Blood

Blood History

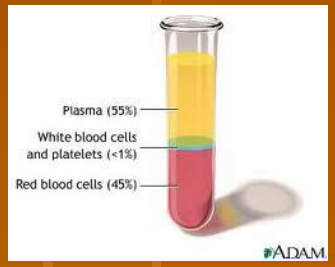
- 1901 – Karl Landsteiner first typed blood into A, B, AB, O
  - He was awarded the Nobel Prize for this
- 1937 – Rh factor was discovered (positive or negative – i.e. AB+, O-

Blood Information

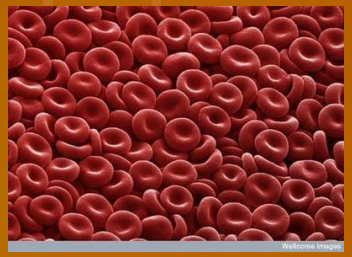
- At present there are over 100 blood factors that can be used to identify a person.
- Until the 1990s scientists used a combination of these factors to link blood to individuals
- Human blood types are determined by genes.

Composition of Blood

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



  - Plasma – liquid portion of blood which is 55% of the blood volume
  - Red Blood Cells (erythrocytes) – Transport oxygen from the lungs to the body tissue and returns CO2 to the lungs for removal.
    - Antigens on the surface of the 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


A White Blood Cell or Leukocyte

Your blood contains antibodies to defend against whichever antigen is NOT normally present in your blood

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

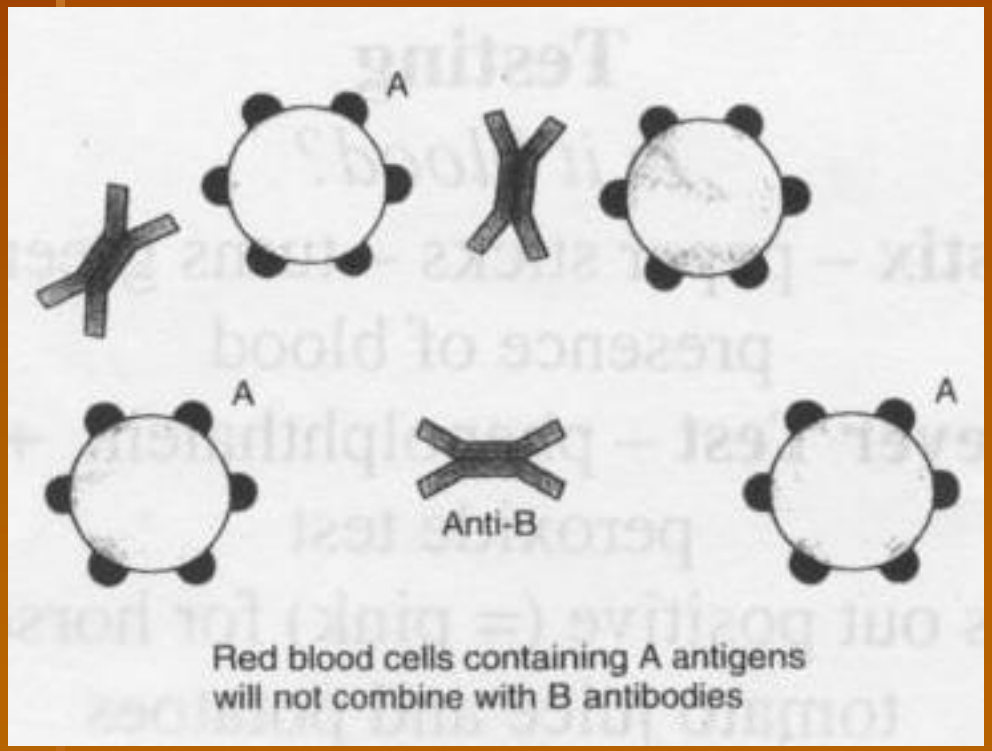
Blood Information

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

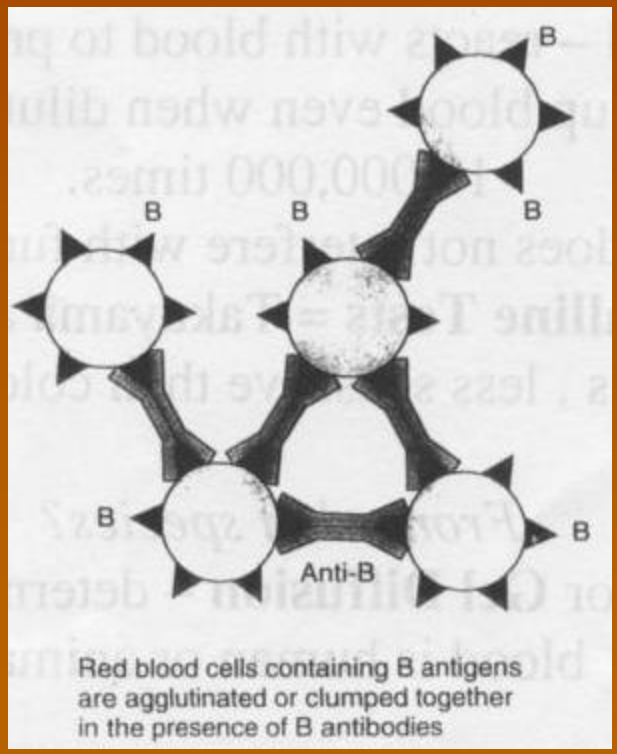
Blood Types

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

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

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

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

- Microcrystalline Tests – Takayama and Teichmann Tests – less sensitive than color tests

Positive = crystal formation

Luminol Example

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.

Preservation of Blood Evidence

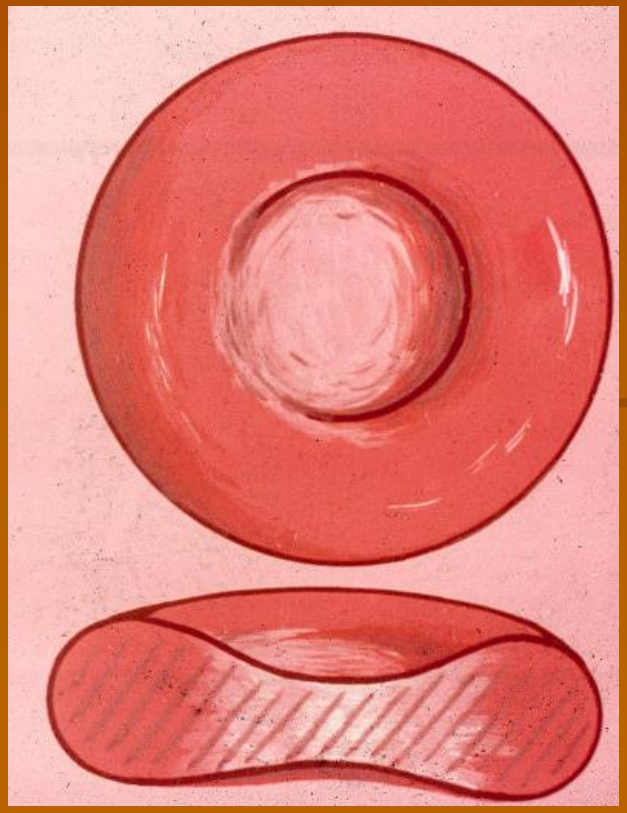
- Photograph all blood stains
- Locations are recorded and sketched
- Shape and position of stains must be evaluated
- All clothes must be collected and sent to the lab
- Search for blood in less obvious places

Preservation of Blood Evidence Cont.

- Type the blood
- Transport the 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
  - Also known as corpuscles
  - 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
  - Made in lymph nodes, bone marrow & spleen
  - Have a nucleus

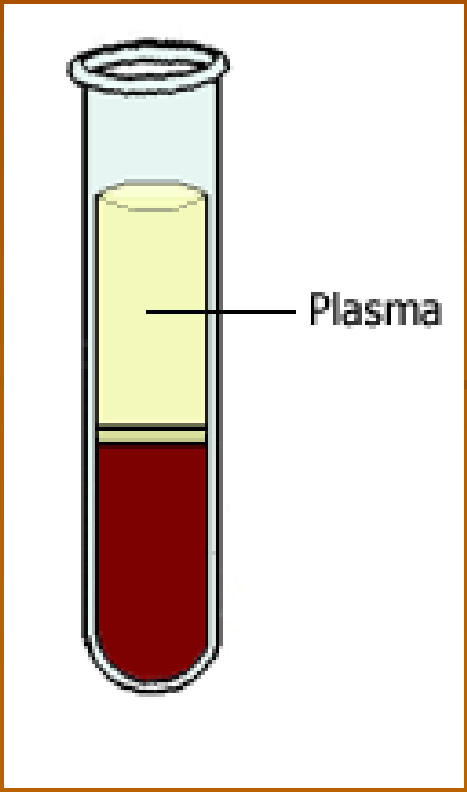
Composition of Blood Cont.

- Component
  - Platelets

- Important Information
  - Fragments of cytoplasm (smaller than RBCs)
  - No nucleus
  - Function is to clot blood
  - Last about 10 days

Composition of Blood Cont.

- Component
  - Plasma



- Important Information
  - Liquid portion of blood
  - Contains water, proteins, salts, sugars
  - Helps transport nutrients, CO_2, wastes, and hormones