

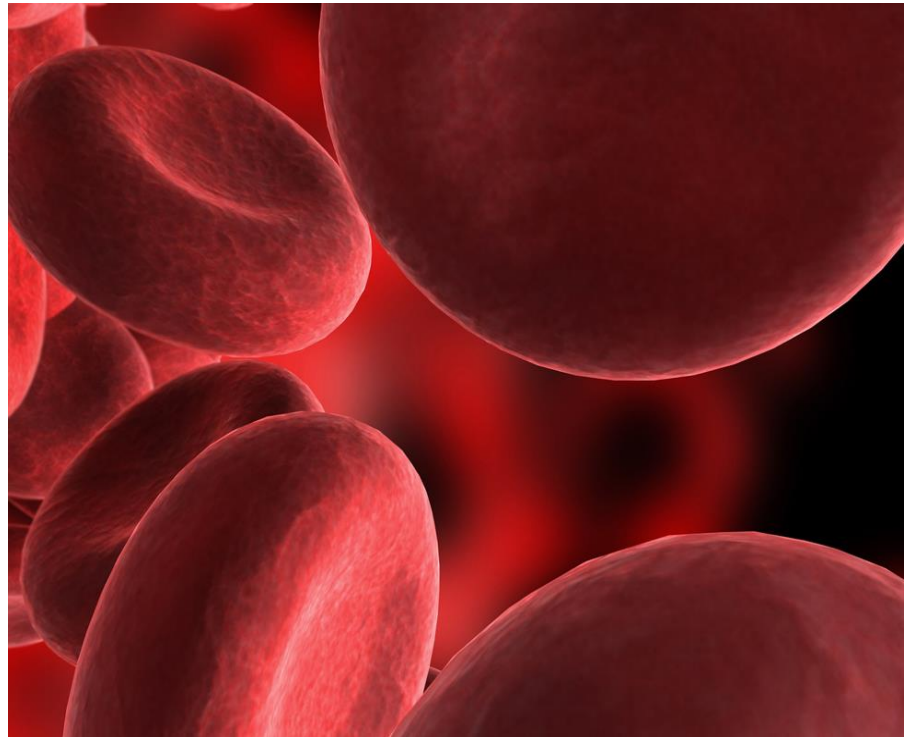
Introduction to Specimens

Learning Objectives

- Learn about blood and how it relates to laboratory testing
- Learn the different tube types and what kind of specimens they provide
- Know the different types of specimens that will be received in SPS

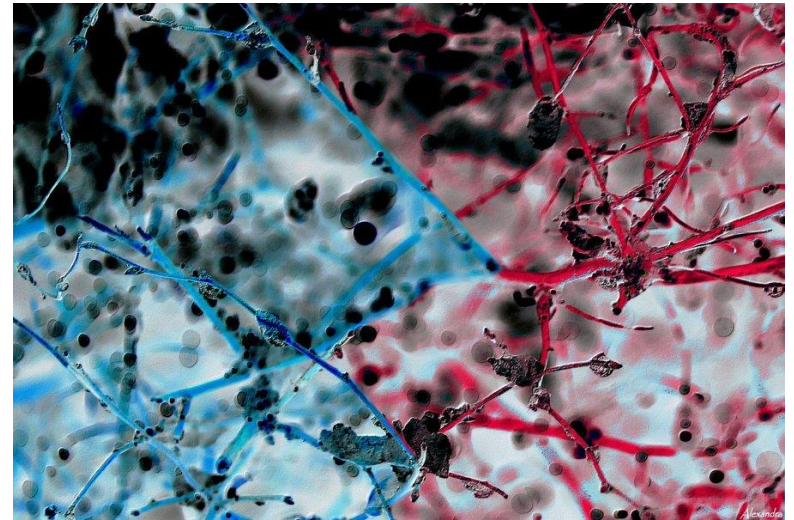
Blood

- The human body contains 4-6 quarts of blood.
- It flows through veins and arteries. Arteries deliver oxygenated blood throughout the body and veins deliver deoxygenated blood back to the lungs.



Where it comes from

- Blood drawn from veins is called “venous blood”
- Blood drawn from arteries is called “arterial blood”
- In the lab, we mostly receive venous blood
- It is important to know which type we receive because the reference ranges for test result interpretation are given based on the type of blood

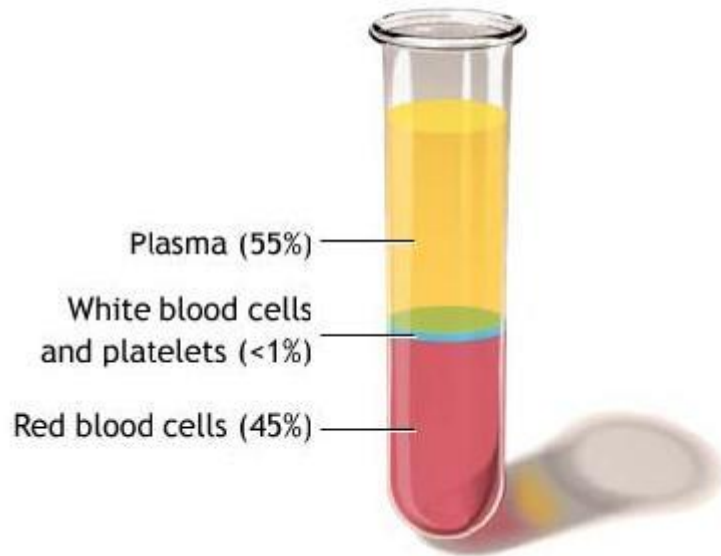


Venipuncture

- Venipuncture, otherwise known as phlebotomy or blood draw, is how we get the blood
- We have a phlebotomy department that performs both outpatient and inpatient blood draws
- Nurses will also draw the blood



Blood Components



- Red blood cells (erythrocytes)
- White blood cells (leukocytes)
- Platelets
- Plasma

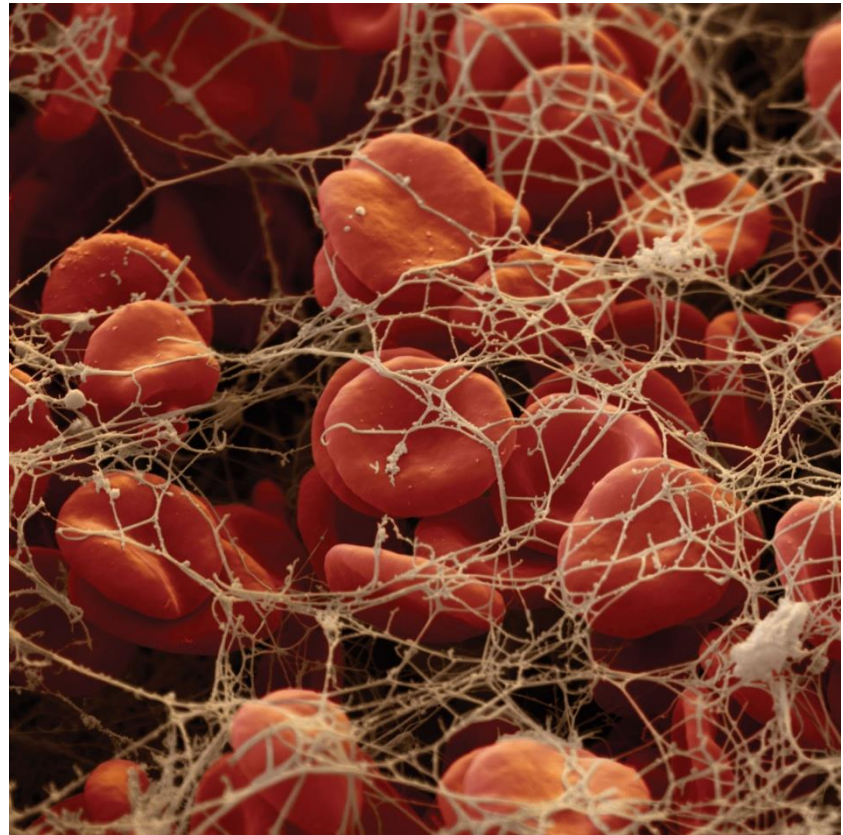
Whole blood



- Blood in its natural state is considered “whole blood”
- Depending on how it is transported, blood may begin to clot as soon as it is collected into a tube

Clotting Time

- The clotting time is the length of time it takes for whole blood to clot completely
- Some of the additives in the tubes speed up the natural clotting time of blood
- Other additives prevent it from clotting at all, so it stays as whole blood



Centrifugation



- Tubes can be centrifuged to provide a different sample type
- If whole blood is centrifuged, it will give off plasma
- When clotted blood is centrifuged, it will provide serum
- The difference between serum and plasma is fibrinogen
 - Fibrinogen is a clotting factor in blood
 - Since the blood already clots before serum is spun off, there is no fibrinogen in serum, while it is present in plasma

Serum vs. Plasma

- Separates from the red and white blood cells and collects at the top of the tube upon centrifugation
- Straw-colored liquid with an oily consistency
- Forms when tube is centrifuged **after** blood clots

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Serum vs. Plasma

- Message: there is *no visible difference* between serum and plasma, so it is important to know which is provided based on the tube type
- Our lab labels will mark the original tube color so that we can still tell the difference after the cap is removed



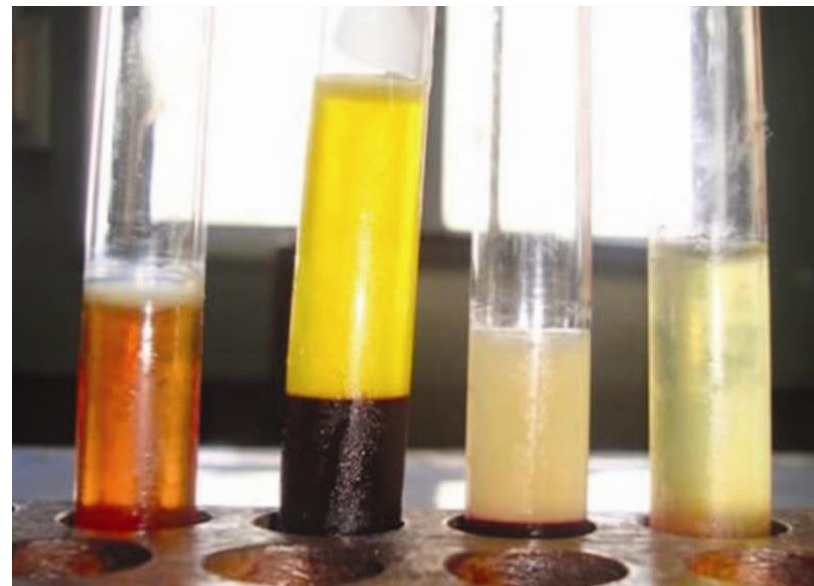
Fibrin Clots



- When serum has not been given enough time to fully clot before centrifugation, a fibrin clot will form
- This will often occupy most of the serum and result in the need to centrifuge the tube again
- The strain on the specimen can alter some test results, so it is always best to wait until the specimen is fully clotted

Problems with Serum and Plasma

- Normal: straw-colored, translucent serum
- Lipemic: High levels of lipids in the blood make the serum look cloudy
- Icteric: high levels of bilirubin in the blood make the serum bright yellow
- Hemolyzed: broken red blood cells in the blood (usually occurs during blood draw) cause the serum to look orange or even red



Hemolyzed

Icteric

Lipemic

Normal

Tube Colors



- Tube colors indicate the type of additive that was placed in the tube prior to collection
- The additive determines whether the blood clots or remains as whole blood
- Some additives can alter test results, so certain tests need to be run on certain tube types

Tube Volume

- There are also different volumes of tubes
- The difference is just the amount of blood that can be drawn into the tube. The additive amount is altered to account for this
- For best test results, a full tube is always optimal for the blood to additive ratio

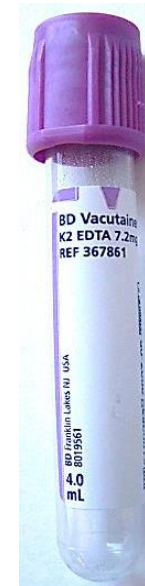


Partial Fill Tubes

- As the name suggests, partial fill tubes can only be filled part way
- The suction on the tube is adjusted so that it does not fill to the top
- Lavender and blue tops are available with the partial fill option. It is noted by the lighter, translucent cap and varies in volume from the darker-capped tubes that appear to be the same size.



Partial Fill
Lavender



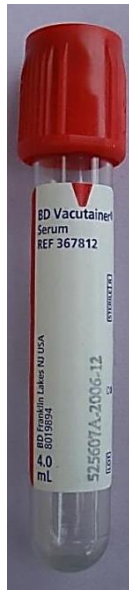
Regular
Lavender



Regular
blue

Partial Fill
Blue

Red Top Tubes



- Red top tubes contain a thrombin activator
- This causes the blood to clot
- It usually takes 30 minutes to an hour for blood to clot completely before it should be centrifuged
- Because the blood clots, red tubes give off serum when spun

Gold Top Tubes

- Gold top tubes contain the same thrombin additive as red tops, but they also contain a gel separator. This gel separator has a density between red blood cells and serum, so it will completely separate the serum when centrifuged.
- Gold tops are also called SSTs, or Serum Separator Tubes
- Tiger top tubes have the same additive as gold, they are just 8.5 mL tubes instead of 5 mL.



Orange Top Tubes

- Orange top tubes contain a rapid clot activator
- This allows the blood to clot just like a gold top tube but much quicker.
- Orange tops also contain a gel separator and give off serum.
- They are also called RSTs, or Rapid Serum Tubes



Lime Top Tubes

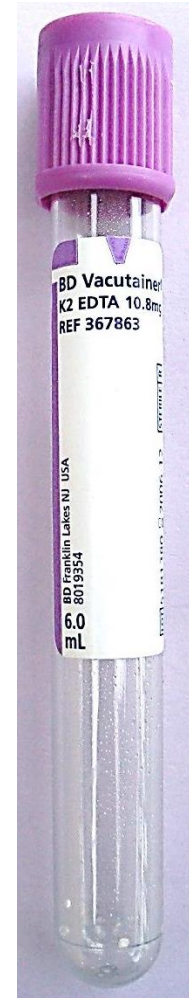
- Lime top tubes contain Lithium Heparin, which prevents blood from clotting
- Because it doesn't clot, a centrifuged lime top will give off plasma
- Lime tops also contain a gel separator like the gold top tubes.
- They are also called PSTs, or Plasma Separator Tubes



Lavender top tubes

- Lavender top tubes contain ethylenediaminetetraacetic acid, commonly called EDTA. It keeps the blood from clotting, so a spun lavender will give off plasma.
- Most tests on lavender top tubes are run by Hematology
- Lavender tube tests are not as fragile to the additive ratio, but it is important to have at least 1 mL of blood in the tube.

The bottom of the tube to the bottom of the label is about 1 mL



Blue Top tubes

- Blue tubes contain Sodium Citrate
- Sodium citrate keeps the blood from clotting, so if it is spun it will produce plasma
- Most tests on blue top tubes are run by the Coagulation bench
- The additive to blood ratio is very important in blue top tubes; it must be 1:9 for accurate test results. Because of this, completely full blue top tubes are very important.



Pearl top tubes



- Pearl top tubes have an EDTA additive like lavender tubes.
- The difference between pearl and lavender is that pearl tubes have a gel separator.
- EDTA prevents the blood from clotting, so plasma is given off when the tubes are spun.

Clear top Tubes

- Clear top tubes have no additive.
- Because of this, if blood is collected in a clear tube, it will clot. Once it is spun, it would give off serum.
- Clear tubes are also used to transport other specimens, such as urine or other fluids.



Green top tubes

- Green top tubes contain Lithium Heparin as well
- The difference between a green tube and a lime tube is that the green tubes do not contain a gel separator.



Na Green top Tubes

- The larger green top tubes contain Sodium heparin instead of Lithium Heparin. This also does not allow the blood to clot, so it produces plasma.
- There is no gel separator in sodium heparin tubes.
- Some tests require Sodium Heparin as the additive rather than Lithium Heparin



Yellow Top Tubes



- Yellow top tubes contain Acid Citrate Dextrose, or ACD. This prevents the blood from clotting.
- If a yellow top were to be spun, it would give off plasma.
- Yellow tubes are one of the few glass tubes that we use. For the tests that we run, yellow top tubes are always kept as whole blood for testing.

Royal Blue

- There are three different types of Royal Blue tubes
 - EDTA
 - No additive
 - Sodium Heparin
- The tube without additive gives off serum while the other two give off plasma when spun.



Why Royal Blue?

- Royal blue tubes do have the same additives as other tubes, but the tube itself doesn't contain any metal
- This is very important when testing the blood for something like Lead, so that the tube does not alter the test results



Sarstedt Tubes

- Sarstedt tubes are syringes that are collected for tests that are sensitive to additives.
- Sarstedts contain silicate thrombin and beads which aid in quick clotting time
- After the blood is drawn, the plunger of the syringe is broken off and it can be put into the centrifuge for processing.
- Because the specimen clots, sarstedt tubes give off serum when they are spun



Gray Top Tubes



- Gray top tubes contain sodium fluoride and EDTA or potassium oxalate
- These additives prevent the blood from clotting, so plasma is provided when the blood is spun down
- These additives can help to preserve things that would normally break down quickly, like glucose or alcohol, in the blood for a longer period of time

Quantiferon Tubes

- Quantiferon tubes are used to run a blood test for Tuberculosis.
- A Quantiferon kit includes three tubes. All three of them need to be collected to run the test.
- The red, lavender and gray tubes are specialized for this particular test. Regular red, lavender and gray tubes cannot be used to run a Quantiferon test.
- Though these tubes have gel in the bottom, we do not spin them before they are sent off for testing
- The volume of these tubes is also very important. They must be filled up to the black square toward the bottom of the tube.



VerifyNow Tubes

- This is a collection kit of three, blue top tubes that test for Aspirin in the blood for quick test results
- When these specialized tests are ordered, all three tubes are needed and cannot be run off of normal blue top tubes.



Pediatric Tubes

- Many tests can be run off of much less blood, as long as the blood to additive ratio is correct
- To accommodate this, there are pediatric, or “pedi” tubes
- These are used on infants as well as people that are difficult draws of all ages
- The tube colors available in pedi tubes are lime, red and lavender



Syringes

- Syringes are used to run blood gases
- The oxygen content is important for these blood gases, so the syringes will always have a cap on them
- All tests run off of syringes are time sensitive and must be run within 30 minutes of collection



Blood Cultures



- Blood cultures will always include two bottles, one for aerobic and one anaerobic
- This is shown by the color of the bottle and determines the order of collection
- Often, two sets of blood cultures will be collected from a patient at the same time, one from the right arm and one from the left arm

Urine

- Many tests are also run off of urine.
- There are two types of urine collections that we may receive
 - Random urine
 - 24 hour urine



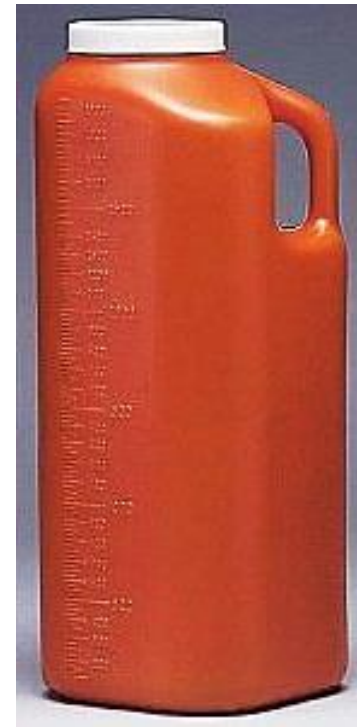
Random Urine Specimens



- We can receive random urine in a urine cup, a yellow top urine tube or a gray top urine tube
- The urine cup and yellow top tubes can be used for almost any urine tests
- The gray top tube is only used for urine cultures

24 Hour Urine Jugs

- 24 hour urine collections come in a large, orange jug during which a patient will collect all urine over the course of 24 hours.
- Some 24 hour urine containers have an additive. If it does, it will have a bright yellow sticker on the jug, describing the type and quantity of the additive.



Stool Samples

- Random Stool
- 72 hour stool collection



Random Stool

- Random stool samples usually come to the lab in sterile urine cups
- Most tests on stool are run by Micro, but there are a few that are logged by SPS and sent to other labs
- There are also occult blood tests, which come in two different forms and are run by Special Chemistry
 - Tubes
 - cards



72 hour Stool

- A 72 hour stool collection is collected over the course of 3 days in a special container
- If someone needs to begin a collection, we provide the containers for this



Fluids

- There are also many types of body fluids that come into the lab
- Most fluids are considered STAT, and should be taken to Micro immediately
 - The most STAT fluids that we receive are Diagnostic Peritoneal Lavage (DPL) and Cerebrospinal Fluid (CSF)
- Fluids will be received in syringes (without the needle), sterile cups, bags, or bottles



Summary

- Many different specimen types are processed by the lab.
- The tube color for blood collection determines if we receive plasma or serum upon centrifugation.
- Serum is provided by red, gold, orange, clear, sarstedt and no additive royal blue tubes.
- Plasma is provided by blue, lavender, lime green, dark green (Li and Na), royal blue with EDTA or Li Heparin, pearl and gray tubes.
- Urine, stool, blood gases, blood culture and fluids are other types of specimens that come through SPS.