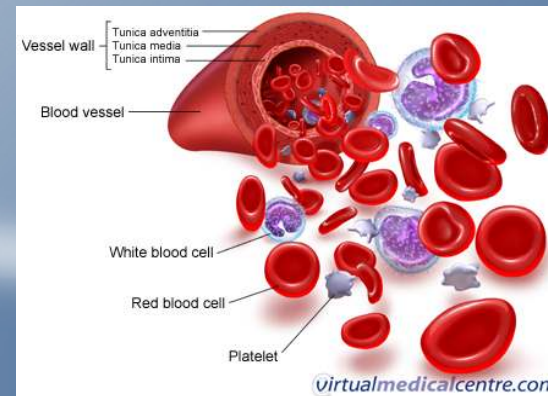


Chapter 10 - Blood

Blood is a fluid tissue that transports chemicals and many different kinds of cells

- Blood performs vital pickup and delivery services
- It also provides much of the protection necessary to withstand foreign "invaders"

The average person has 4-6 liters of blood and it normally accounts for 7 to 9% of total weight



Blood is made up of 55% plasma and 45% formed elements

1.) Plasma is the liquid part of blood

Plasma is mainly made up of water but a small portion is proteins, nutrients, hormones, and gases

Plasma proteins are the proteins in the plasma that thicken the blood, contain antibodies and cause the blood to clot

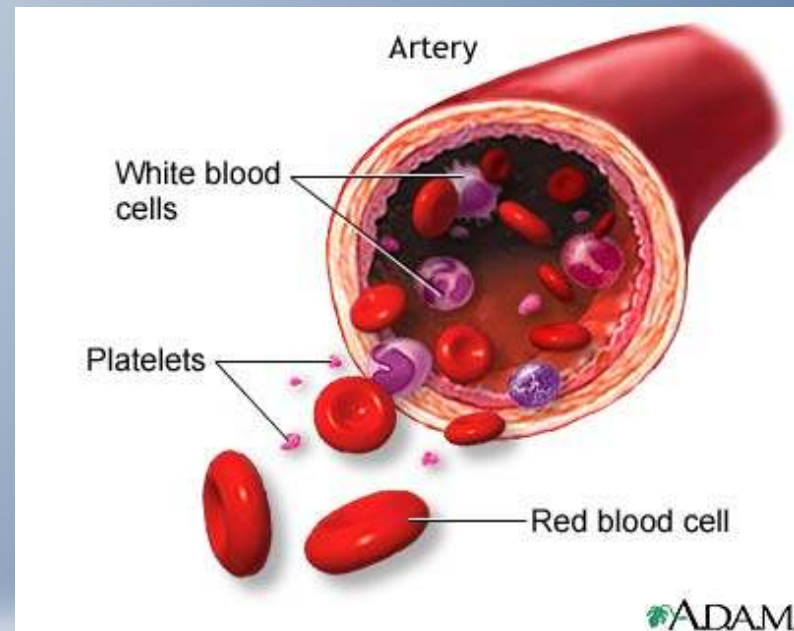
Serum is the plasma minus the clotting factors



2.) **Formed elements** are the cells and cell fragments in the blood

There are three main types of formed elements:

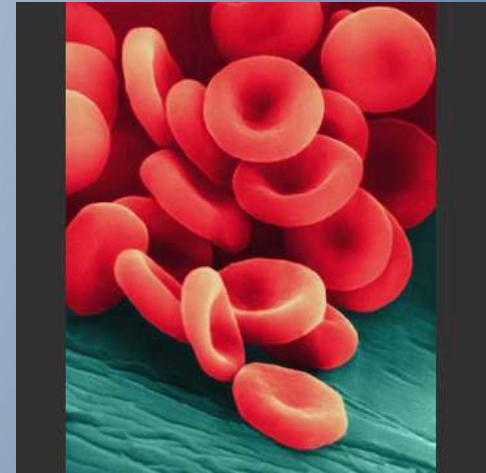
- a.) Red blood cells
- b.) White blood cells
- c.) Platelets



A.) Red Blood Cells

Look like circles with an area caved in on each side and the mature RBC's do not have a nucleus!

The shape is critical for the RBC's to carry oxygen and carbon dioxide (lots of surface area! how much??)



How many red blood cells do you suppose would be in a drop of blood? 1 mm^3

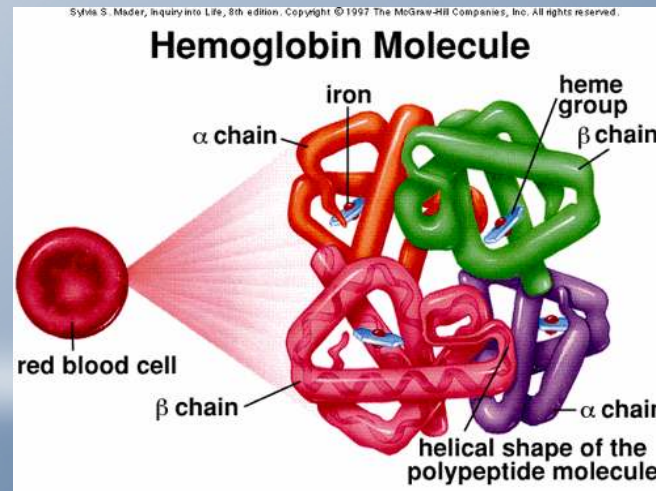


What is the function of RBCs?

A.) They carry carbon dioxide away from cells to the lungs where it is exhaled

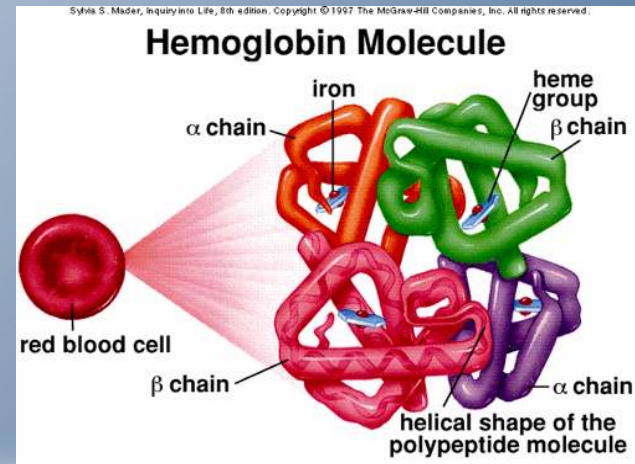
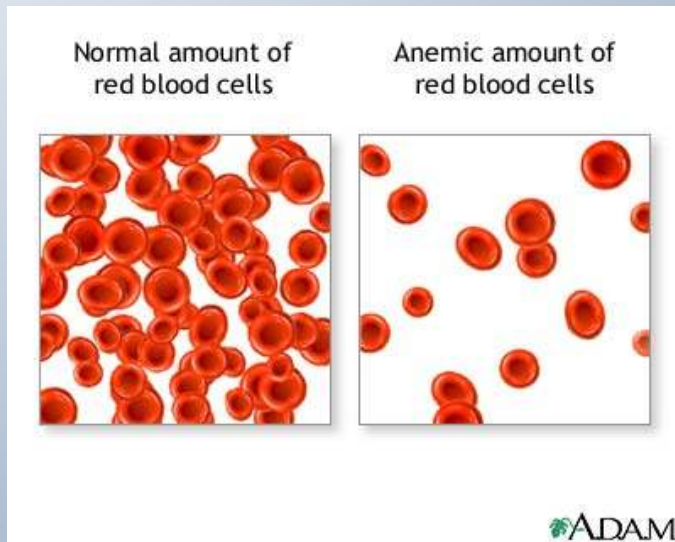
B.) Carry oxygen from the lungs to the cells

-hemoglobin is a red pigment in RBCs that bind with oxygen



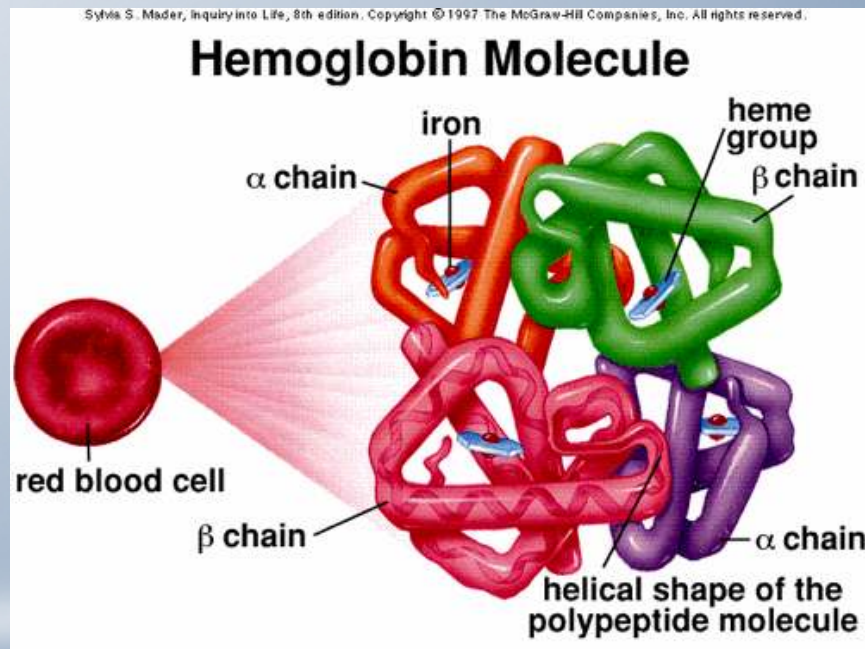
Anemia is a condition caused by an inability of the blood to carry sufficient oxygen to the body cells

Can result from either inadequate numbers of RBCs or a deficiency of hemoglobin



Iron is a critical component of hemoglobin. Improper diets may not provide enough iron for the body to manufacture enough hemoglobin

One sign of being anemic is being tired all the time



A hematocrit is a common lab test to find the volume of RBC's in a sample

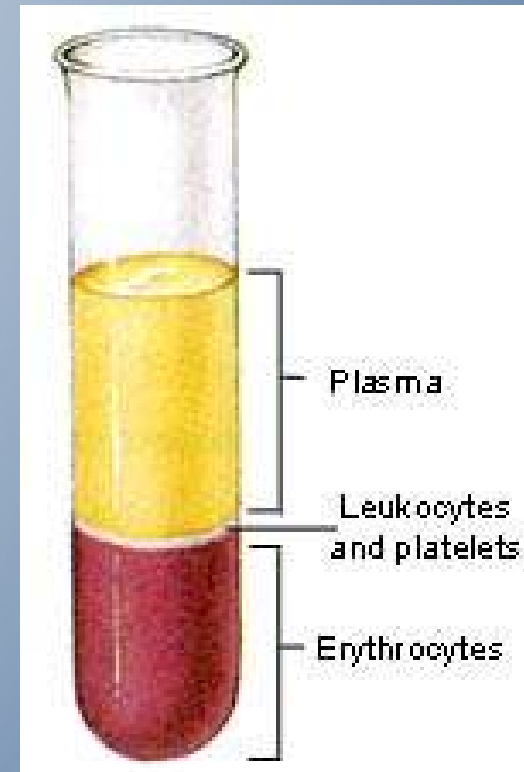
- This is done by spinning blood in a centrifuge

- The heavier stuff will settle to the bottom

- RBC's at bottom

- Buffy coat in the middle (WBC and platelets)

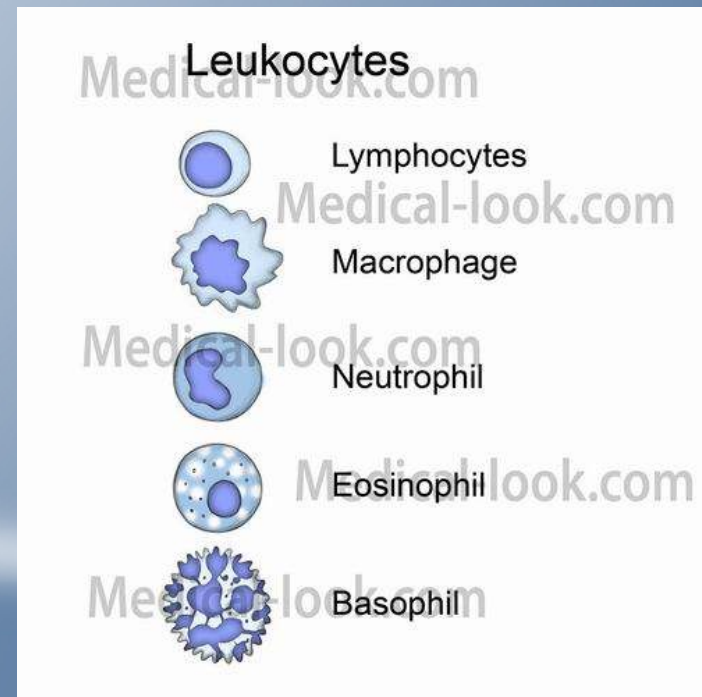
- Plasma at the top



B.) White Blood Cells

WBCs defend the body from microorganisms that have invaded the tissues or bloodstream

WBCs are also called leukocytes



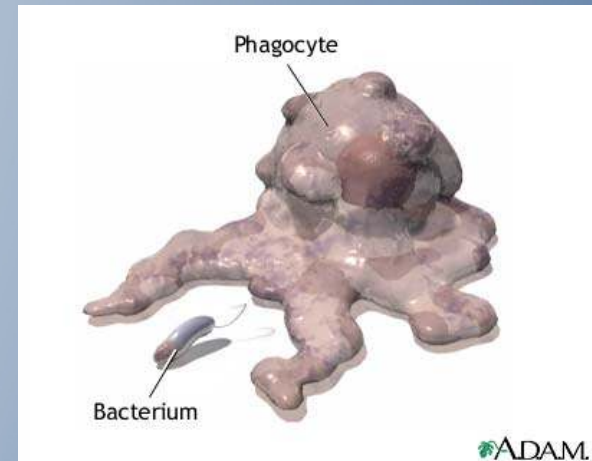
1.) Neutrophils (First responders)

2.) Monocytes

Both of these types of WBCs engulf microbes through a process called phagocytosis

Phagocytosis is the process of ingesting and digesting particles inside of a cell

Therefore neutrophils and monocytes are also called phagocytes

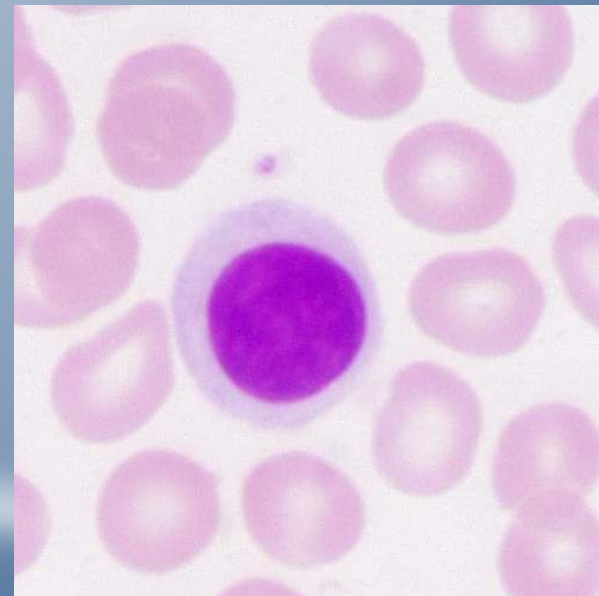
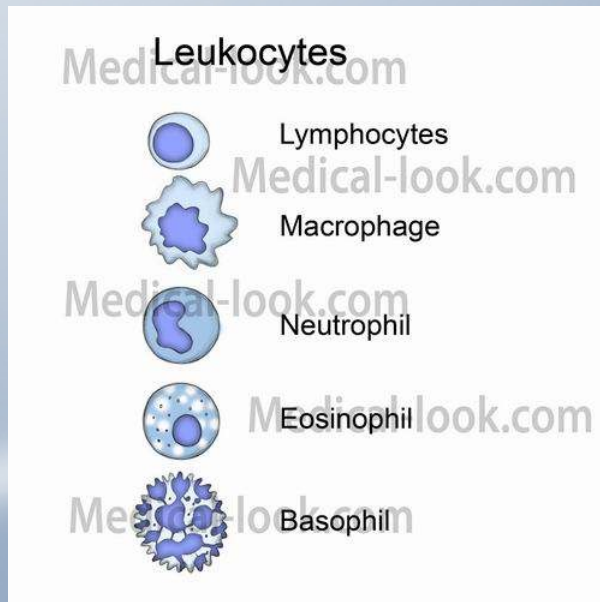


3.) B-lymphocytes

4.) T-lymphocytes

Both of these produce antibodies that inhibit microbes

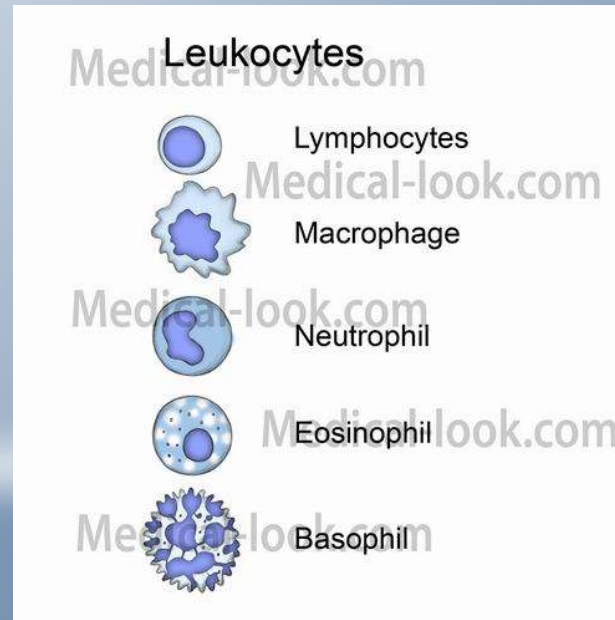
Collectively called lymphocytes



5.) **Eosinophils** use phagocytosis to protect the body against parasites and irritants that cause allergies

6.) **Basophils** also function in allergic reactions

- Also secrete a chemical called **heparin** which prevents the clotting of blood as it flows through the blood vessels



There are many diseases of the WBCs

1.) Leukopenia refers to an abnormally low WBC count (less than 5000 WBC/mm³ of blood)

i.e. AIDS (Acquired immunodeficiency syndrome)

2.) Leukocytosis refers to abnormally high WBC count (more than 10,000 WBC/mm³ of blood)

i.e. Leukemia which is "blood cancer"

- The extra WBCs created do not function properly

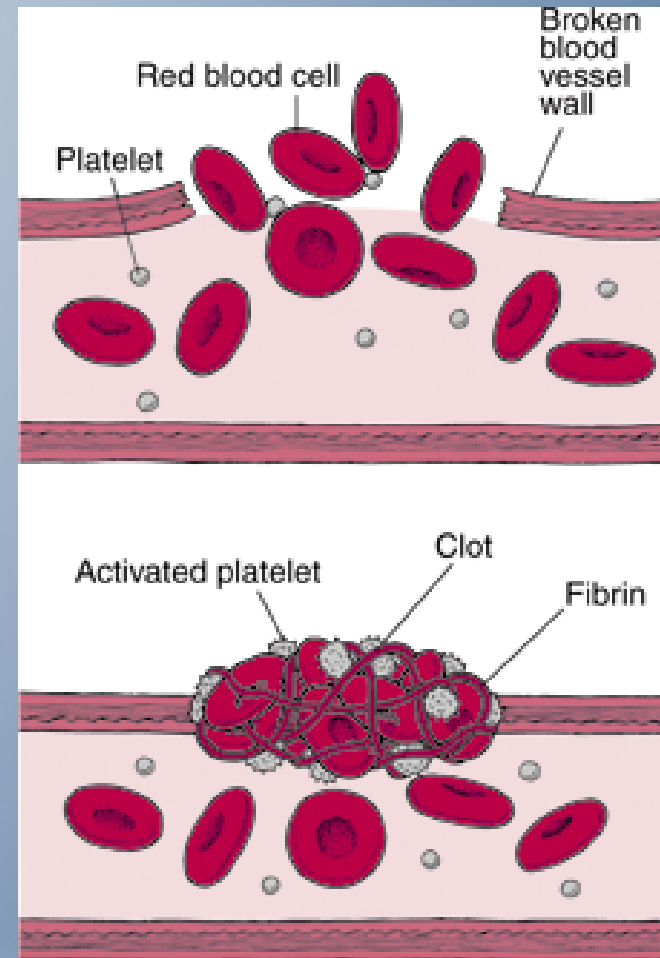
C.) Platelets

Platelets are the essential parts of blood clotting

A clot plugs up a torn or cut vessel

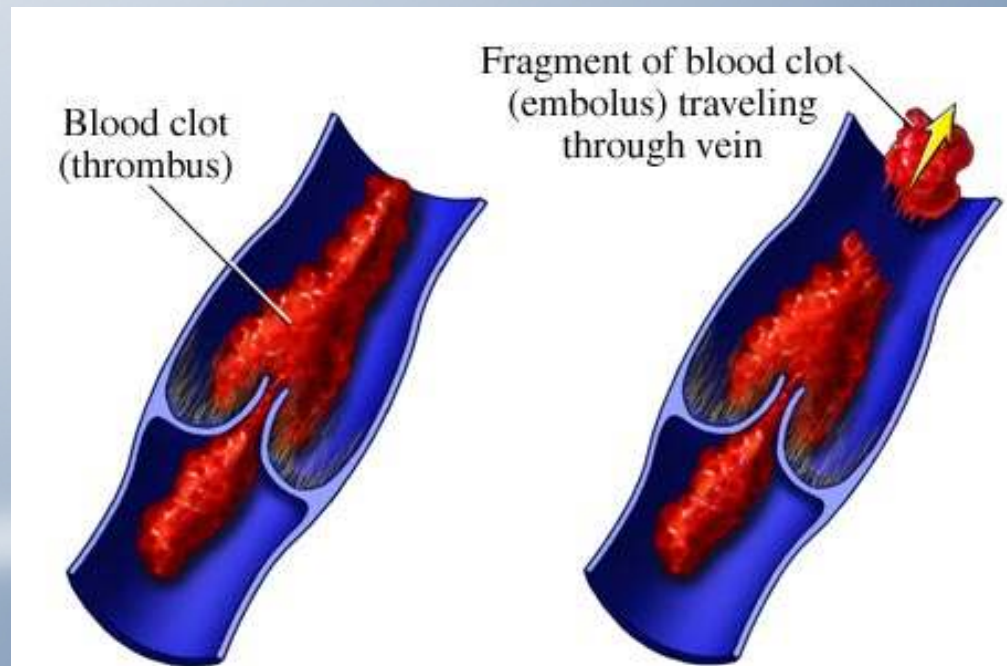
Two proteins **thrombin** and **fibrinogen** combine to form a fibrous gel called **fibrin**.

There are many other steps involved...one of them being correct blood calcium level



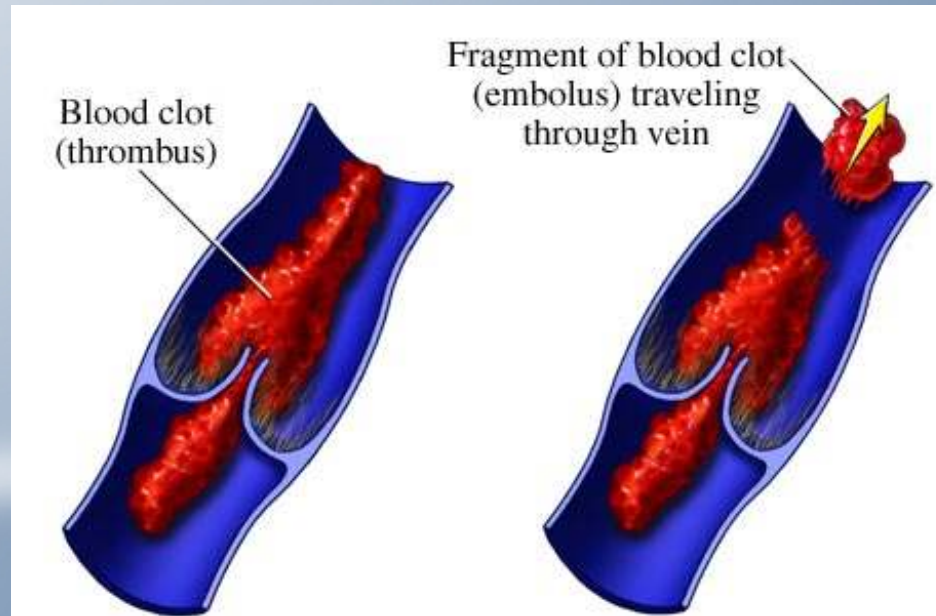
Clots sometimes form in unbroken blood vessels of the heart, brain, lungs or other organs and can cause sudden death by shutting off blood supply

These clots can induce strokes and heart attacks



An unwanted clot that stays in place where it was formed is called a **thrombus** and the condition is called **thrombosis**

If part of this clot dislodges and circulates through the blood stream it is called an **embolus** and the condition is called an **embolism**

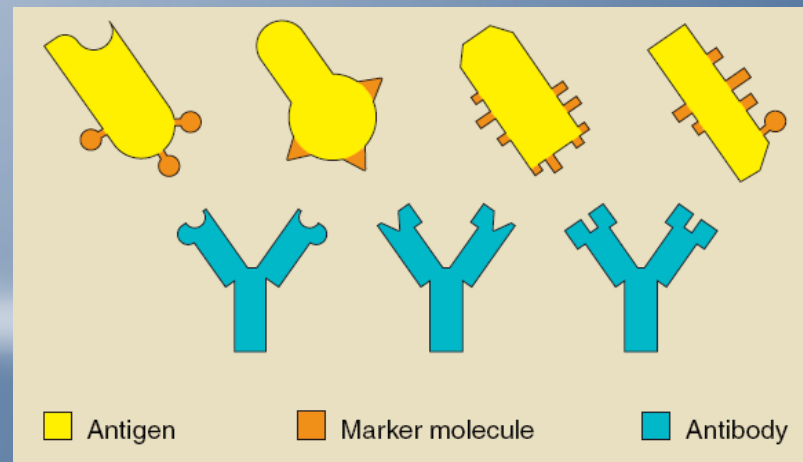


Blood Types

Blood type is identified by certain self-antigens located in the membranes of RBCs

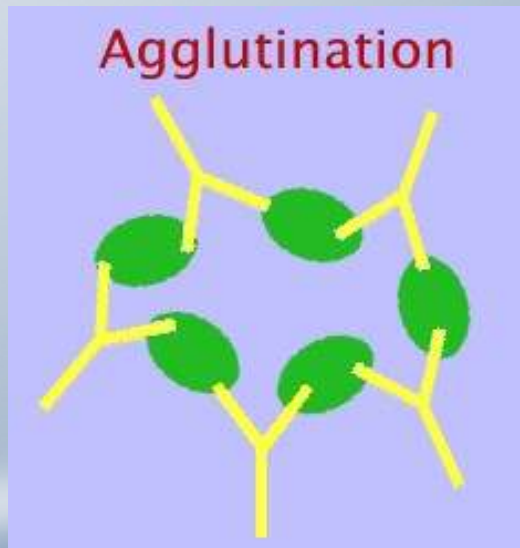
Antigen - a substance that can activate the immune system to produce antibodies

Antibodies - a substance made by the body in response to stimulation by an antigen



When an antigen and antibody come into contact they agglutinate or clump together

Usually antigens are found on the cell walls of invading bacteria, which stimulates your immune system thanks to the antibodies in your blood



There are four different types of blood

1.) Type A

2.) Type B

3.) Type AB

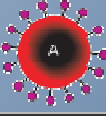
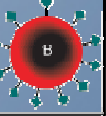
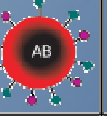







4.) Type O

Suppose you have type A blood

This means you have the type A antigens in your red blood cells membranes

Because you were born with this blood, your body does not react with it. i.e. your body does not form anti-A antibodies

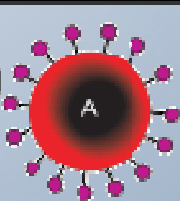
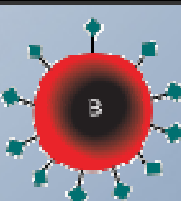
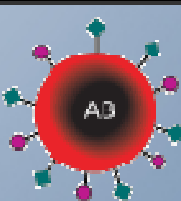
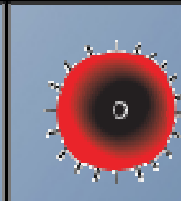
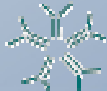


For an unknown reason, type A blood naturally contains anti-B antibodies

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	 A antigen	 B antigen	 A and B antigens	None

This is important to know for blood transfusions

If you have type A blood and receive type B blood what will happen?

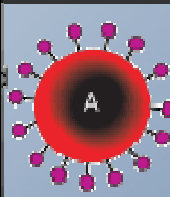
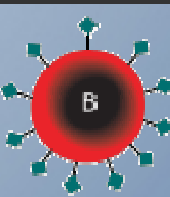
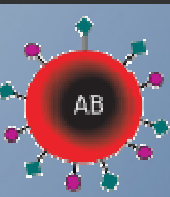
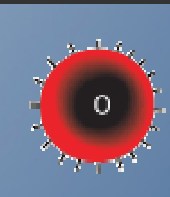



Your B antibodies will react with the antigens on the B blood, causing them to agglutinate (clump)

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti B	 Anti A	None	 Anti A and Anti B
Antigens present	A antigen	B antigen	A and B antigens	None

Type O blood has no antigens at all

Therefore it can be given to anyone and people with type O blood are called universal donors

Type AB blood has both A and B antigens, so they can receive blood from anyone and are called universal recipients

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	A antigen	B antigen	A and B antigens	None

Rh factor is another antigen on RBCs

Rh-positive means your blood has the antigen

Rh-negative means your blood does not have the antigen

Rh factor is important in pregnancies

If Rh-negative mother has a child with Rh-positive father and the baby happens to inherit the Rh positive gene....

When the child is being delivered the babies blood can mix with the mothers blood....

This causes the mothers body to produce antibodies for the Rh factor

If the mother later carries another Rh-positive fetus her new Rh antibodies will react with the baby's Rh-positive antigens

This causes a disease called erythroblastosis fetalis which often leads to death of the fetus