles, the Gastrocnemius and Soleus. As one walks or paces, the two muscles compress the vein forcing blood to move in one direction. This is why if you are standing all day your legs might swell yet if you are running or walking, they might not swell or at least not as much. This is under normal conditions when the valves are working well but if the valves lose their function, called venous insufficiency, swelling will occur more regular.

25. Which vein might be used for a cardiac bypass?

26. Why might someone's legs swell when standing but not when walking?

27. Why might someone's legs swell when walking.

28. Using all knowledge of the circulatory system why might clotting of the deep veins of the leg lead to problems getting the blood oxygenized in the lungs?