

BLOOD PRODUCTS

Biology 12

LAST DAYS NUGGETS...

- Draw and label the various parts of the heart



LAST DAYS NUGGETS...

- Draw and label the conduction system of the heart



LAST DAYS NUGGETS...

- Draw and label the three types of vessels and outline characteristics and what happens in each



Formed Elements of Blood



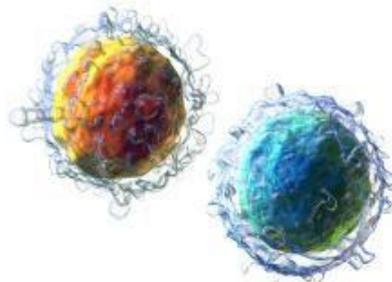
Red Blood Cells



Platelets



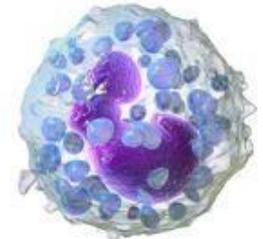
Monocyte



Lymphocytes



Eosinophil



Basophil

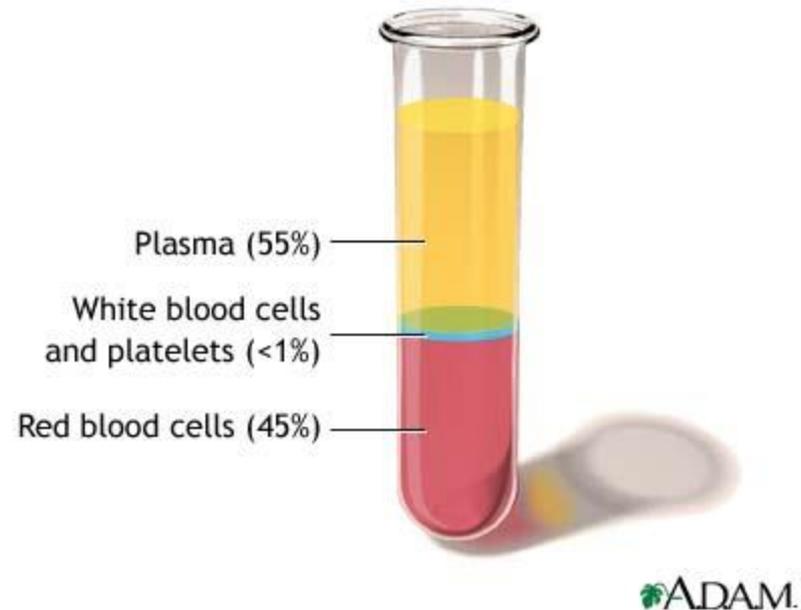


Neutrophil

White Blood Cells

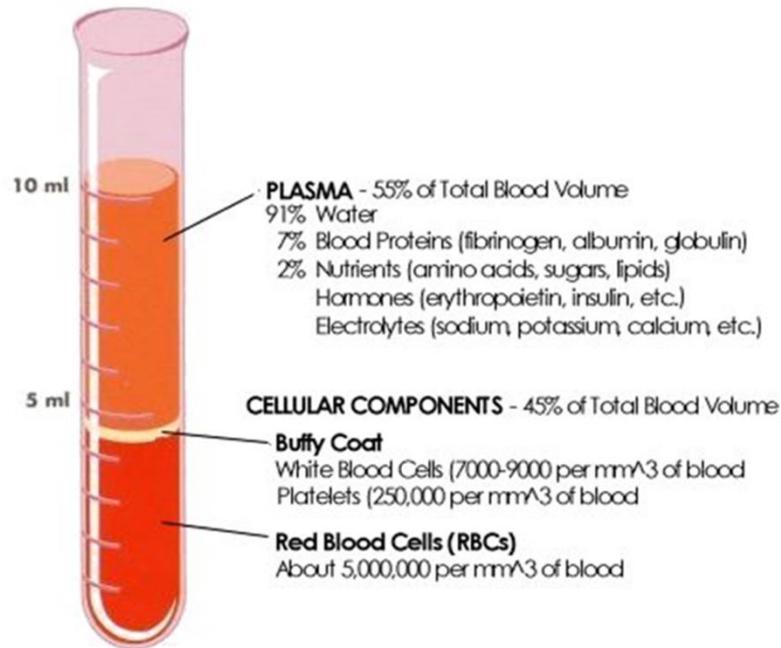
WHAT IS IN YOUR BLOOD?

- Red blood cells-
erythrocytes = carry O₂
- **Thrombocytes** - platelets
= clot blood
- **Leukocyte** - white blood
cell = immune system
- **Plasma** – fluid (90%) water
with dissolved salts and
proteins

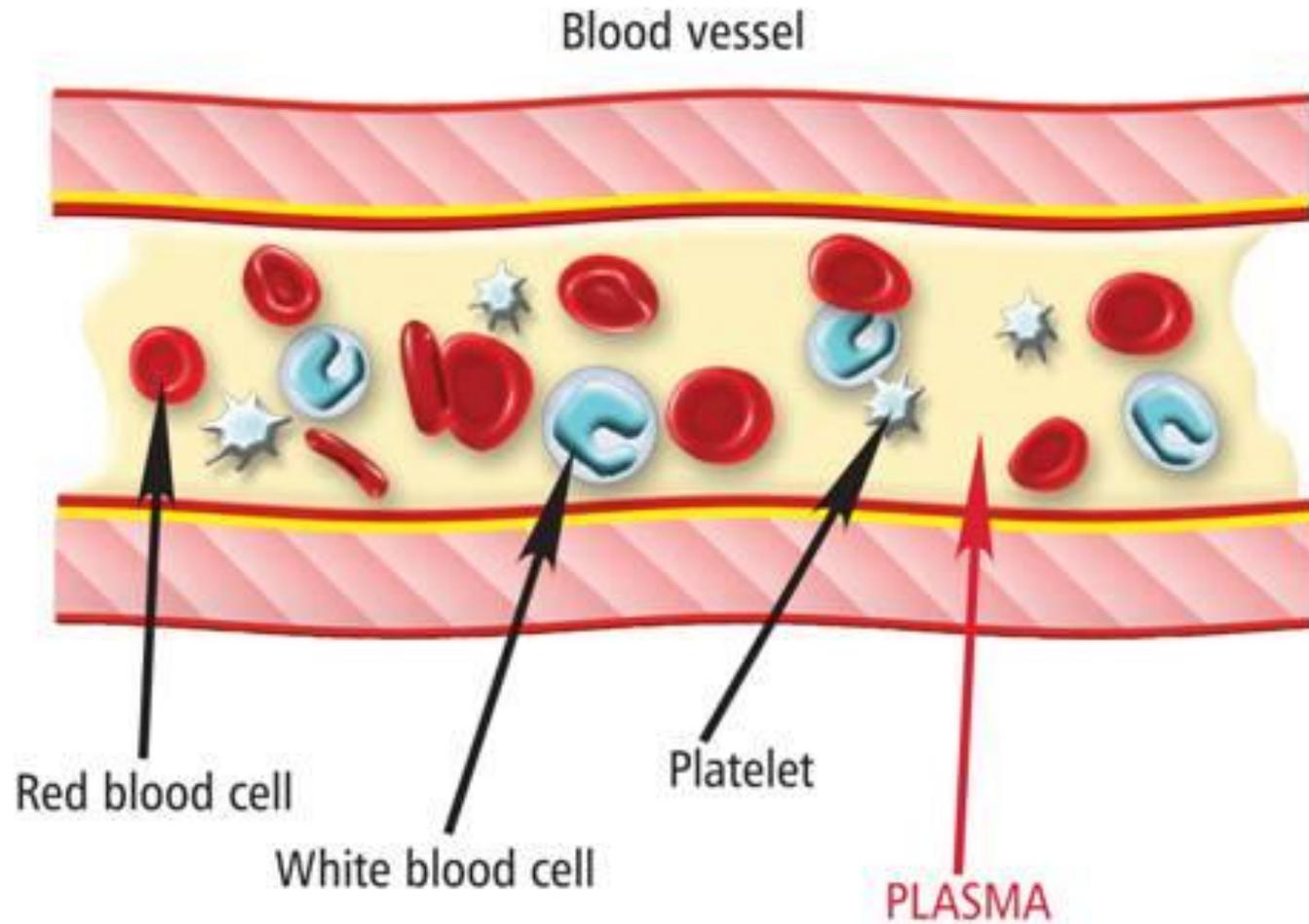


HEMOCRIT

- Gives an estimate of percent of the various parts of your blood
- Are you making enough RBC's?
- Do you have more WBC's? (clue to infection)



WHAT IS IN YOUR BLOOD?



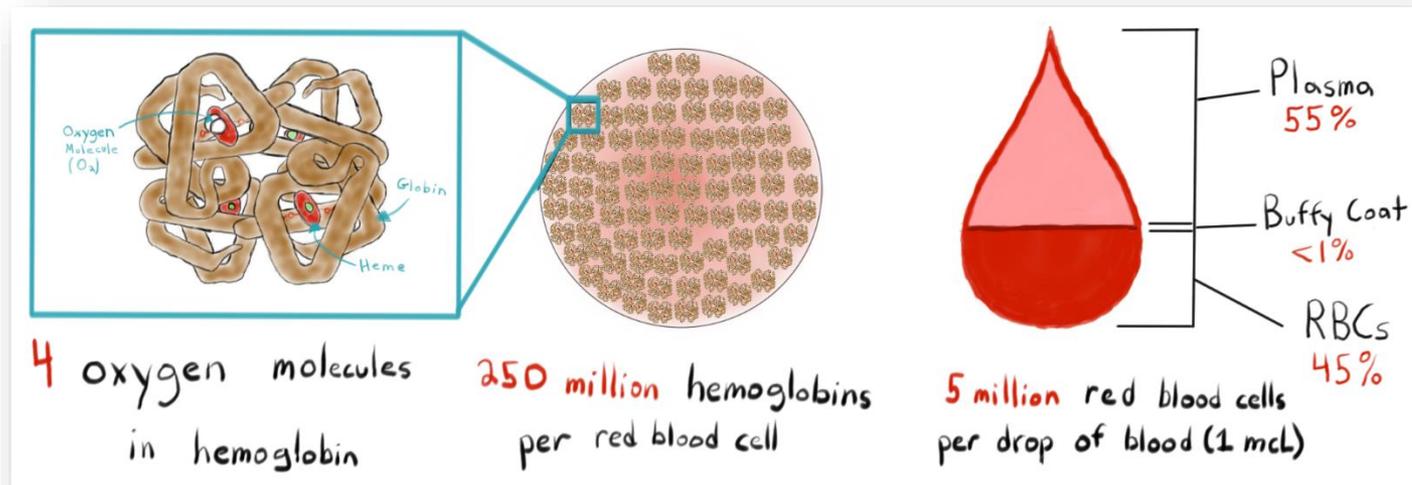
WHAT IS BLOOD PLASMA

- 90% water and dissolved in it... a lot of stuff such as...
 - Blood proteins
 - Albumin - osmotic balance (liver)
 - Fibrinogen - blood clotting (liver)
 - Gases (O₂, HCO₃⁻ CO₂,)
 - Nutrients (fats, glucose, amino acids, nucleotides)
 - Wastes (urea, ammonia)
 - Vitamins
 - Hormones
 - Salts



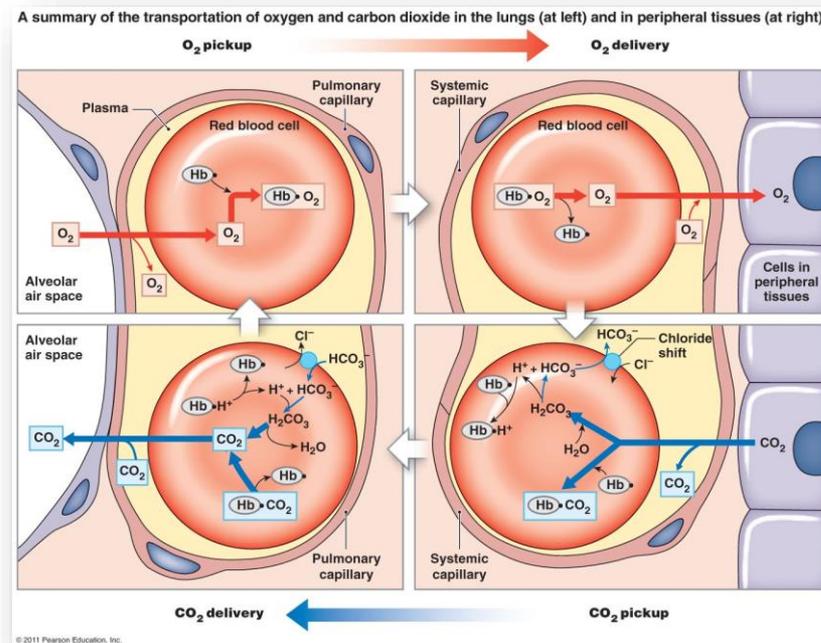
HOW DOES A RED BLOOD CELL CARRY O₂

- Erythrocytes are filled with hemoglobin (250 mill/cell)
- Each hemoglobin can carry 4 oxygen molecules



OXYGEN IN BLOOD

- 3% of oxygen is dissolved in the blood plasma (fluid portion of blood)
- 97% of oxygen travels attached to haemoglobin in RBC

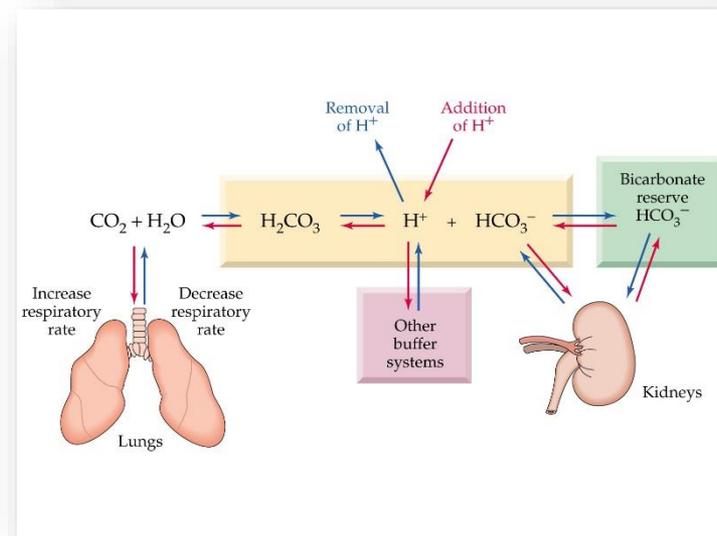


CARBON DIOXIDE IN BLOOD



3 ways CO_2 travels in blood:

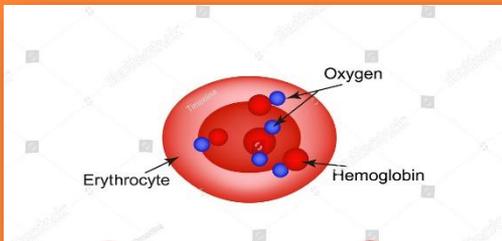
1. 10% dissolved in blood
2. 30% carbaminohaemoglobin
3. 60% as HCO_3^-



TYPES OF HAEMOGLOBIN

Oxyhaemoglobin

When the haemoglobin is all connected to oxygen



Carbaminohaemoglobin

When the haemoglobin is all connected to carbon dioxide

Carbon dioxide can leave in 3 ways:

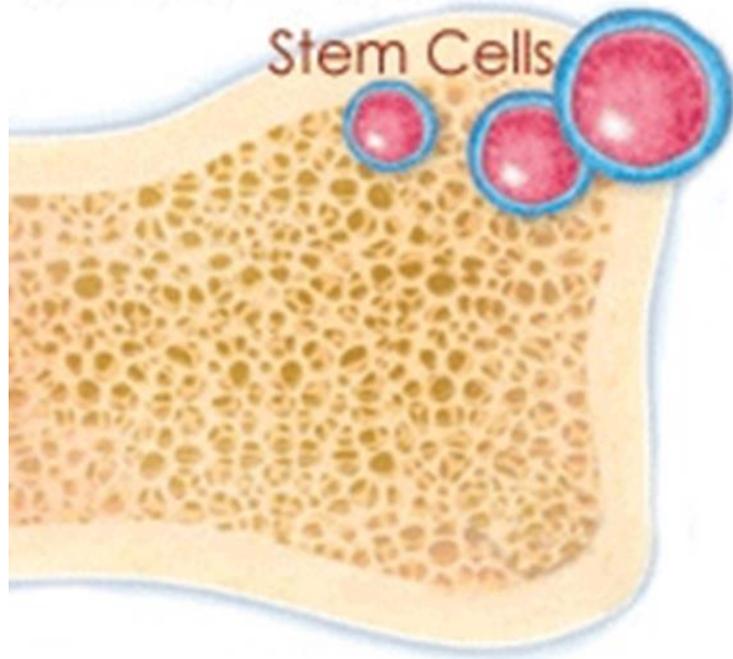
1. Attach to Hb
2. Dissolve in water
3. React with water (pH issues)

Reduced haemoglobin

When the haemoglobin not bonded to anything

HOW DO YOU MAKE BLOOD?

Healthy bone marrow contains stem cells.
Bone marrow stem cells mature into red blood cells,
white blood cells and platelets.



Red blood cells
(RBCs)



White blood cells
(WBCs)



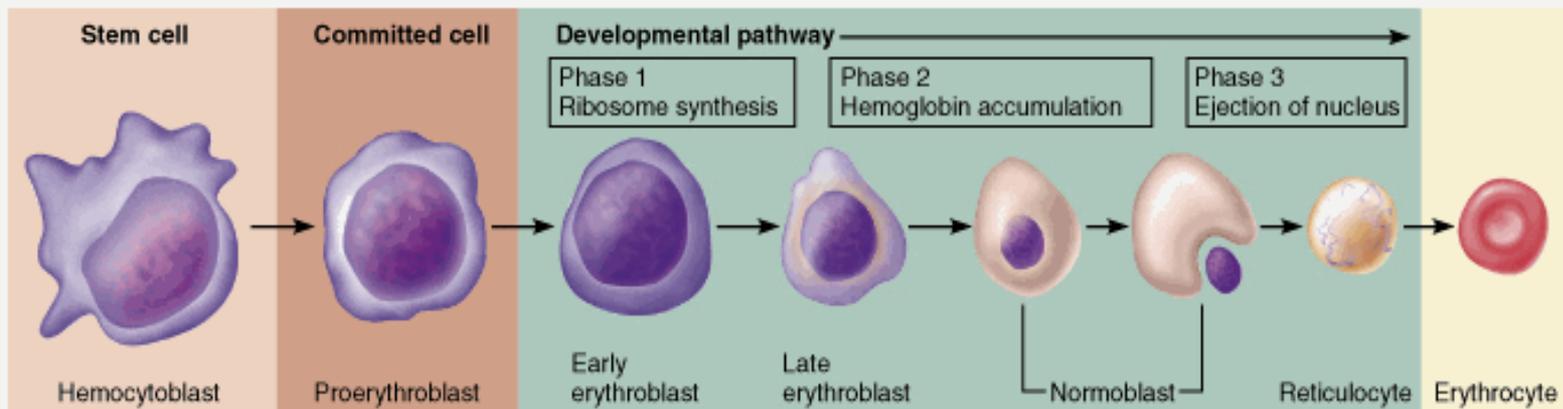
Platelets

Watch
video



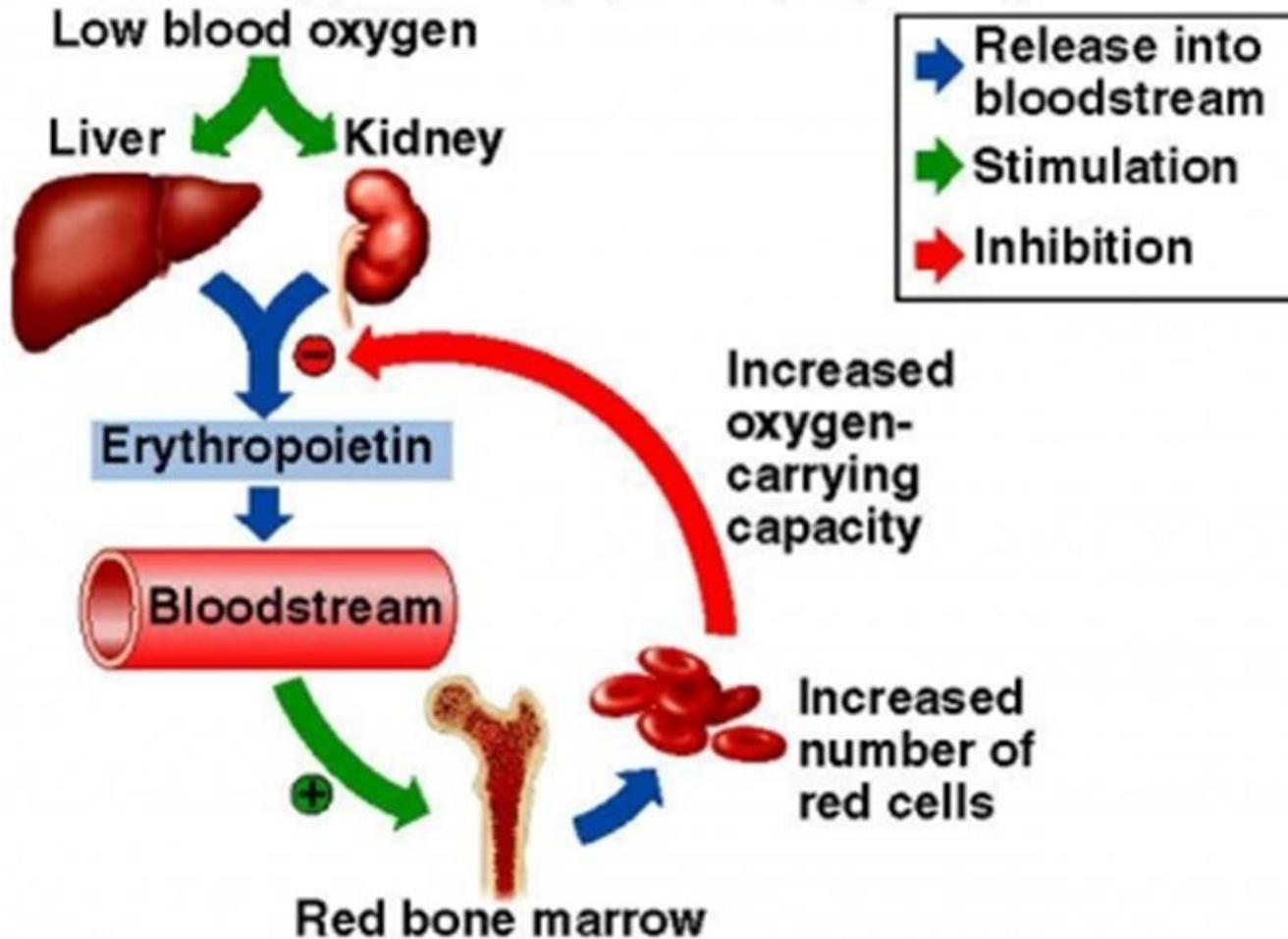
MAKING NEW RED BLOOD CELLS

- making of new RBC in bone marrow rely on the hormone **erthyropoetin** being released from the kidney to start the process
- RBC's do NOT have DNA as they lost their nucleus
- When you get DNA from blood sample, you get it from WBC



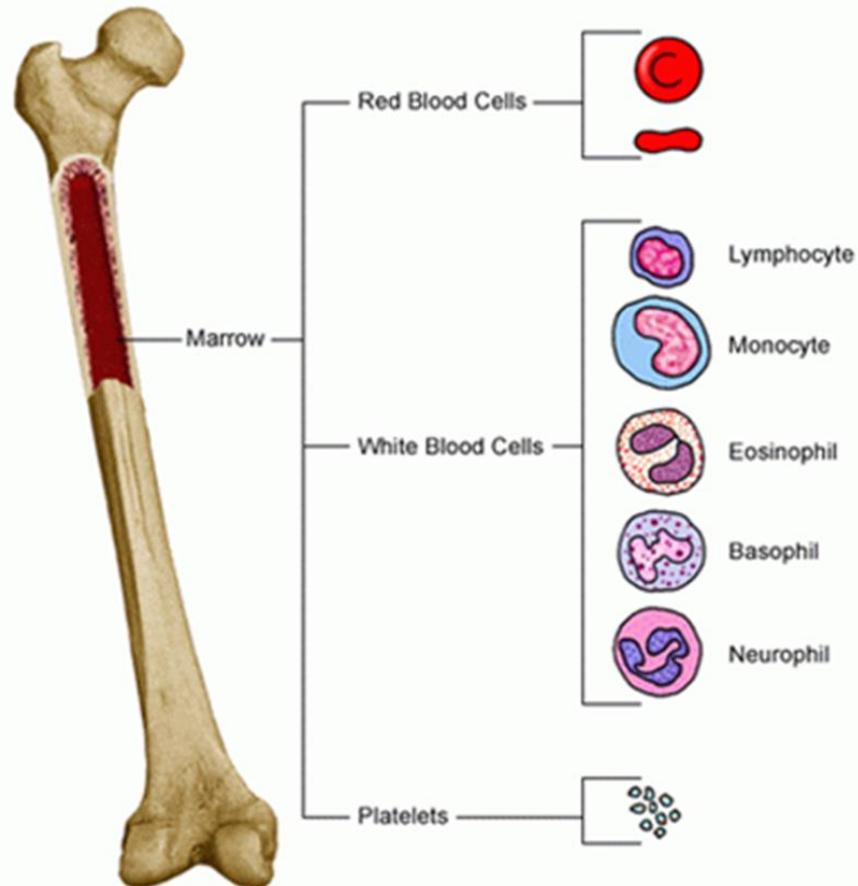
POSITIVE/NEGATIVE FEEDBACK LOOP

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IMPORTANCE OF BONE MARROW

- Large bone marrow make new blood cells
- Pelvis
- Thigh (femur)





BLOOD CLOTTING

- Damage to platelets initiate clotting reaction
- Triggers release of **thromboplastin** enzyme & Ca^{2+} from platelet
- Thromboplastin converts **prothrombin** (protein made by liver...globulin) to **thrombin** (needs Ca^{2+})
- Thrombin triggers the conversion of **fibrinogen** (globulin) into **fibrin** (insoluble)
- Fibrin traps blood cells (clot)



BLOOD CLOTTING



Damage to platelets

Trigger release of thromboplastic and Calcium

Prothrombin → Thrombin

Fibrinogen → Fibrin

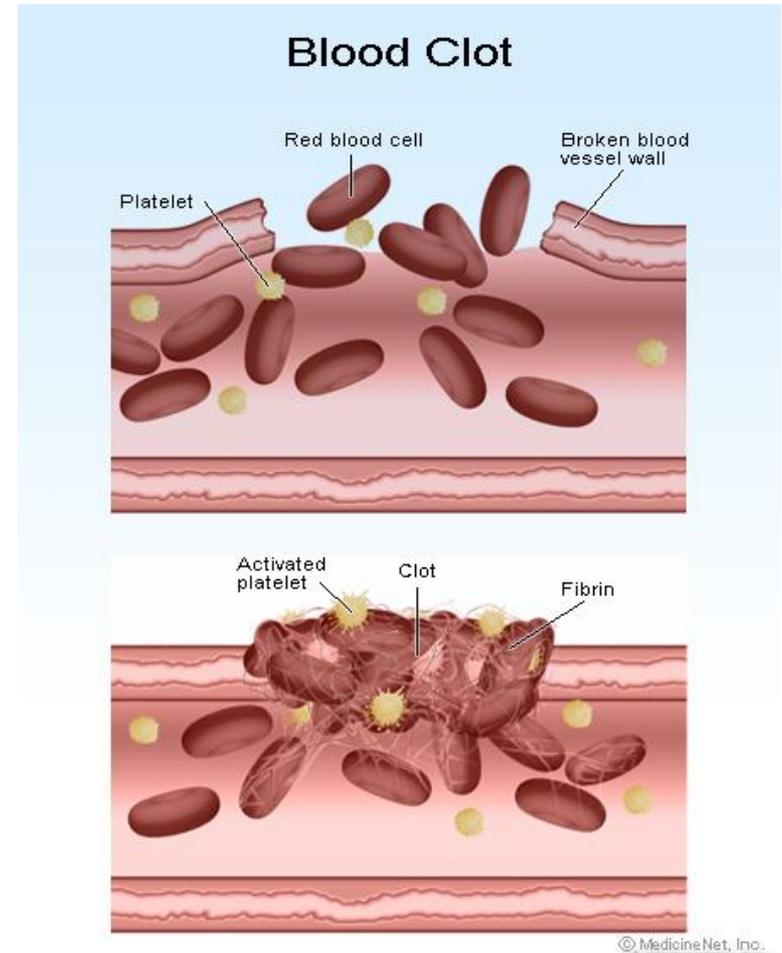
Fibrin is a web that traps RBC which stops bleeding



Clotting is a
**positive feedback
loop**

The process of
platelets
connecting releases
more chemicals
that attract more
platelets

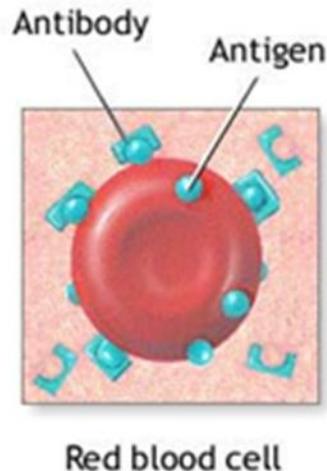
**More gets you
more...**



ANTIGEN VS ANTIBODY

(REMEMBER YOUR BI 11 VOCABULARY)

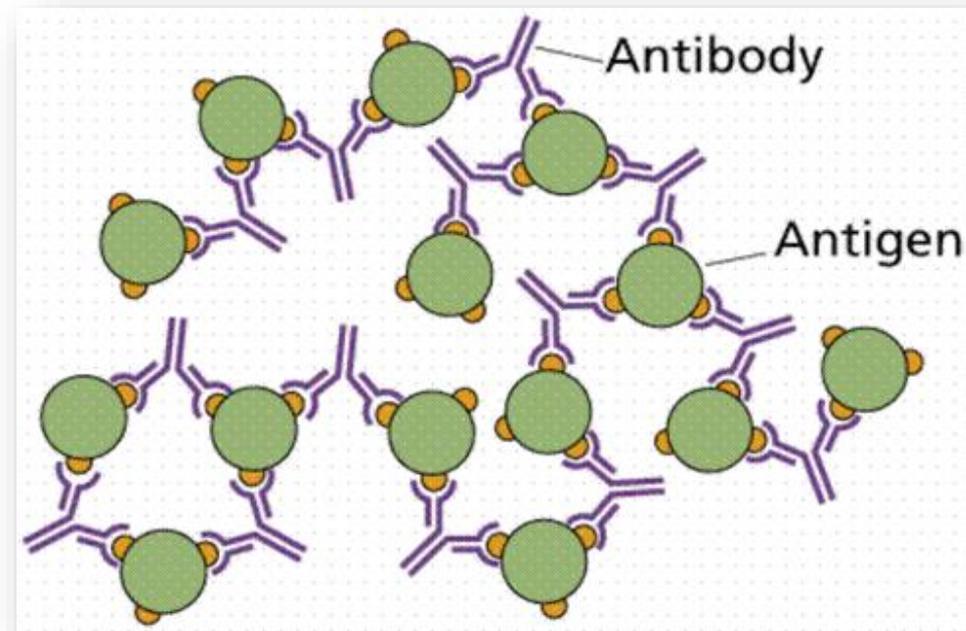
- **Antigen** – an agent that is foreign (or self) and is recognized by the immune system
- **Antibody** – a Y shaped protein capable of identifying and binding to a specific antigen



An antigen is a substance that induces the formation of antibodies because it is recognized by the immune system as a threat

AGGLUTINATION

- **Antibodies connect to the antigen of the pathogen and round up the infection in one area (a clump)**



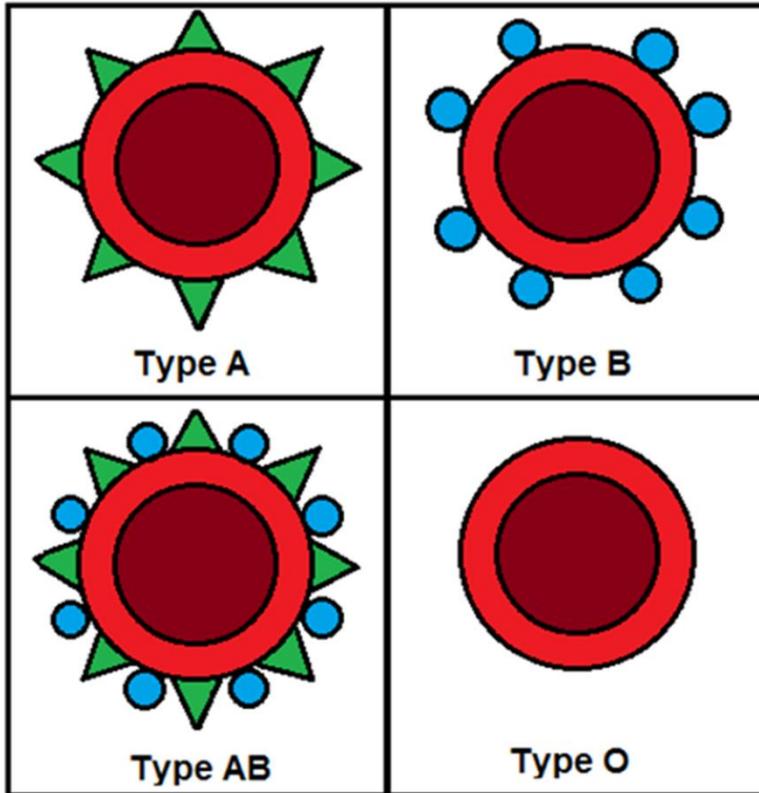
WHAT'S YOUR BLOOD TYPE?



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WHAT'S YOUR BLOOD TYPE?



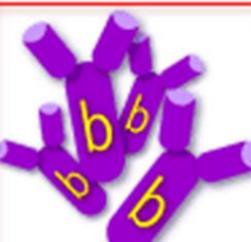
Anti-A	Anti-B	Anti-D	Control	Blood type
				O-positive
				O-negative
				A-positive
				A-negative
				B-positive
				B-negative
				AB-positive
				AB-negative
				Not valid



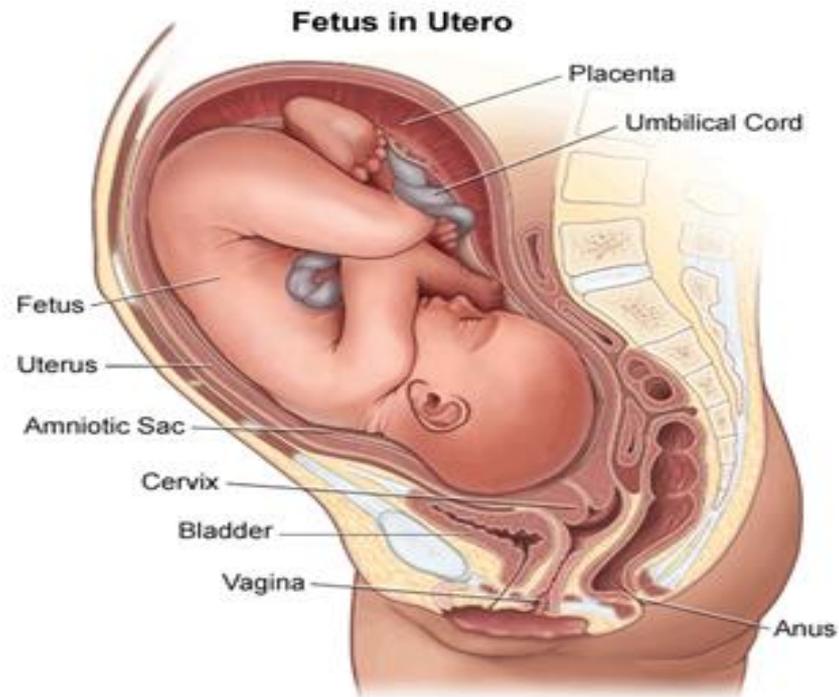
CAN YOU GET BLOOD FROM JUST ANYONE?

- Blood transfusion game

The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	NONE. No agglutinin	 a and b agglutinin

Fetal Circulation is a little different

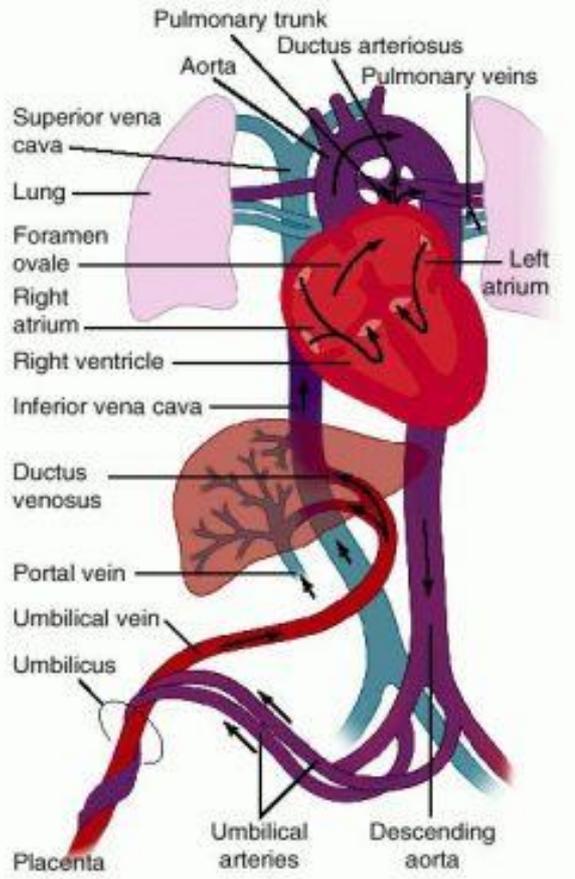


General Differences Between Fetus and Adult

- Fetus doesn't "breathe"
- Lungs too dense
- A bit of blood goes to lungs to provide nutrients to lung tissue
- Oxygenated blood comes through umbilical cord, not from lungs



Fetal Circulation



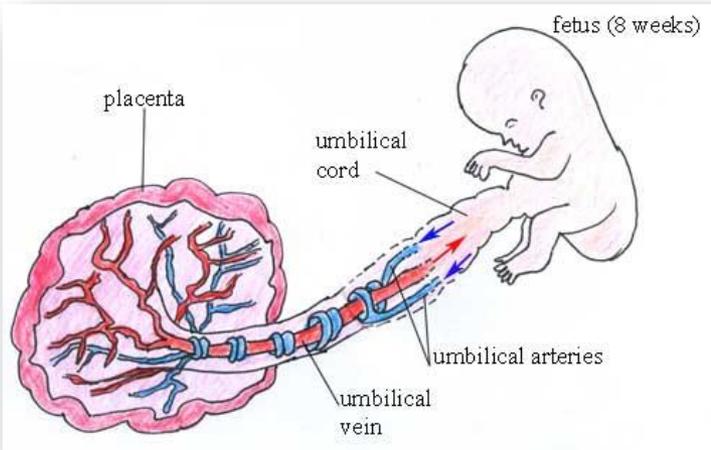
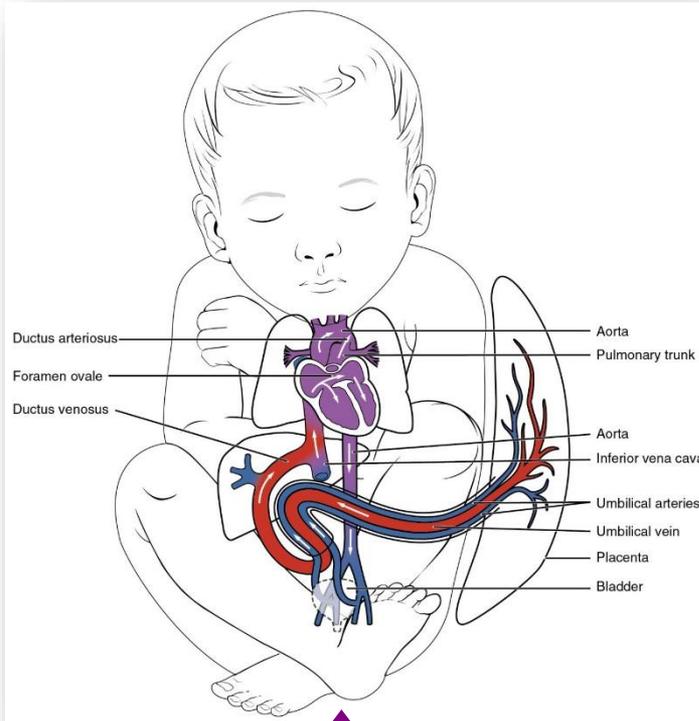
- Four new structures:
1. Umbilical vein and artery
 2. Ductus venosus
 3. Foramen ovale
 4. Ductus arteriosus



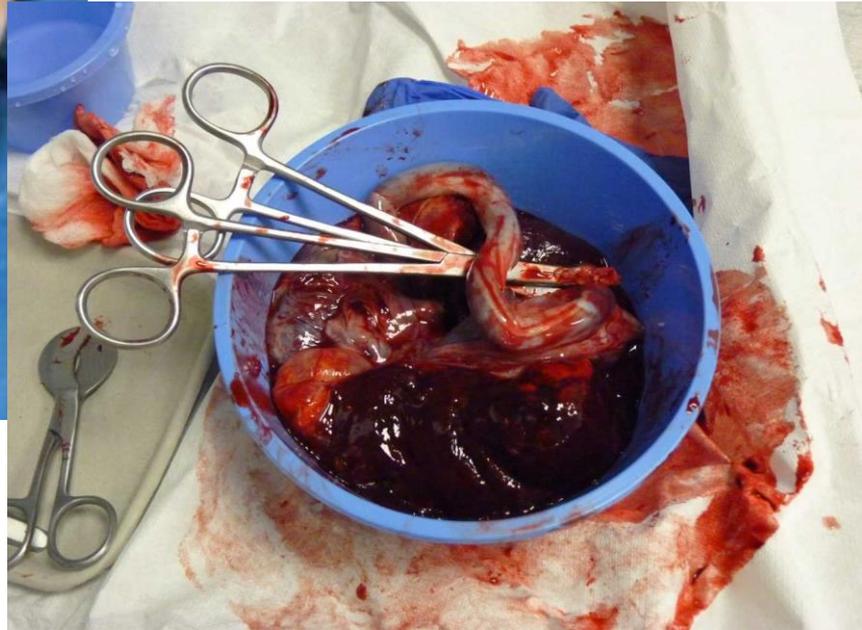
Umbilical Cord - 3 vessels

Umbilical vein

- Blood with oxygen and nutrients go to fetal heart to “feed” cells



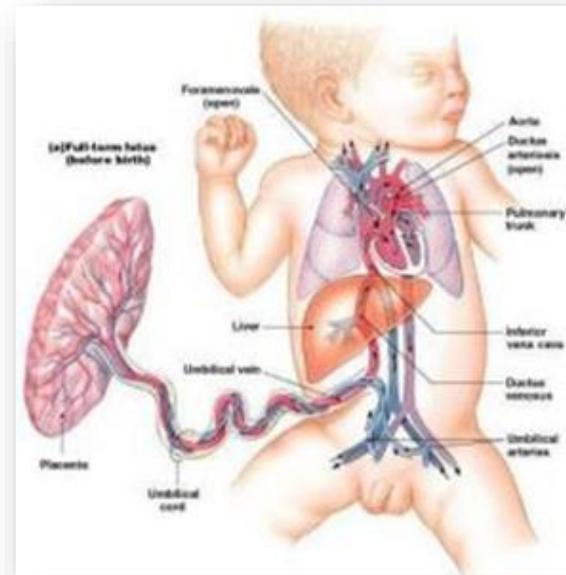
Umbilical Cord - 3 vessels



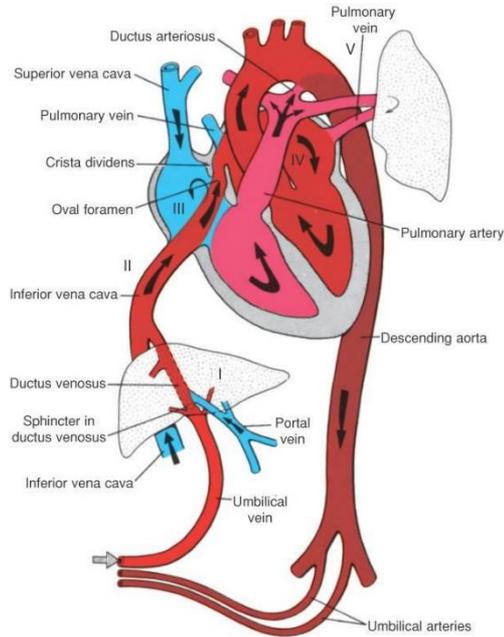
Umbilical Cord - 3 vessels

2. Umbilical Arteries

- Both branch off of fetal iliac arteries
- take waste out of fetus, towards placenta for gas exchange



Ductus Venosus

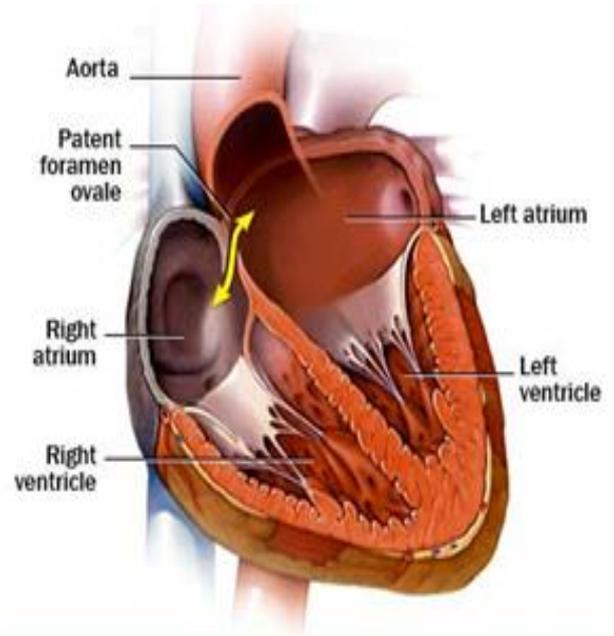


- **Capillaries have low BP...going through all the capillaries in livers would lower BP too much to reach heart**
- **Result - No filtering of blood by fetus**
- **(impact on drugs and alcohol that cross the placental barrier)**



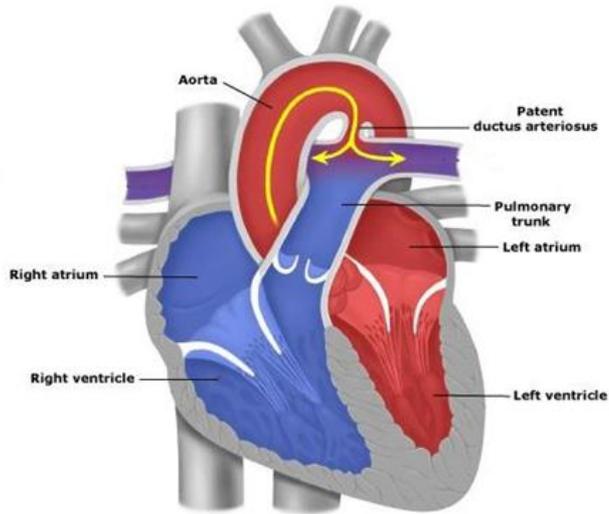
Foramen ovale

- **Fetal heart valve between R and L atrium**
- **Allows blood to bypass lungs**
- **re-routes oxygenated blood from R atrium to L atrium**



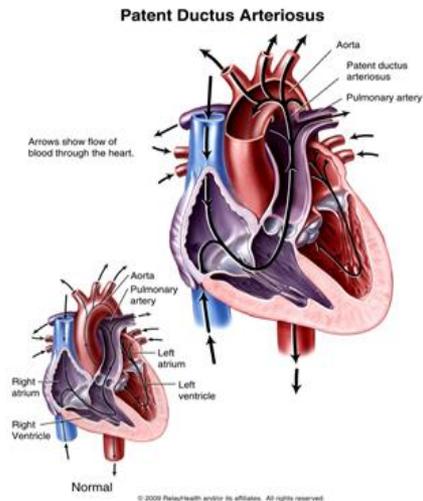
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Ductus arteriosus

- Connects pulmonary artery to aorta
- Another lung bypass
- pushes blood out to the aorta to get it through the body



Baby's First Breath

- Lungs expand which reduces density
- The lungs can now facilitate gas exchange
- The change in density triggers the foramen ovale and ductus arteriosus to close



Changes After Birth - Placenta

- 1. no longer use placenta
- 2. use lungs to get own oxygen and remove own CO₂
- 3. placenta produced prostoglanins which keep ductus arteriosus open. Without placenta, ductus arteriosus will constrict and close.

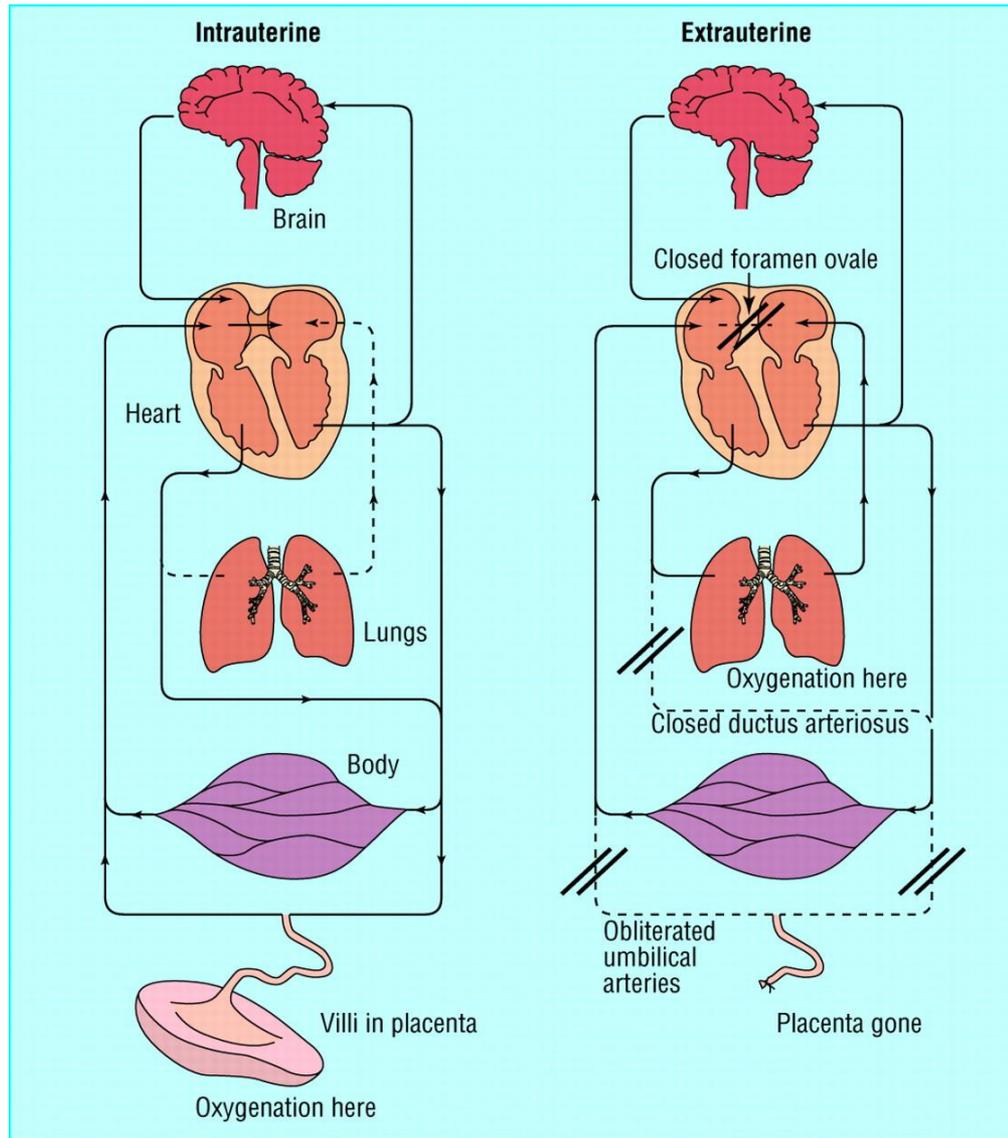


Changes After Birth

Shunt	Functional closure	Anatomical closure	Remnant
Ductus arteriosus	10 – 96 hrs after birth	2 – 3 wks after birth	Ligamentum arteriosum
Formamen ovale	Within several mins after birth	One year after birth	Fossa ovalis
Ductus venosus	Within several mins after birth	3 – 7 days after birth	Ligamentum venosum



Changes After Birth



First breathe of air

LUNG use

- 1. Change in pressure causes the alveoli to pump up**
- 2. Causes foramen ovale to close off (like a flap) - within the first 2 - 3 minutes of birth**

