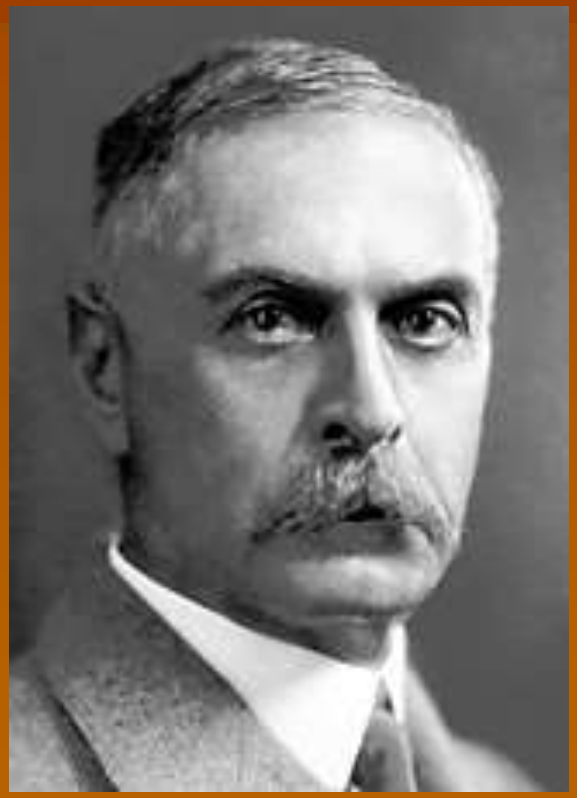
Blood

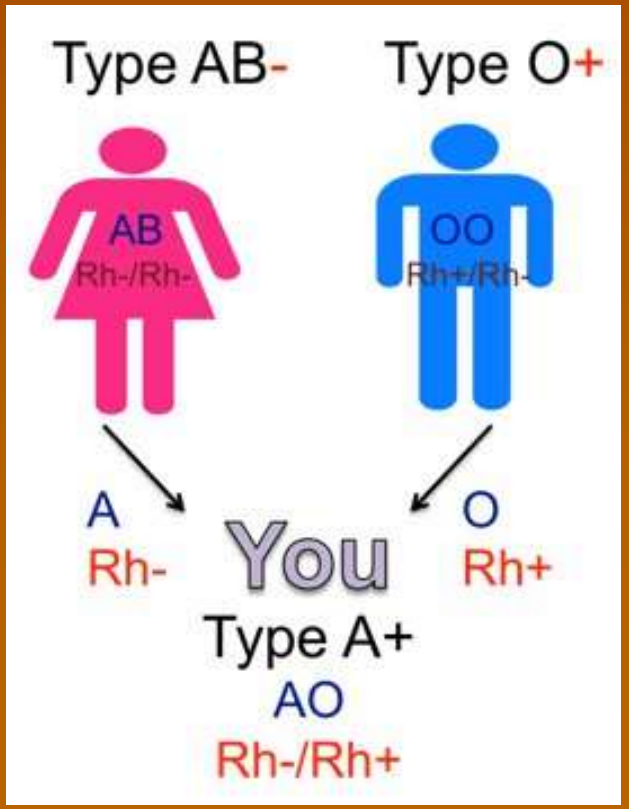
Blood History

- 1901 – Karl Landsteiner first typed blood into A, B, AB, O
  - He was awarded the Nobel Prize for this
- 1937 – Rh factor was discovered (positive or negative – i.e. AB+, O-



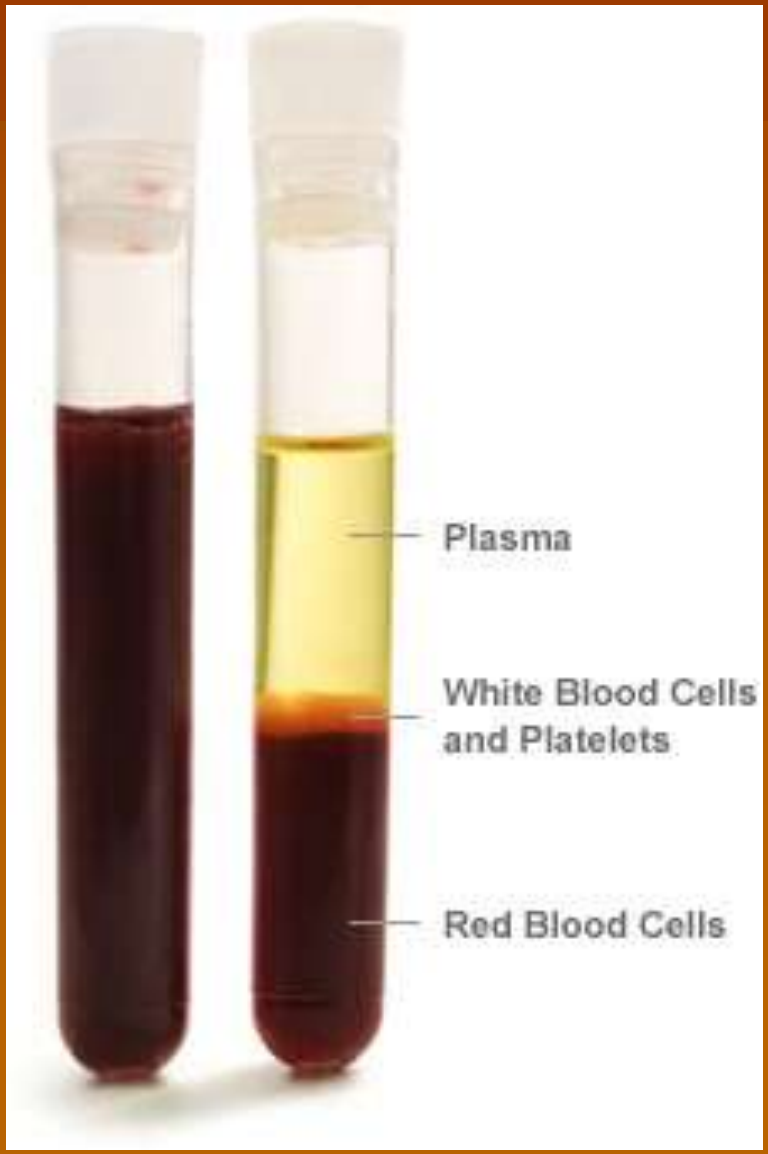
Blood Information

- At present there are over 100 blood factors that can be used to identify a person.
- Until the 1990s scientists used a combination of these factors to link blood to individuals
- Human blood types are determined by genes.



Composition of Blood

- Blood is a mixture of cells, enzymes, proteins, and inorganic substances.
- There are 4 Main Parts of the blood:



Composition of Blood Cont.

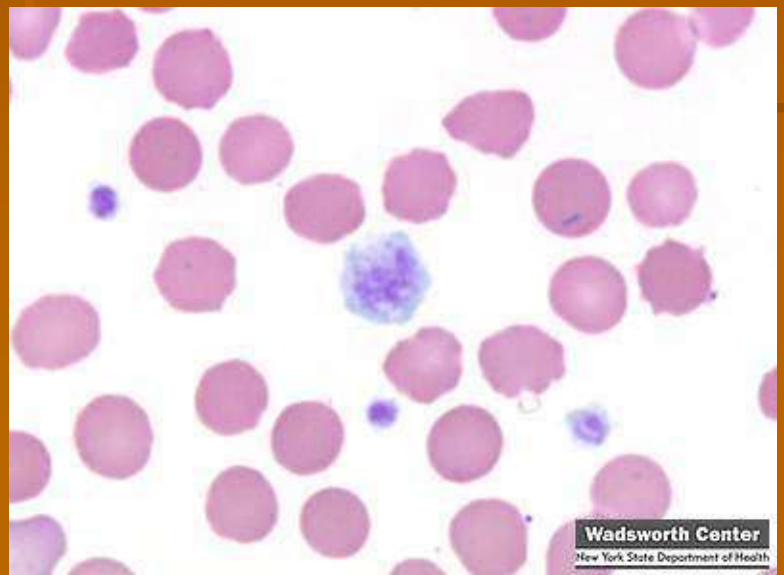
- Plasma – liquid portion of blood which is 55% of the blood volume

Composition of Blood Cont.

- Red Blood Cells (erythrocytes) – Transport oxygen from the lungs to the body tissue
  - Antigens on the surface of red blood cells give them their blood characteristics (A, B, AB & O)

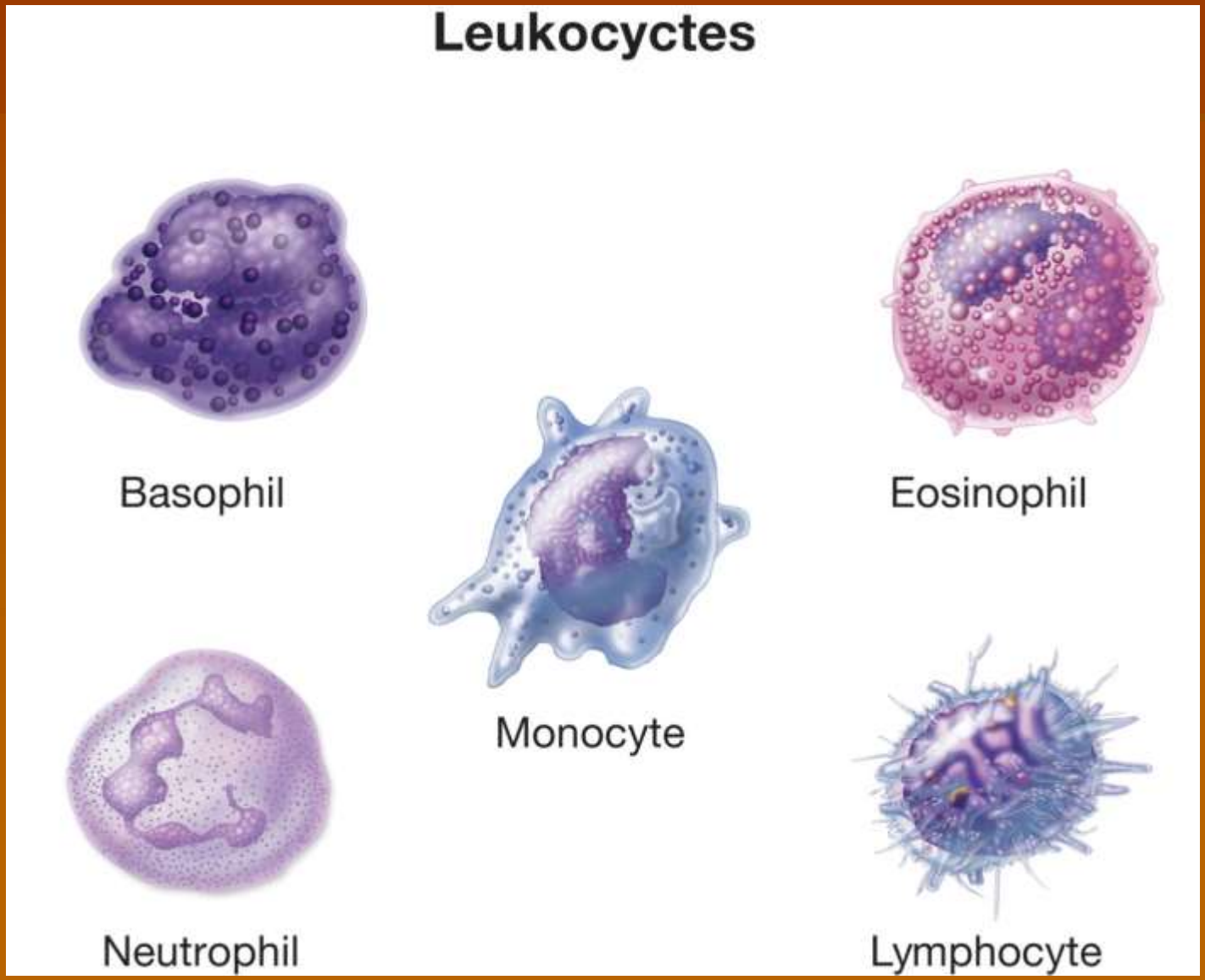
Composition of Blood Cont.

- White Blood Cells (leukocytes) – produce antibodies to disable and/or destroy invaders to the body
  - Your blood contains antibodies to defend against whichever antigen is NOT normally present in your blood



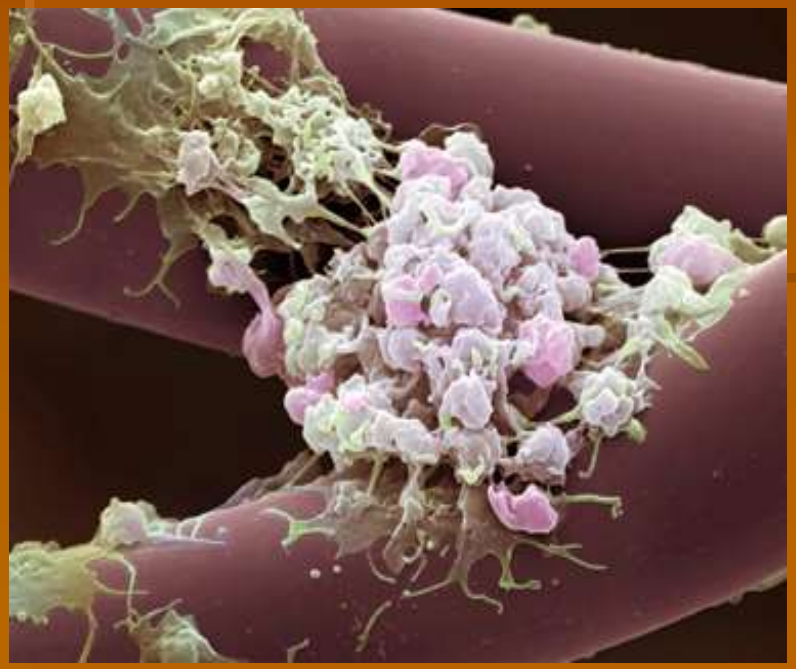
A White Blood Cell or Leukocyte

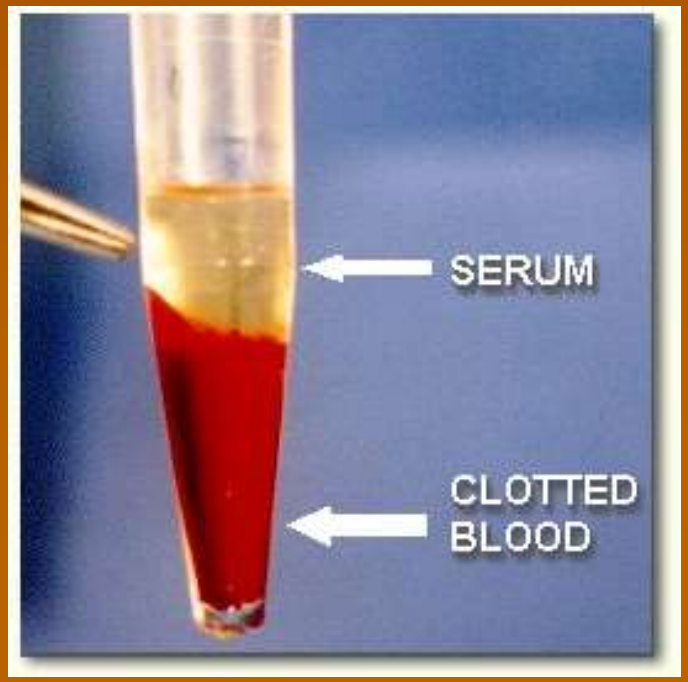
Different Types of WBC

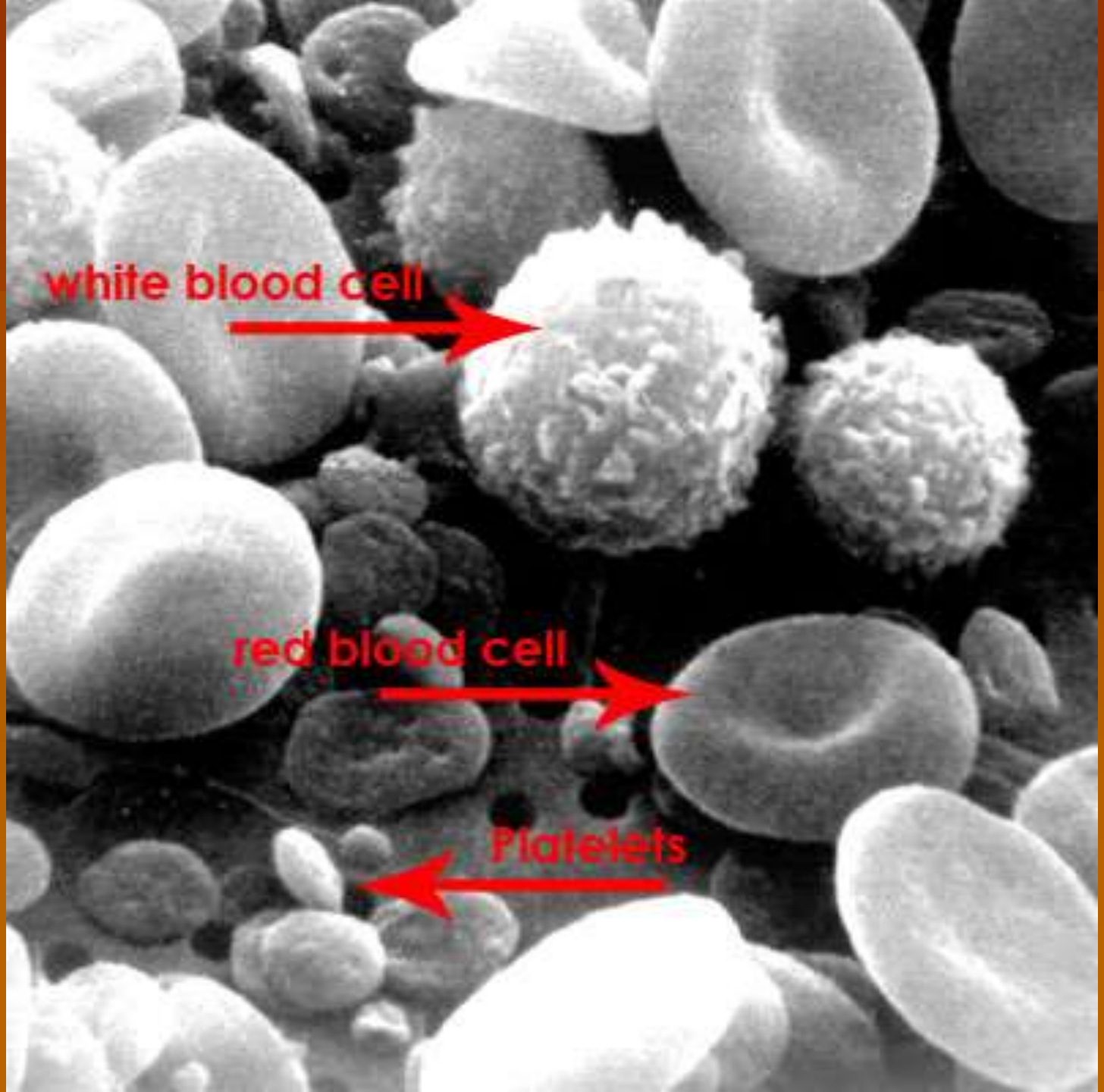


Composition of Blood Cont.

- Platelets – help the blood clot. The protein fibrin catches red blood cells. If a clot is removed, a yellowish liquid called serum is left.





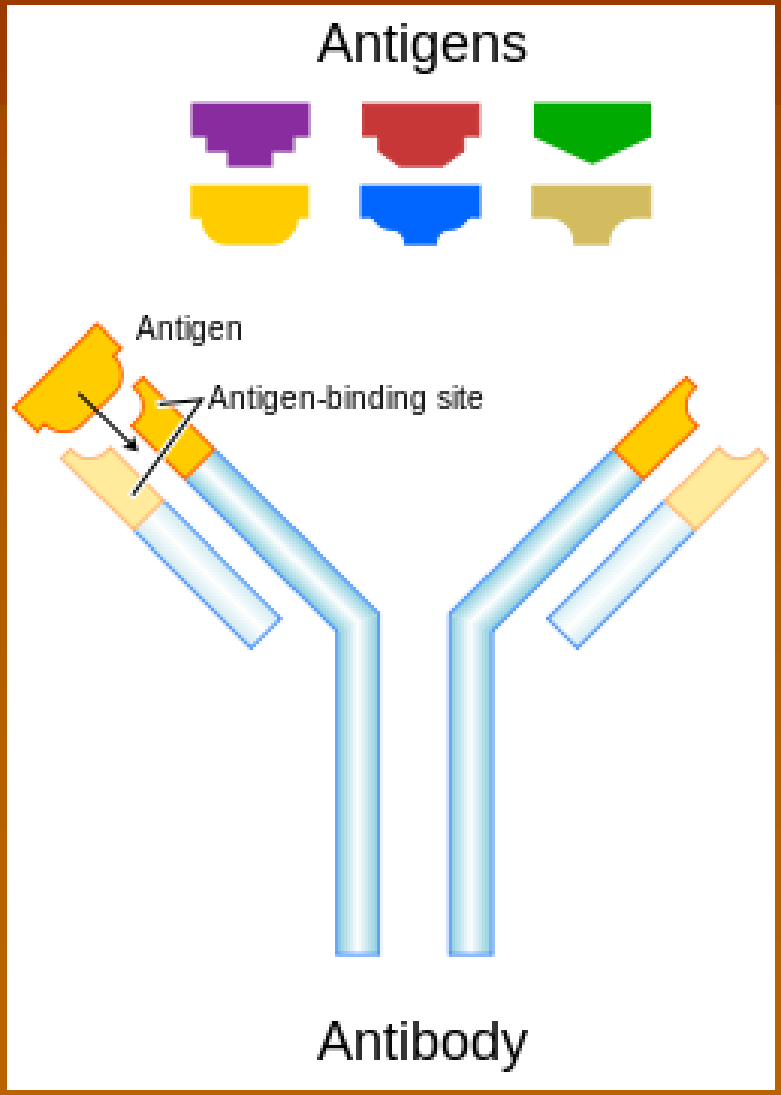

white blood cell
red blood cell
Platelets

Blood Information

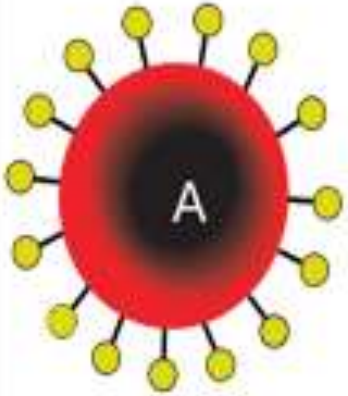
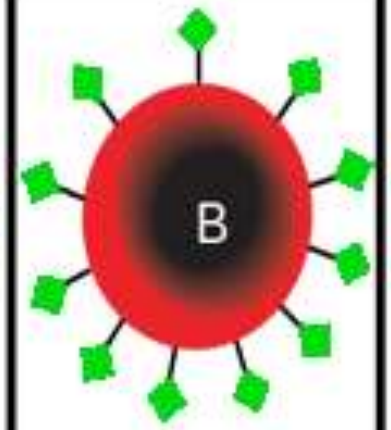
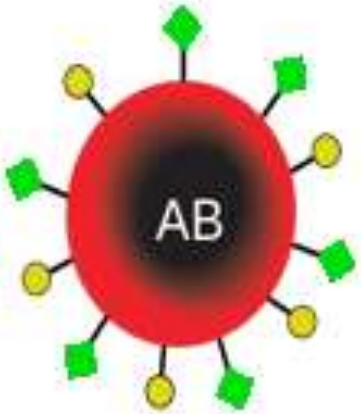
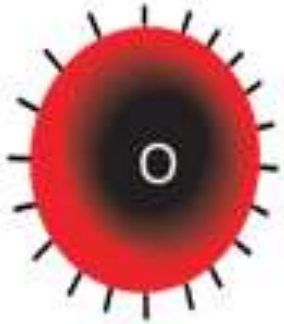
- Serology is the study of antigen/antibody reactions.
- Serum contains antibodies that react with a specific antigen.

Blood Information

- An antibody is a protein that destroys or inactivates a specific antigen. Antibodies have 2 active sites and can attach to 2 antigens, which causes blood to clump or agglutinate.



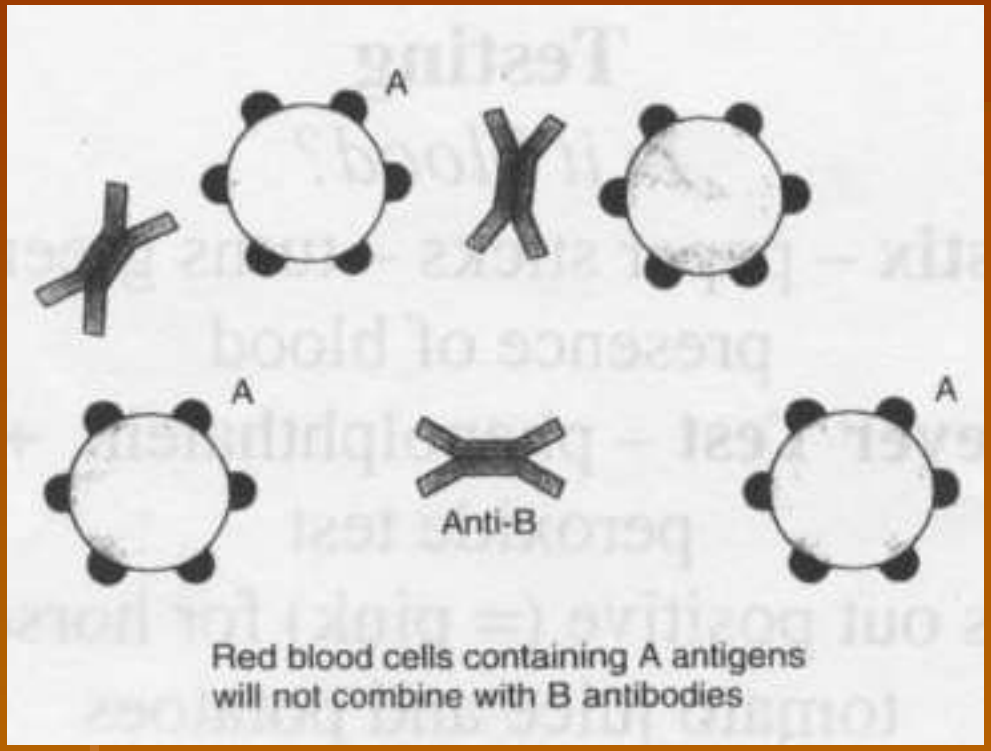
Blood Type Antigens

	Group A	Group B	Group AB	Group O
Red blood cell type				 (Type O doens'nt have antigens)

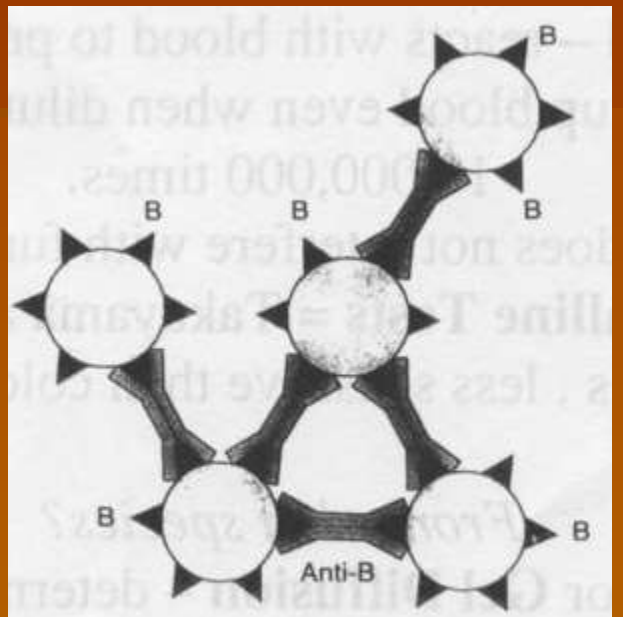
Blood Types

Blood Type	Antigen	Antibody	Donate to	Receive from
A	A	Anti-B	A and AB	A or O
B	B	Anti-A	B and AB	B or O
AB	A and B	None	AB	All
O	None	Anti-A and Anti-B	All	O

Agglutination

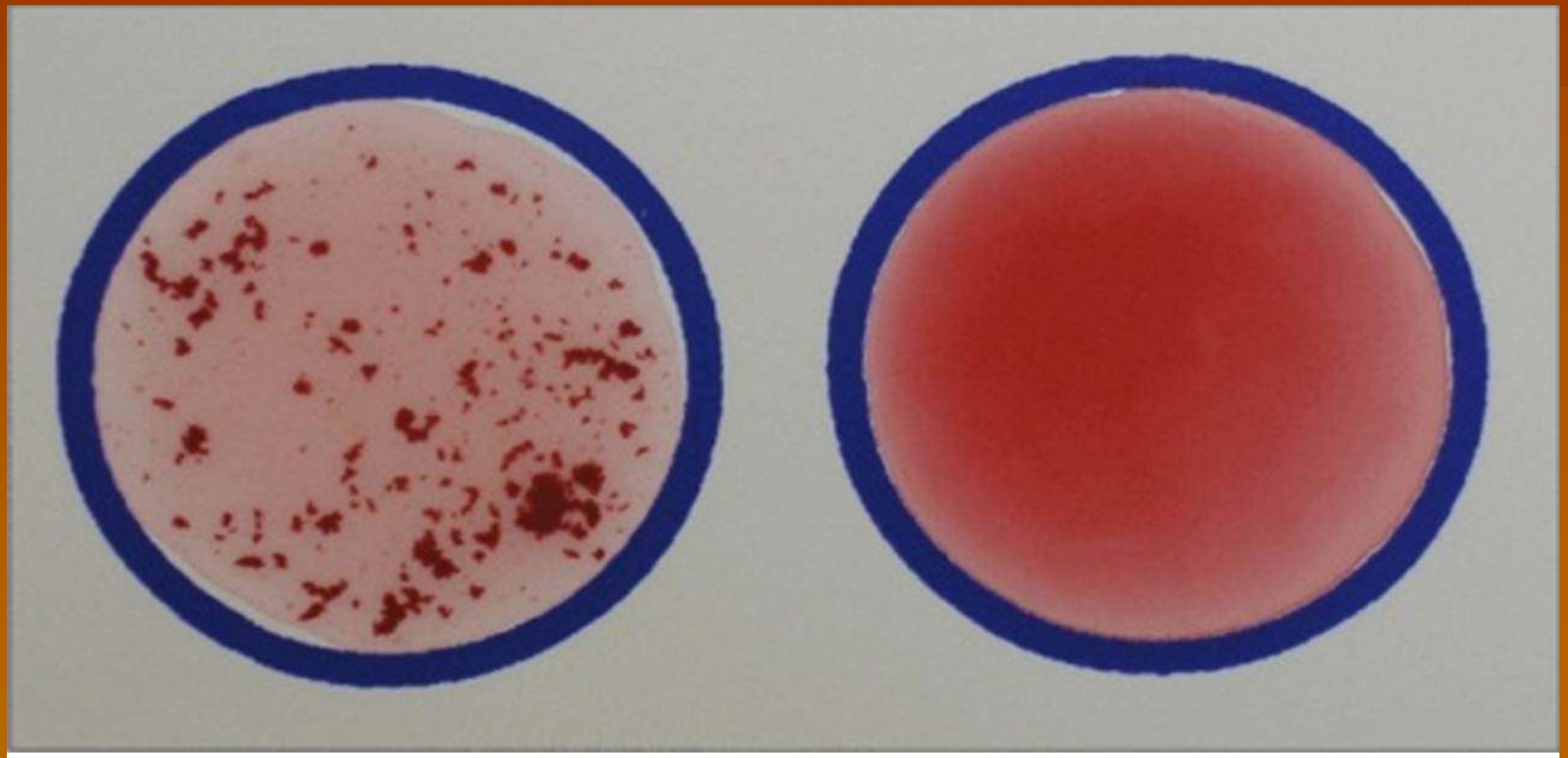


Red blood cells containing A antigens will not combine with B antibodies



Red blood cells containing B antigens are agglutinated or clumped together in the presence of B antibodies

Agglutination



+ -

Blood Evidence

- Three questions that are asked of blood evidence:
  - Is it blood?
  - From what species?
  - If it is human, how closely can it be associated with a particular individual?

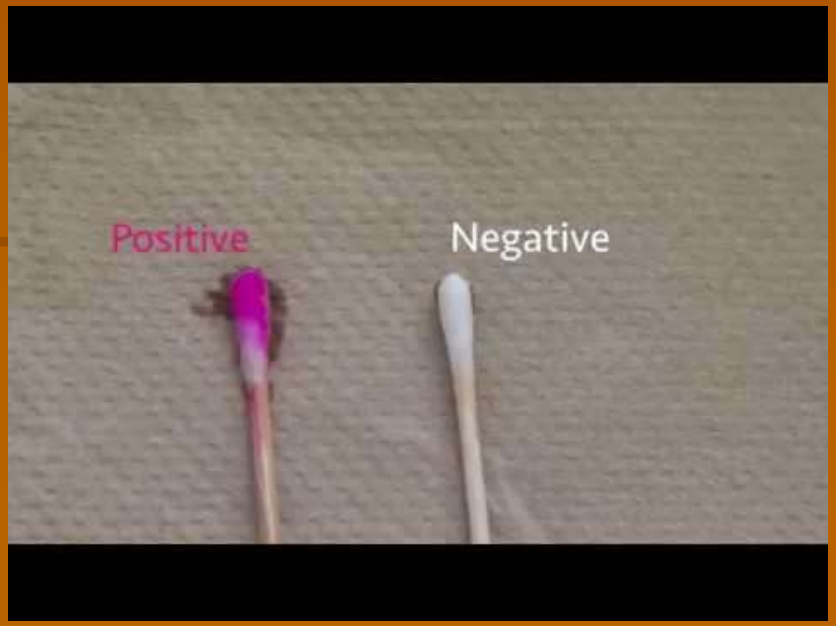
Testing Blood Evidence

- Is it blood?
  - Hemastix – paper sticks that turn green in the presence of blood

Video - Hemastix test

Testing Blood Evidence Cont.

- Kastle-Meyer Test – phenolphthalein + hydrogen peroxide test
  - Also comes out positive (pink) for horseradish, tomato juice, & potatoes



Video - Kastle Meyer Test

Testing Blood Evidence Cont.

- Luminol – reacts with blood to produce light
  - Picks up blood even when diluted up to 10,000,000 times.
  - Luminol does not interfere with further testing

Luminol Example

Testing Blood Evidence Cont.

- Microcrystalline Tests – Takayama and Teichmann Tests – less sensitive than color tests
  - Chemical reagent is added to blood, forming specific size/shape crystalline precipitate

Positive = crystal formation

Testing Blood Evidence Cont.

- From what species?
  - Precipitin or Gel Diffusion – determines whether blood is human or animal
  - Blood from mummies (4000-5000 years old) has given positive results with the precipitin test!
  - Diluted blood also will give positive results.

Is it human blood?

- The precipitin test is the test used to determine if the blood is human.
- The same principles that we used when studying blood typing help us determine if blood is human.
- When human blood is injected into animals (usually rabbits), antibodies form to fight off the invading human blood.
- When blood is subjected to this "human antiserum", it forms a precipitate at the place where they meet.

Preservation of Blood Evidence

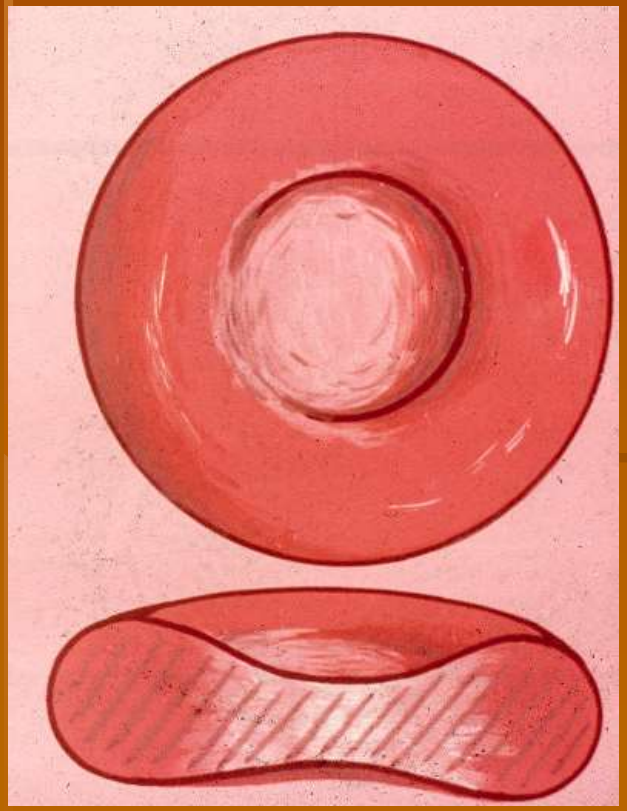
- Photograph all blood stains
- Locations are recorded and sketched
- Shape & position of stains must be evaluated
- All clothes must be collected & sent to the lab
- Search for blood in less obvious places

Preservation of Blood Evidence Cont.

- Type the blood
- Transport blood using boxes or paper bags
- 5 mL of blood should be collected from individuals associated with the scene
- Avoid preservatives in collecting blood
- Keep refrigerated

Composition of Blood

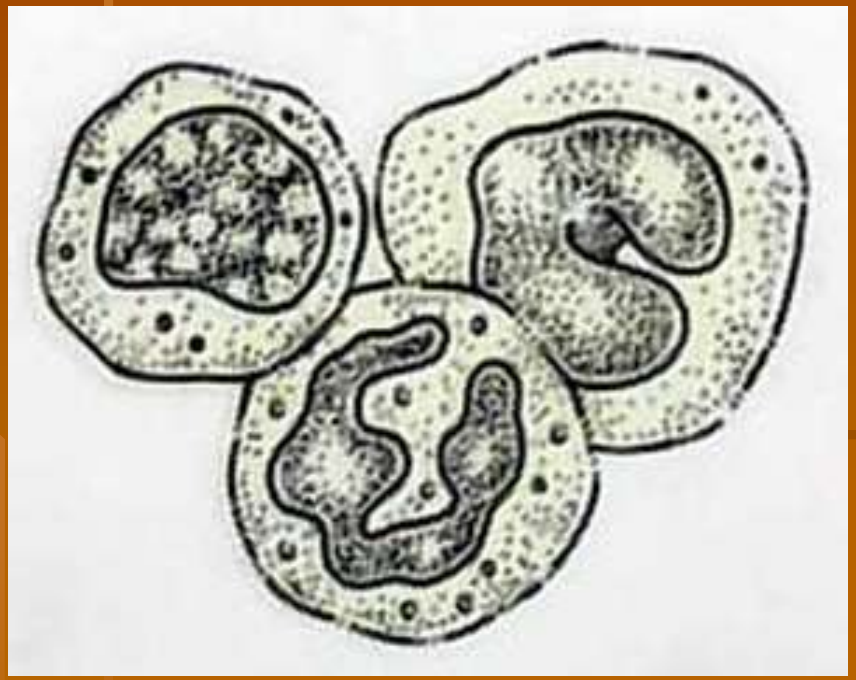
- Component
  - Red Blood Cells



- Important Information
  - Carry oxygen
  - Carry hemoglobin
  - A.K.A. corpuscles or erythrocytes
  - Have no nucleus
  - Made in bone marrow
  - Last about 120 days (4 months)
  - Liver & spleen remove

Composition of Blood Cont.

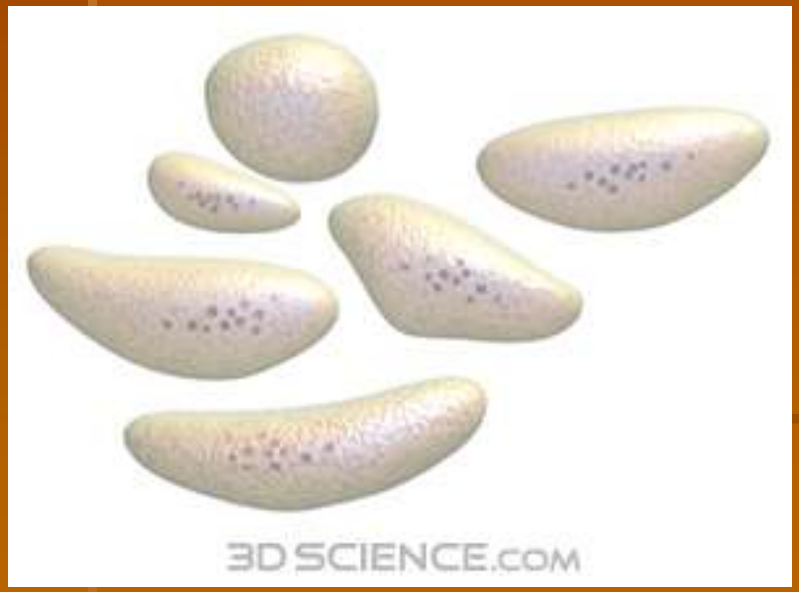
- Component
  - White Blood Cells



- Important Information
  - Fight bacteria & other pathogens
  - Made in lymph nodes, bone marrow & spleen
  - Have a nucleus
  - A.K.A. leukocytes
  - Last a few hours to few years (diff. types)

Composition of Blood Cont.

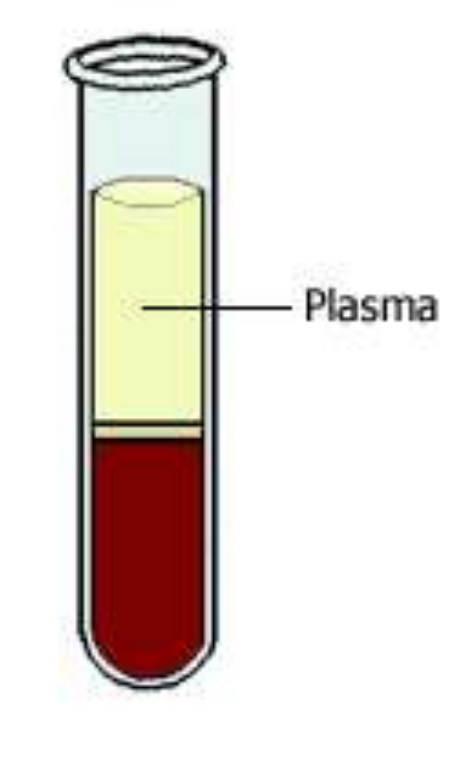
- Component
  - Platelets



- Important Information
  - Fragments of cells (smaller than RBCs)
  - No nucleus
  - Function is to clot blood
  - Last about 10 days
  - A.K.A. thrombocytes

Composition of Blood Cont.

- Component
  - Plasma

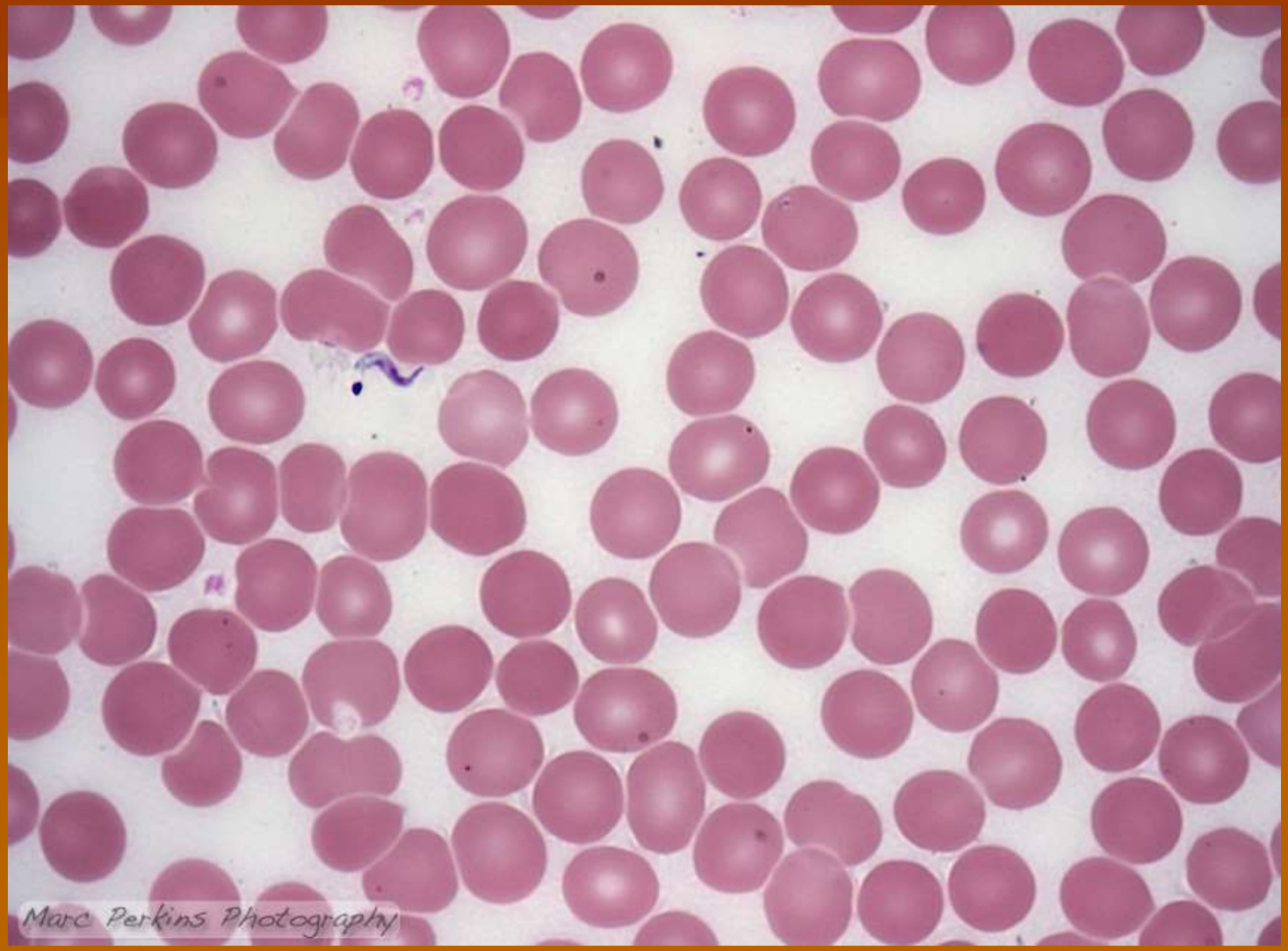


- Important Information
  - Liquid portion of blood
  - Contains mostly water
  - Helps transport nutrients, CO_2, salts, wastes, antibodies, hormones, enzymes, clotting factors

Blood Slide Lab

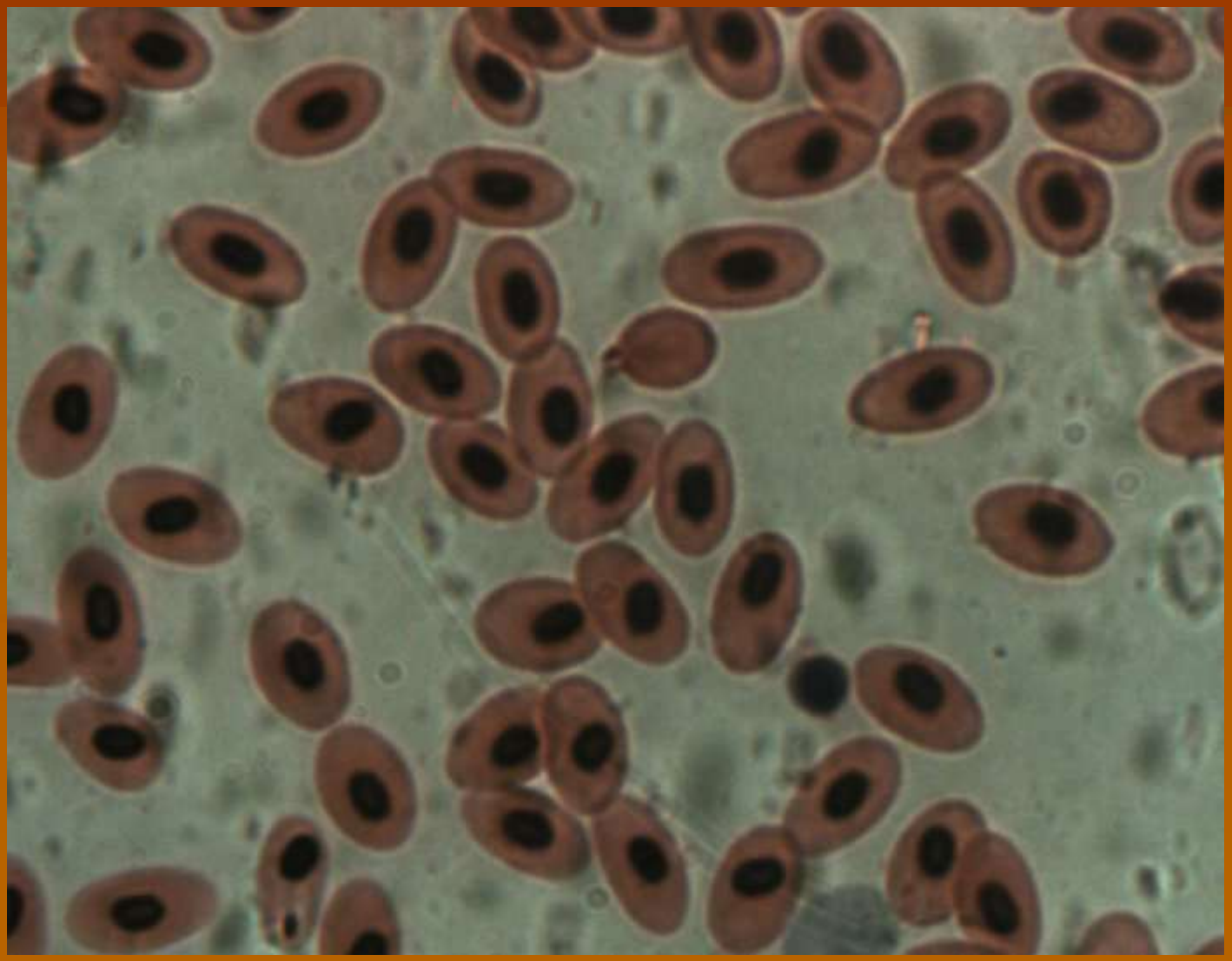
- Use the microscope images on the following slides to compare the similarities and differences of blood cells among the following 6 species:
  - Human
  - Frog
  - Fish
  - Bird
  - Cat
  - Bovine (cow)

Human Blood

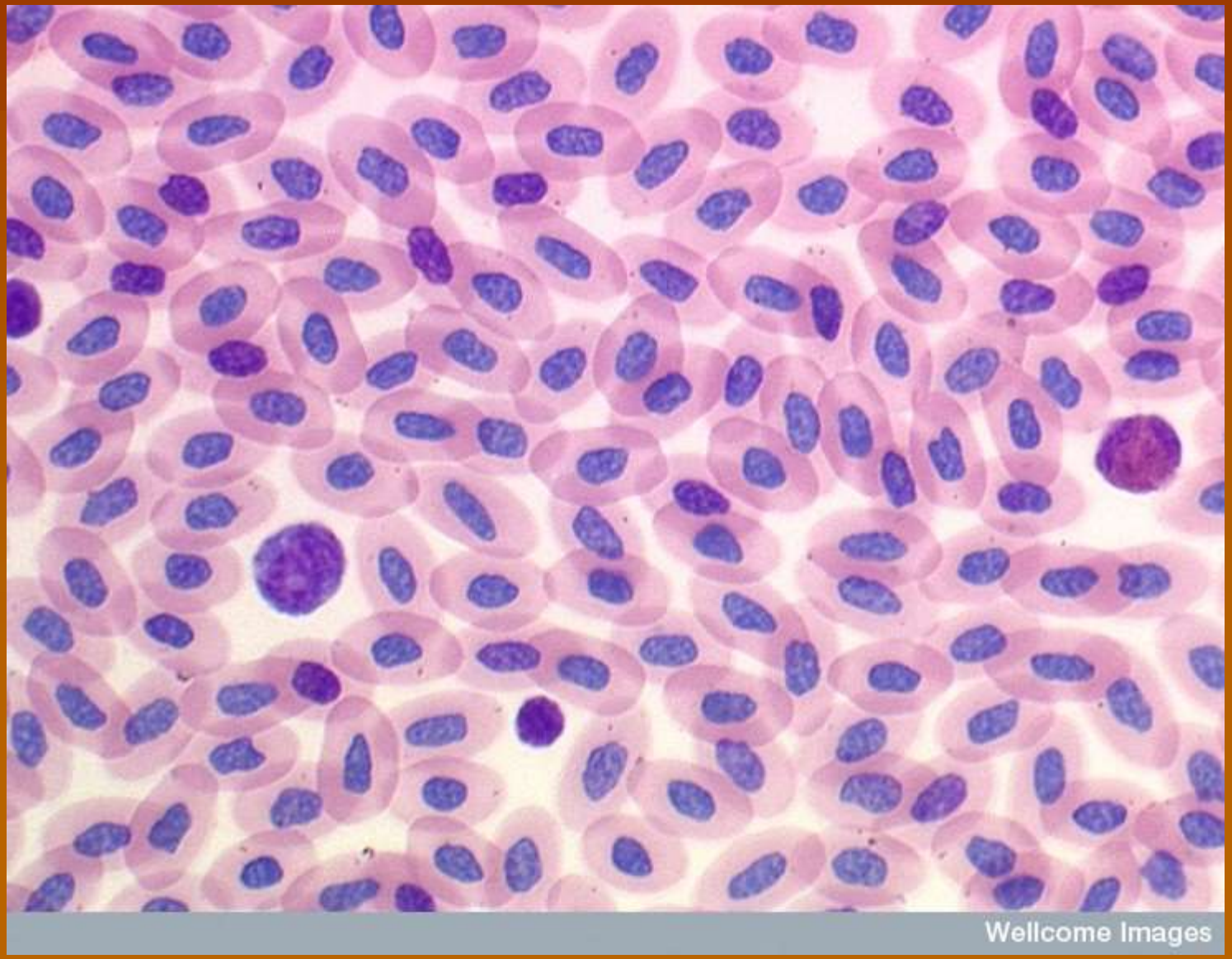


Frog Blood

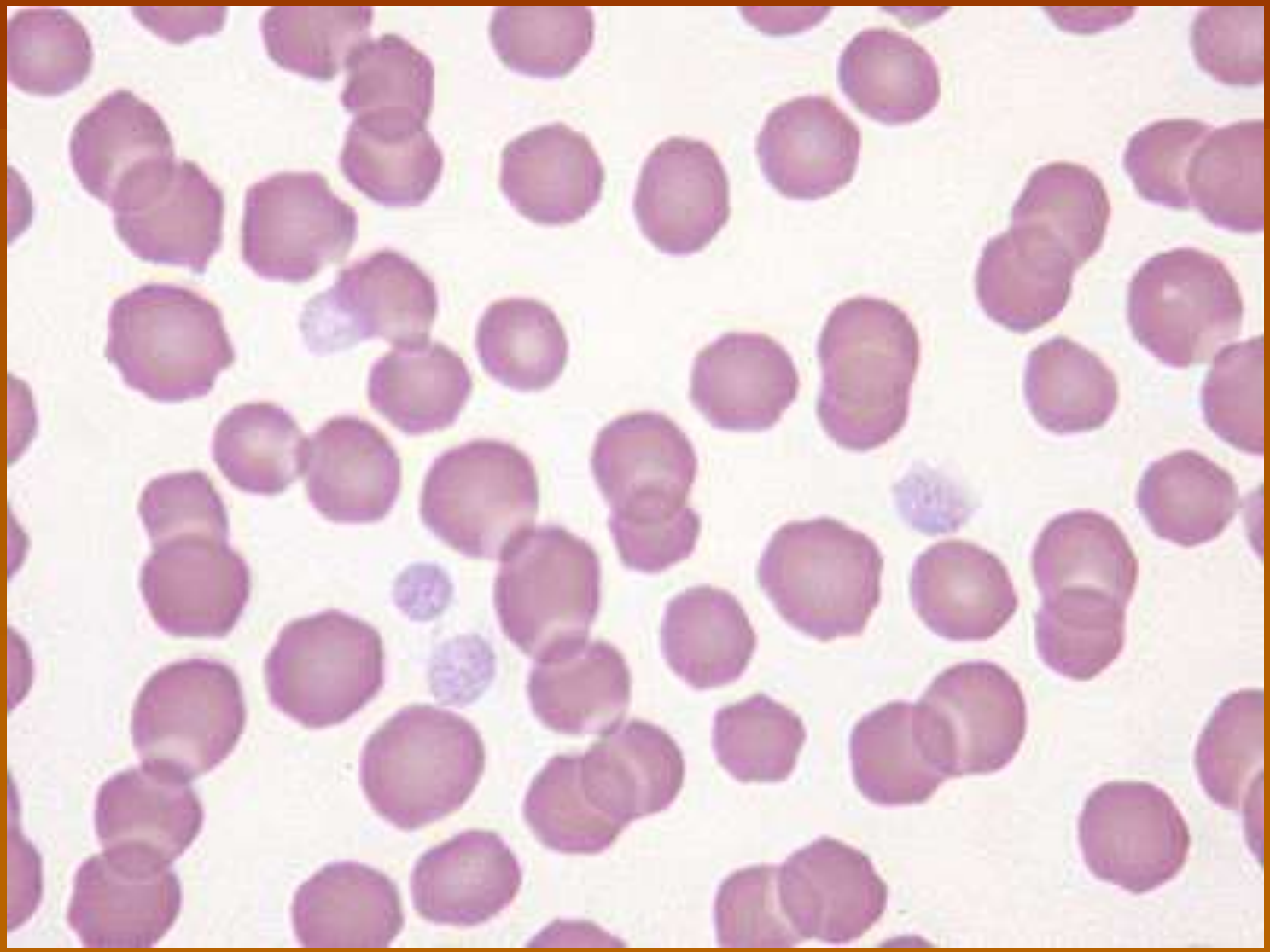
Fish Blood



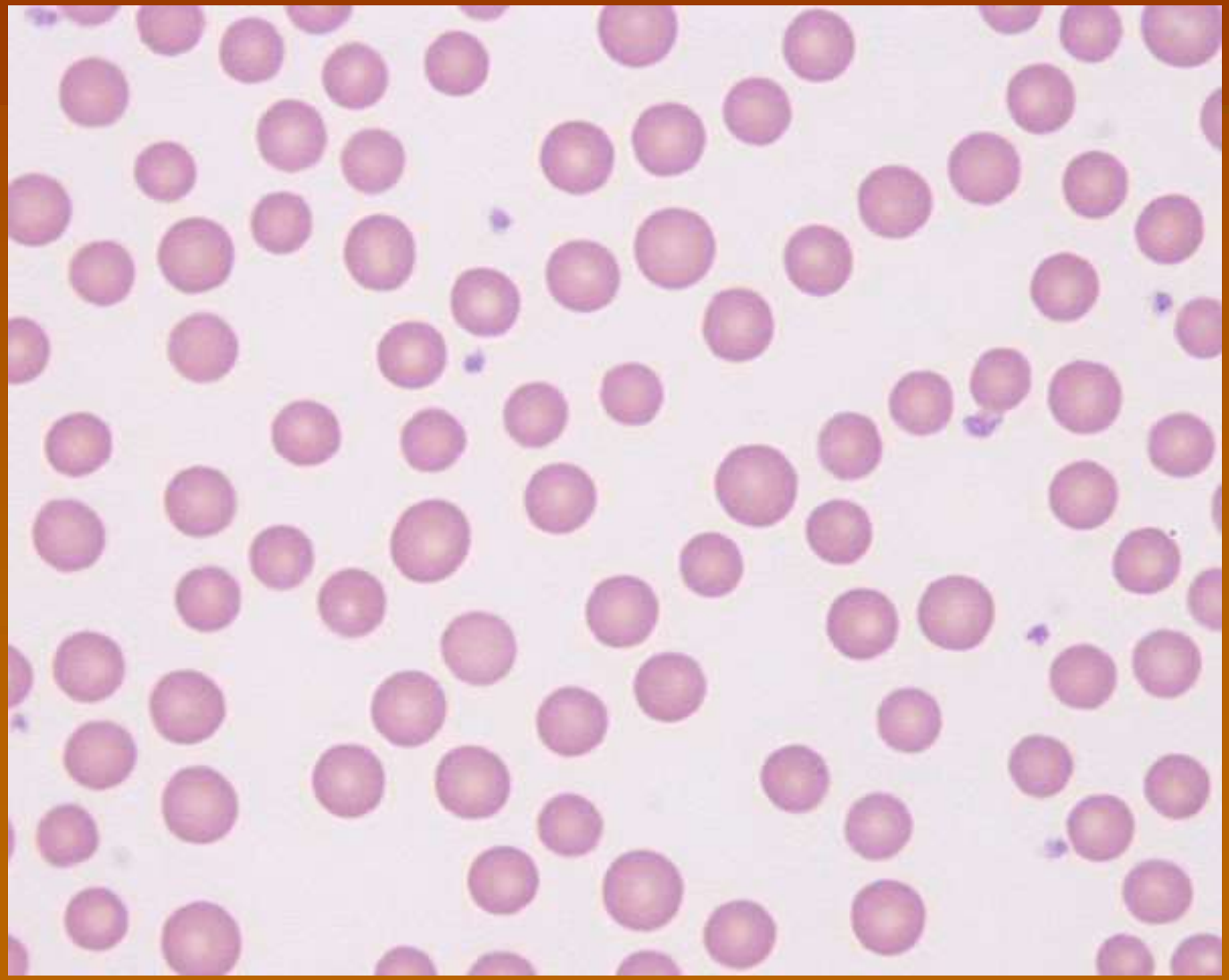
Bird Blood



Cat Blood



Bovine Blood



Blood Typing Lab

If you were absent, use the following photos to complete the lab activity we did in class.

Blood Typing Lab Results
Sample 1

Blood Typing Lab Results

Sample 2

Blood Typing Lab Results

Sample 3

Blood Typing Lab Results

Sample 4