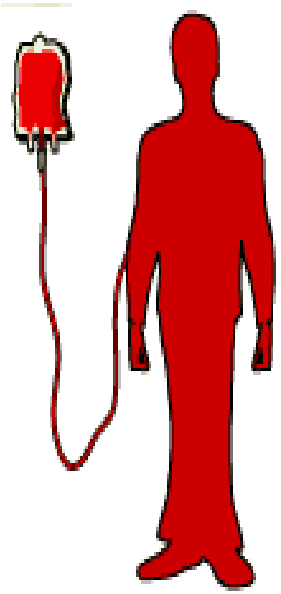
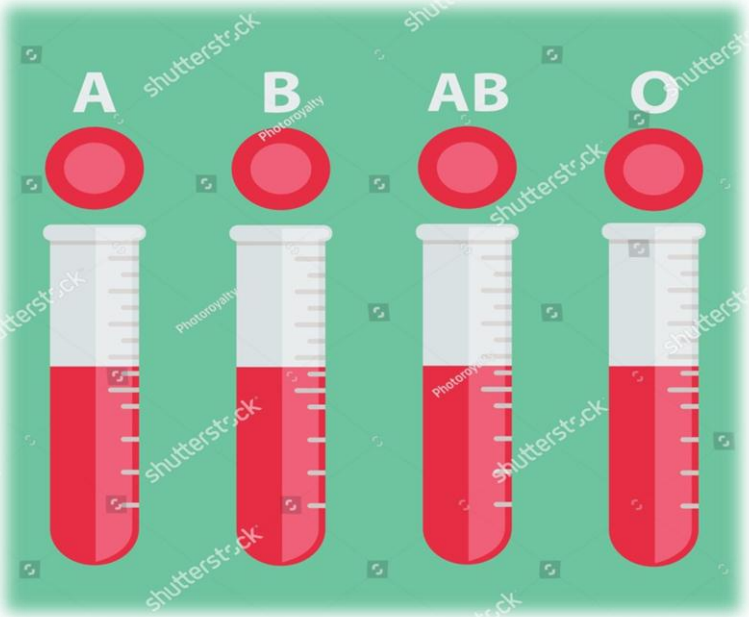
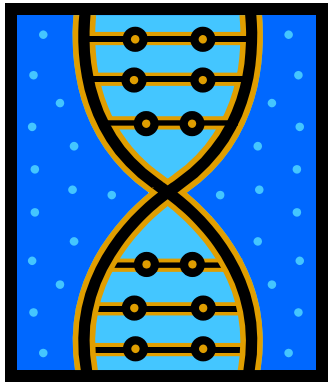

# The Blood group in human

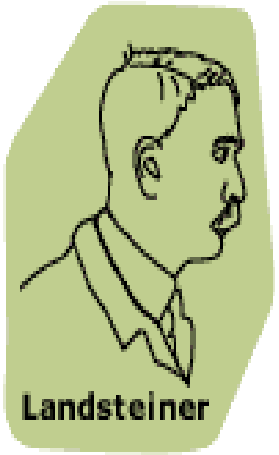




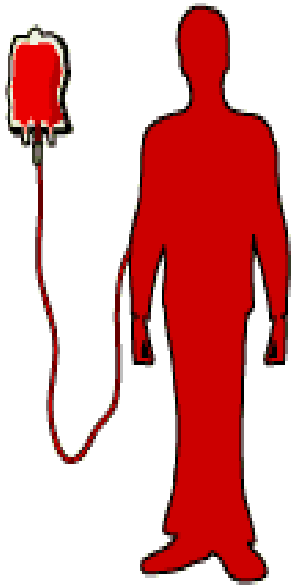



LAB 7


# History of Blood Groups and Blood Transfusions

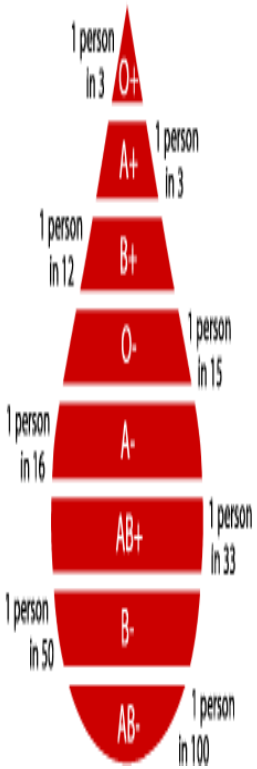



- Experiments with blood transfusions have been carried out for hundreds of years. Many patients have died and it was not until 1901, when the **Austrian Karl Landsteiner** discovered human blood groups, that blood transfusions became safer.



- He found that mixing blood from two individuals can lead to blood clumping. The clumped RBCs can crack and cause toxic reactions. This can be fatal.

# The ABO-Blood group system




- Karl Landsteiner discovered that blood clumping was an immunological reaction which occurs when the receiver of a blood transfusion has antibodies against the donor blood cells.

- The ABO and Rhesus (Rh) systems are the most important ones used for blood transfusions.

- Not all blood groups are compatible with each other. Mixing incompatible blood groups leads to blood clumping or agglutination, which is dangerous for individuals.

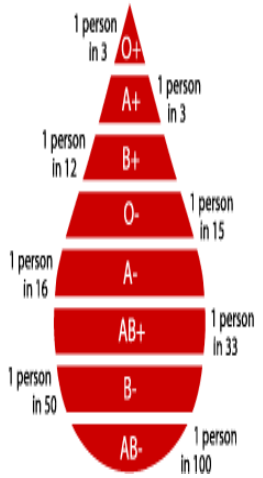
# The ABO-Blood group system


- The differences in human blood are due to the presence or absence of certain protein molecules called **antigens** and **antibodies**.

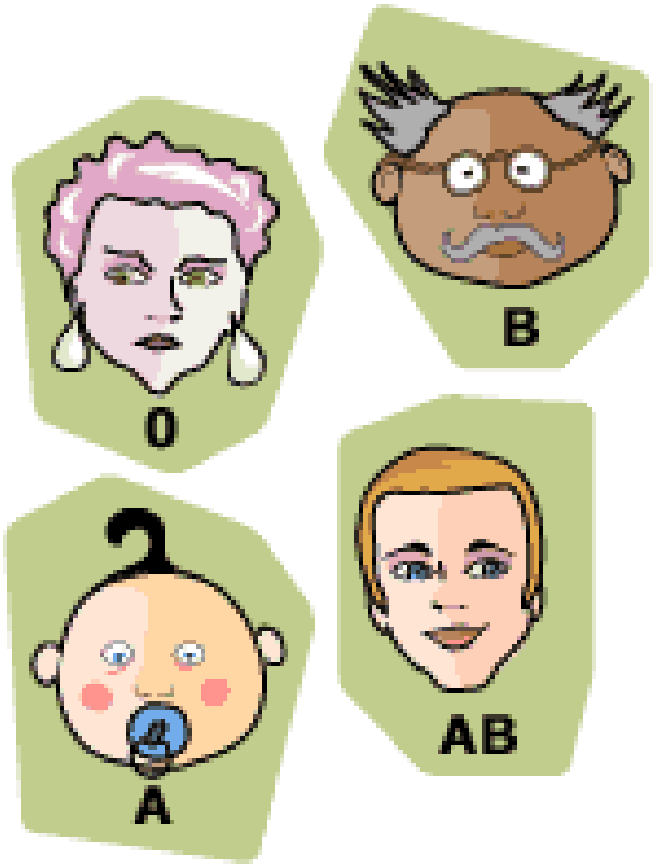
- The antigens are located on the surface of the RBCs and the antibodies are in the blood plasma.

- Individuals have different types and combinations of these molecules.

- The blood group you belong to depends on what you have inherited from your parents.



# ABO blood grouping system




According to the ABO blood typing system there are four different kinds of blood types: A, B, AB or O.

If an antigen (Ag) is present on a patients red blood cells the corresponding antibody (Ab) will NOT be present in the patients plasma, under ‘normal conditions’.

# ABO Blood Group


| Blood Group | Antigens on Red Blood Cells | Antibodies in Plasma |
|---|---|---|
| A | A | Anti-B |
| B | B | Anti-A |
| AB | AB | None |
| O | None | Anti-A<br>Anti-B |

| Can give blood to | Can receive blood from |
|---|---|
| A and AB | A,O |
| B and AB | B,O |
| AB | AB,A,B,O |
| AB, A, B, O | O |

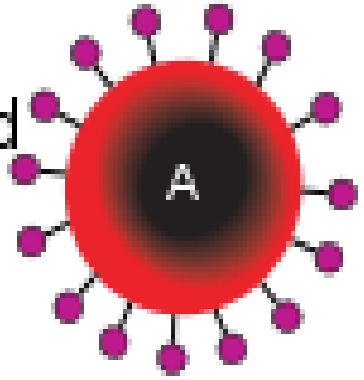
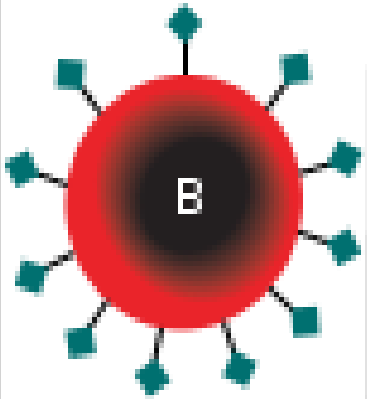
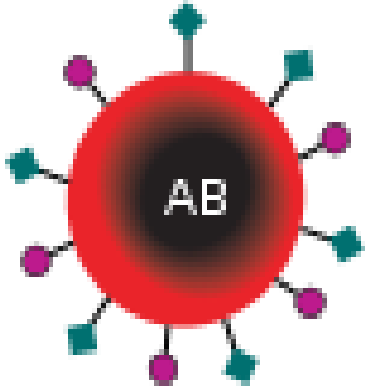
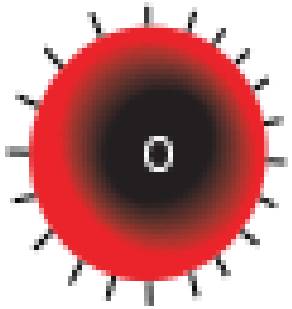
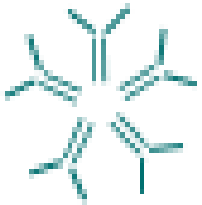
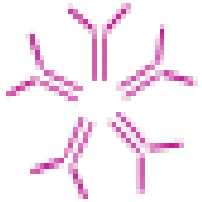
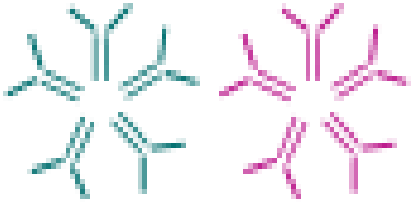
**universal donors O**

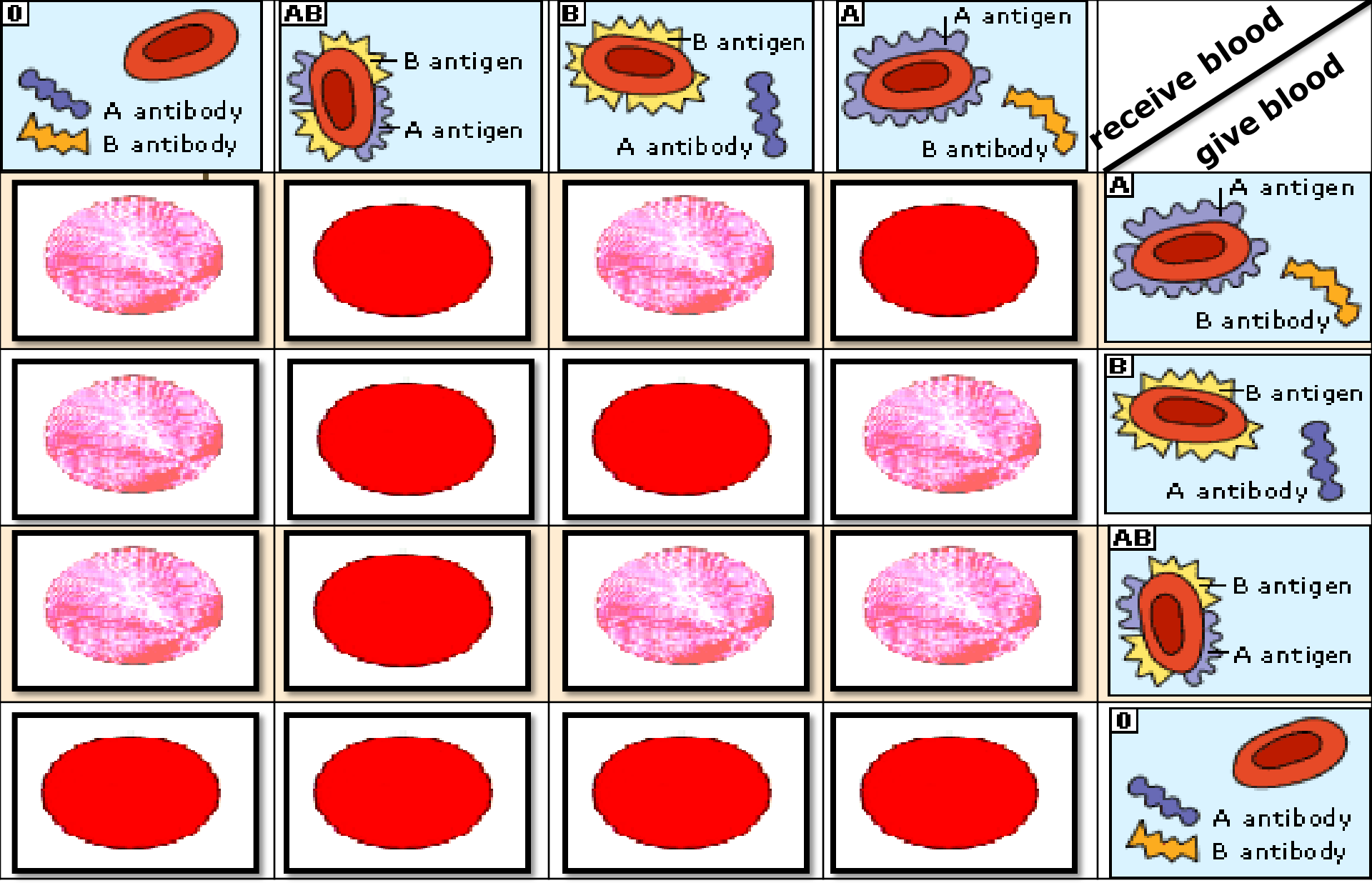
**universal receivers AB**

# Blood Groups

- **Type AB: (Universal Recipient)**
  - RBC's have both A and B antigens.
  - Cen receive from A, B, AB, and O types.
  - Can donate to AB type only.
- **Type O: (Universal Donor)**
  - RBC's have NO antigens.
  - Can receive from O type only.
  - Can donate to A, B, AB and O types.

- **Type A:**
  - RBC's have A antigens only.
  - Can receive from A and O types.
  - Can donate to A and AB types.
- **Type B:**
  - RBC's have B antigens only.
  - Can receive from B and O types.
  - Can donate to B and AB types.

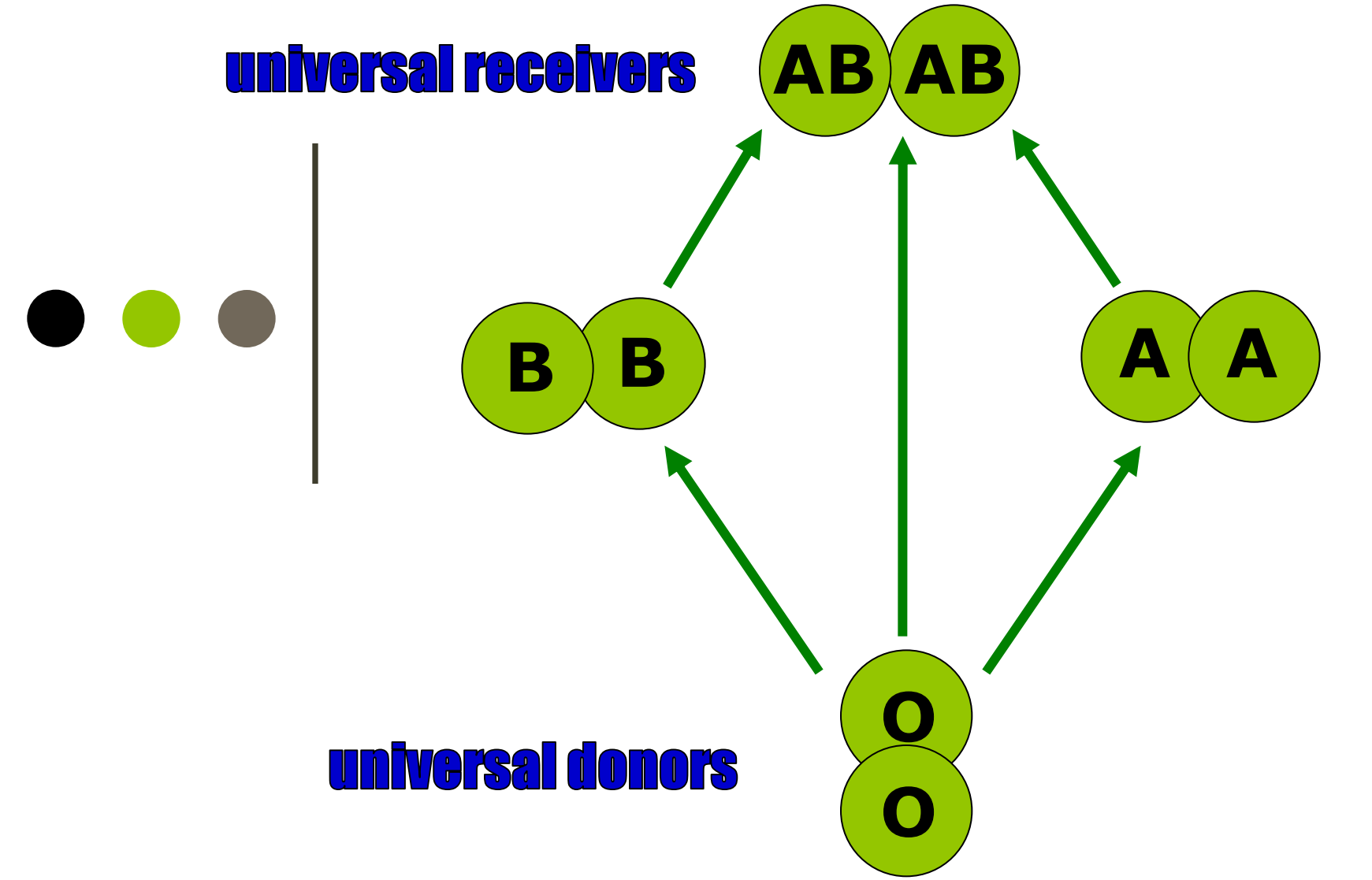
| | Group A | Group B | Group AB | Group O |
|---|---|---|---|---|
| Red blood cell type |   |   |   |   |
| Antibodies present |  Anti-B |  Anti-A | None |  Anti-A and Anti-B |
| Antigens present |  A antigen |  B antigen |  A and B antigens | None |




# The blood transfusion process

NO

YES




# Blood transfusions diagram

# ABO blood grouping system

**According to the ABO blood typing system there are four different kinds of blood types: A, B, AB or O.**

**Blood group A**

**If you belong to the blood group A, you have A antigens on the surface of your red blood cells and B antibodies in your blood plasma.**

**Blood group B**

**If you belong to the blood group B, you have B antigens on the surface of your red blood cells and A antibodies in your blood plasma.**

**Blood group AB**

**If you belong to the blood group AB, you have both A and B antigens on the surface of your red blood cells and no A or B antibodies at all in your blood plasma.**

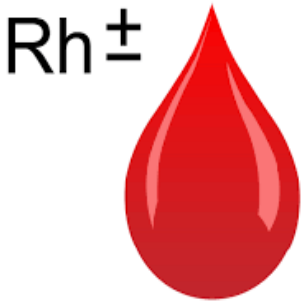
**Blood group O**

**If you belong to the blood group 0 (null), you have neither A or B antigens on the surface of your red blood cells but you have both A and B antibodies in your blood plasma.**

# Permissible Transfusion!!

- You must keep in mind that you cannot except a blood type that has anitbodies against your own.
- O is often called the universal donor because it lacks antigen A and B, however it does contain ***BOTH*** anti A and anti B antibodies so it can only except blood from another type O.

# Rh Factor




This Rh antigen found on the erythrocytes of most people.

This antigen was first isolated & identified in the Rhesus monkey.

85 % of the population are Rh positive meaning that the Rh antigen is present.

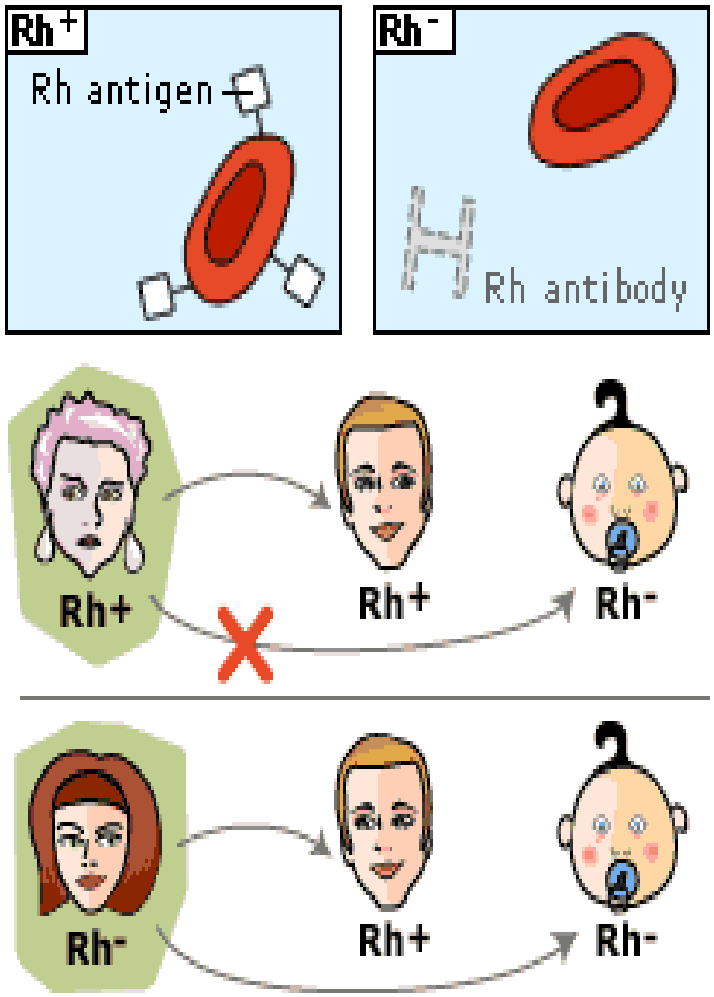
It is very important to know the Rh factor when crossmatching blood for transfusions

# Rh Factor and Pregnancy

- Also, a very important Rh problem can occur with a pregnant woman.
- If a Rh negative mother has a Rh positive baby, then antibodies can build up against the Rh + blood.
- This is not usually a big problem for the first baby, but it could cause problems with a future pregnancy.
- Rh immune globulin (Rhogam) will be given to the mother after delivery to help prevent the development of these antibodies.

# Rh Blood group system

Many people also have a so called Rh factor on the red blood cell's surface. This is also an antigen and those who have it are called Rh+. Those who haven't are called Rh-. A person with Rh- blood does not have Rh antibodies naturally in the blood plasma (as one can have A or B antibodies, for instance). But a person with Rh- blood can develop Rh antibodies in the blood plasma if he or she receives blood from a person with Rh+ blood, whose Rh antigens can trigger the production of Rh antibodies. A person with Rh+ blood can receive blood from a person with Rh- blood without any problems.



# The Rh Blood Type System

- As with the ABO system, there is a dominant allele which happens to be the positive family. This means that the genetic pairs that can exist in humans are as follows:
- Genetic makeup Blood type

| | |
|---|---|
| ++ | Rh positive |
| +- | Rh positive |
| -- | Rh negative |

# Blood transfusion between persons according to the Rhésus system

| The possibility of transportation | Transfer status |
|---|---|
| Transfer is possible | Rh+ ← Rh+ |
| Transfer is not possible | Rh- ← Rh+ |
| Transfer is possible | Rh- ← Rh- |
| Transfer is possible | Rh+ ← Rh- |

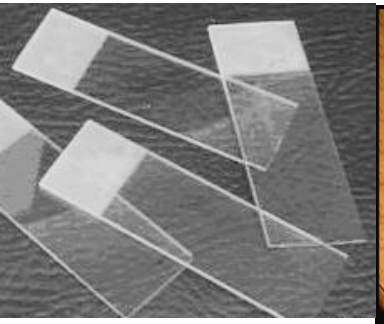
For a blood transfusion to be successful, AB0 and Rh blood groups must be compatible between the donor blood and the patient blood. If they are not, the red blood cells from the donated blood will clump or agglutinate. The agglutinated red cells can clog blood vessels and stop the circulation of the blood to various parts of the body.

# Slide Method

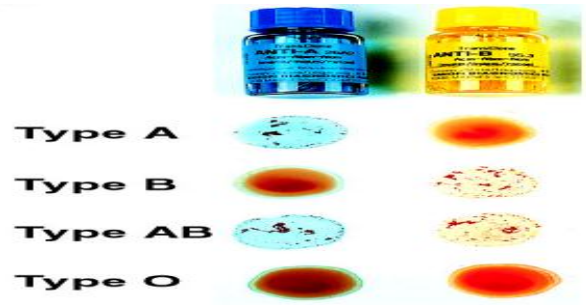
- **Principle:**

When red cells are mixed with various reagent antiseras (soluble antibody), agglutination will occur on the slides containing cells positive for (possessing the antigen) the corresponding antigen.

No agglutination will occur when the red cells do not contain the corresponding antigen.

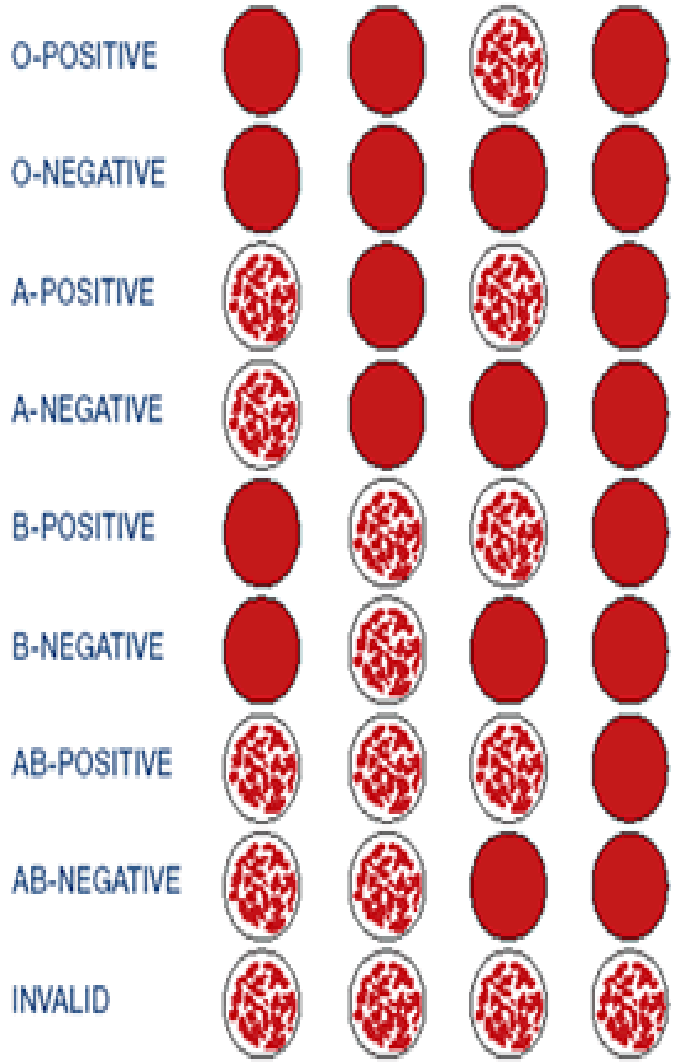


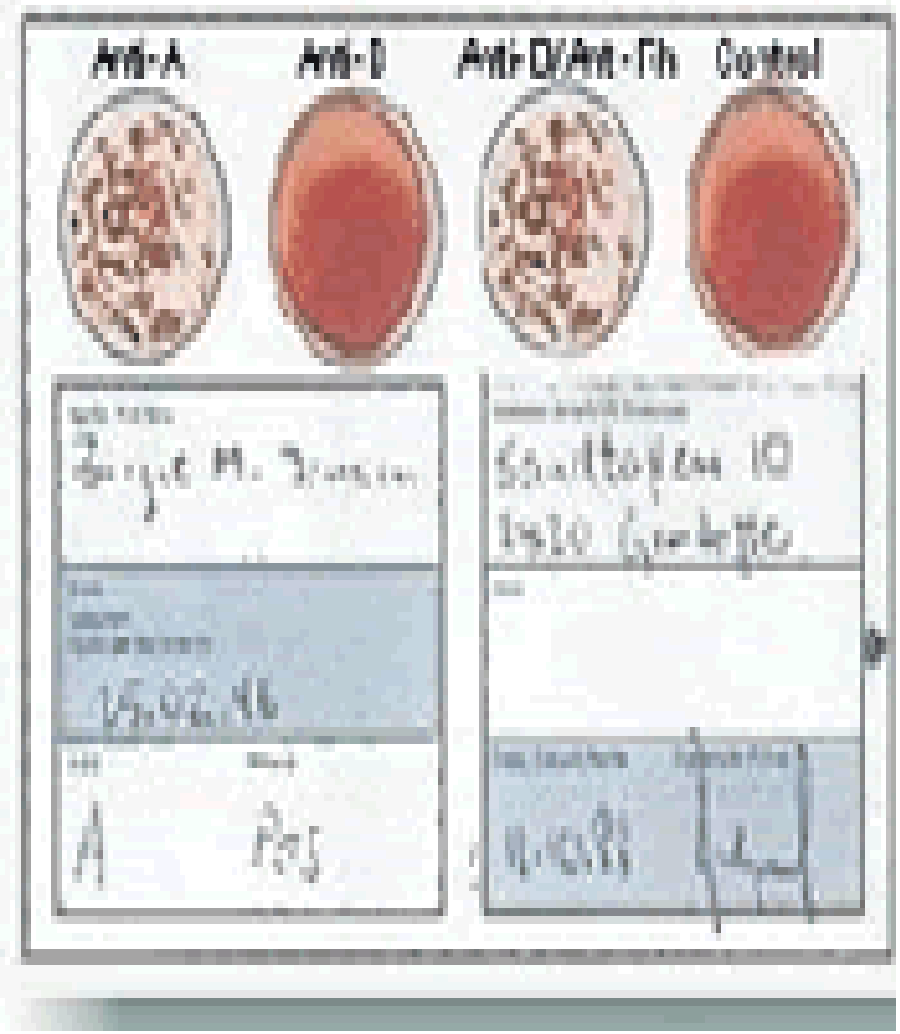
# Procedure




1. On the section of slide labeled anti-A place one drop of antibody A.
2. On the section of slide labeled anti-B place one drop of antibody B.
3. On the section of slide labeled anti-AB place one drop of antibody AB.
4. On new slide labeled anti-D place one drop of antibody D.
5. Place one drop of cells in each antibody containing circle.
6. Carefully mix each solution with a separate applicator stick.
7. Tilt slowly for one minute, then observe for the agglutination.

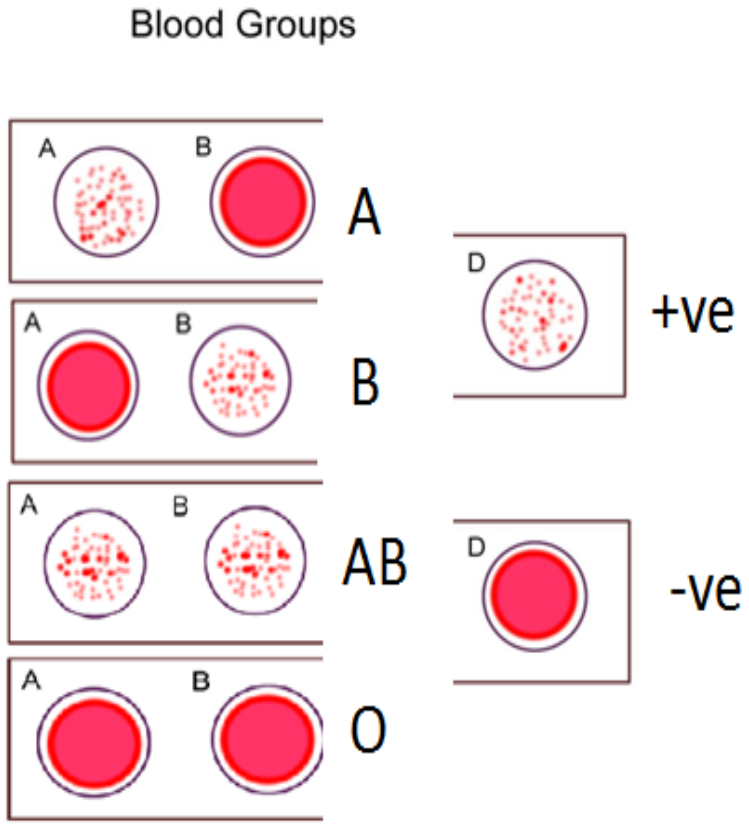
# HOW TO READ YOUR RESULTS

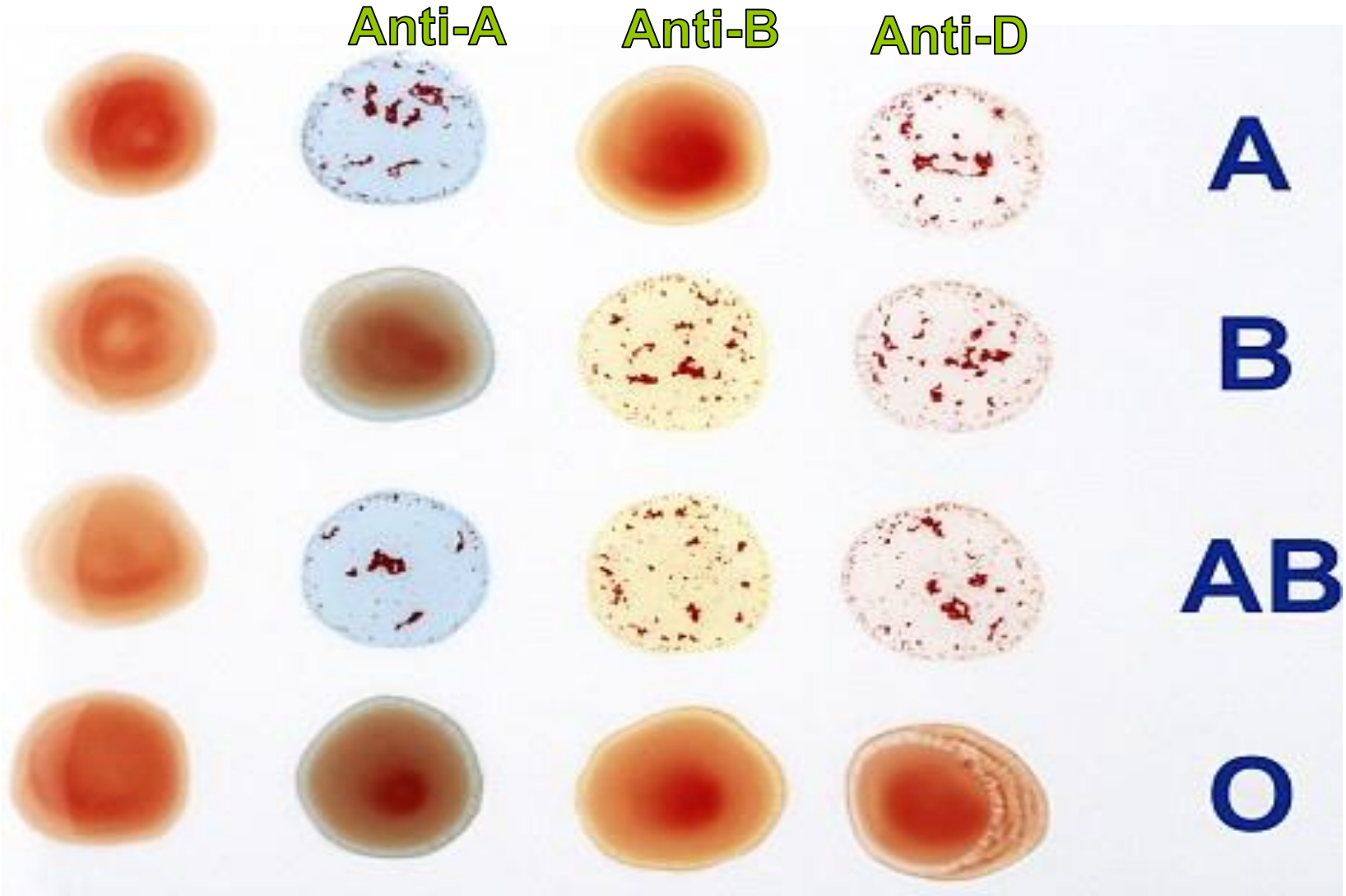



# Interpretation of the results

- **Strong agglutination of RBCs in the presence of any ABO grouping reagent constitutes a positive result.**
- **A smooth suspension of RBCs at the end of 2 minutes is a negative result.**
- **Samples that give weak or doubtful reactions should be retested by Tube test ABO grouping**



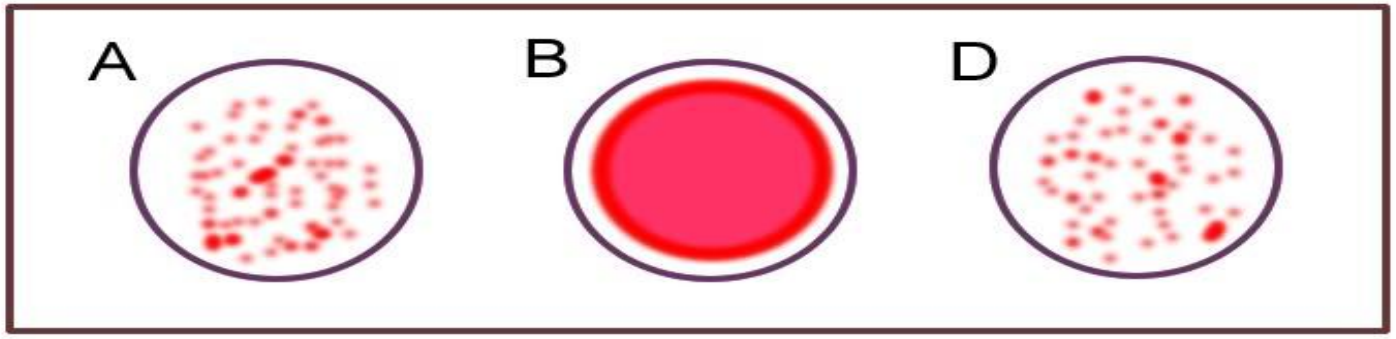
# Results



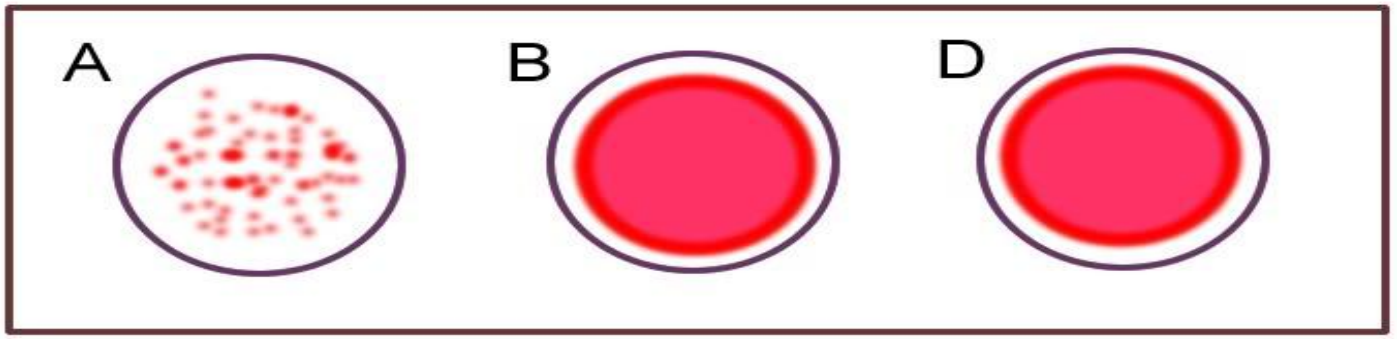
# Results

| Reaction of cells tested with | | Interpretation | |
|---|---|---|---|
| **Anti-A** | **Anti-B** | **Cell Ag** | **ABO Group** |
| - | - | No Ag | O |
| + | - | A | A |
| - | + | B | B |
| + | + | A, B | AB |

# Blood Groups

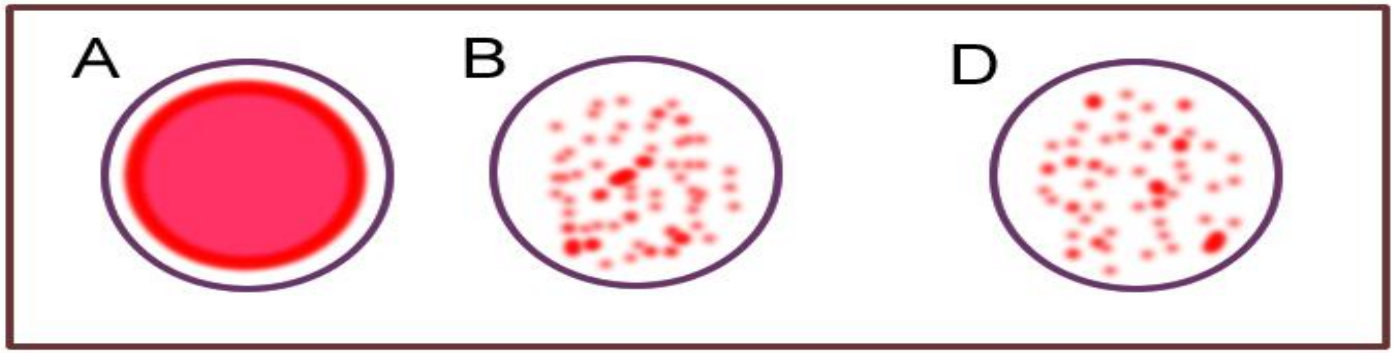



A +

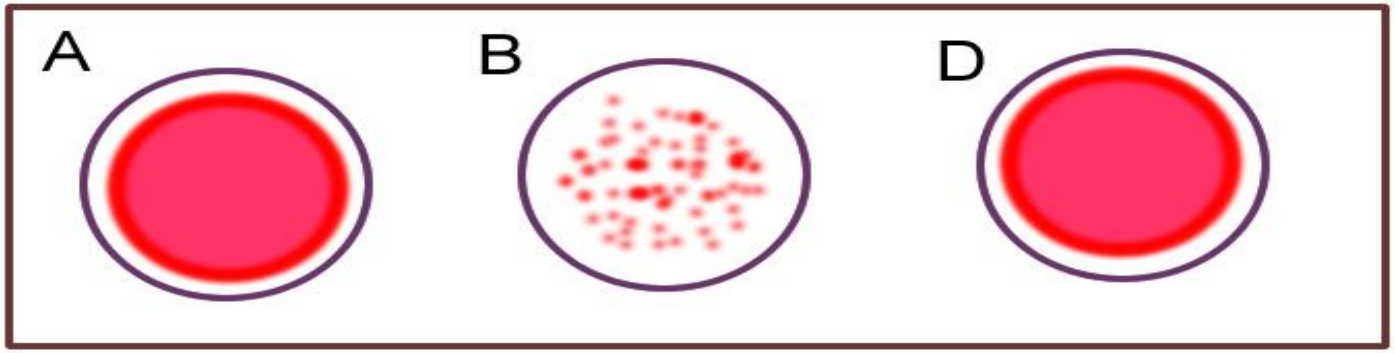



A -

# Blood Groups

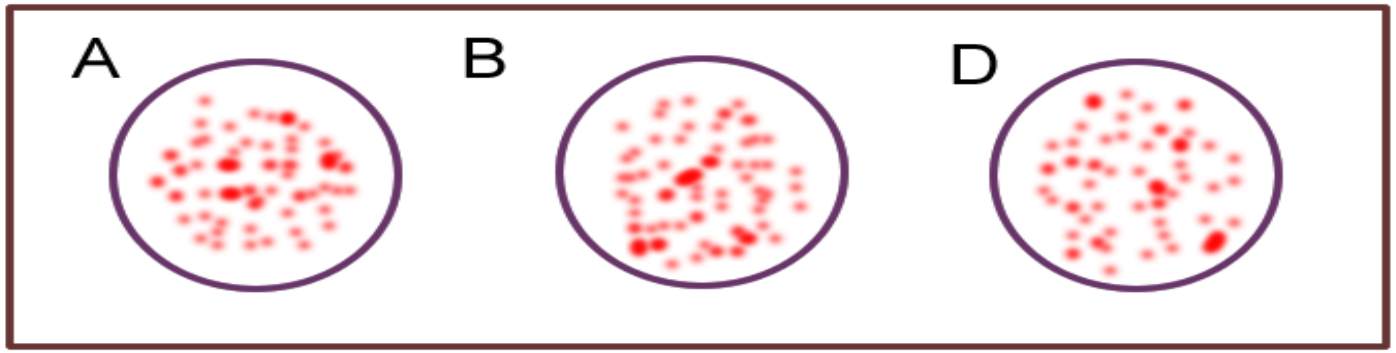



B +

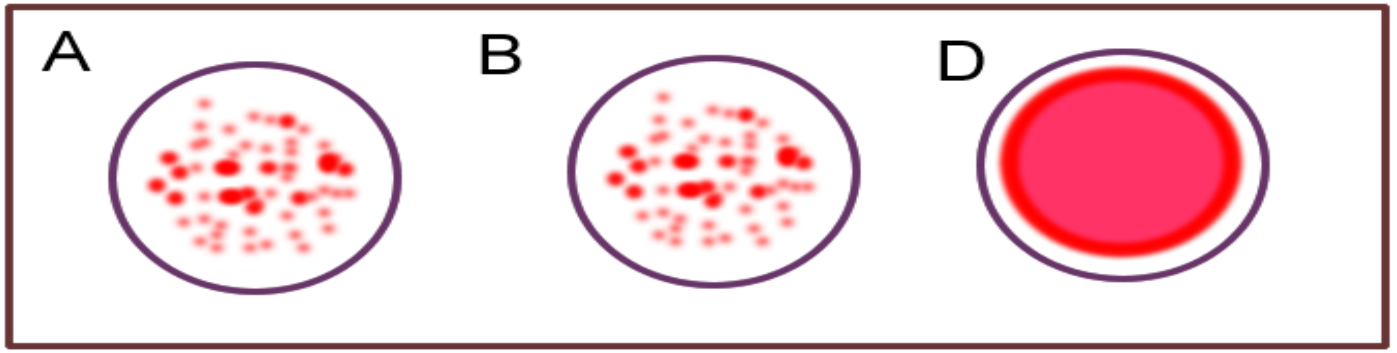



B -

# Blood Groups

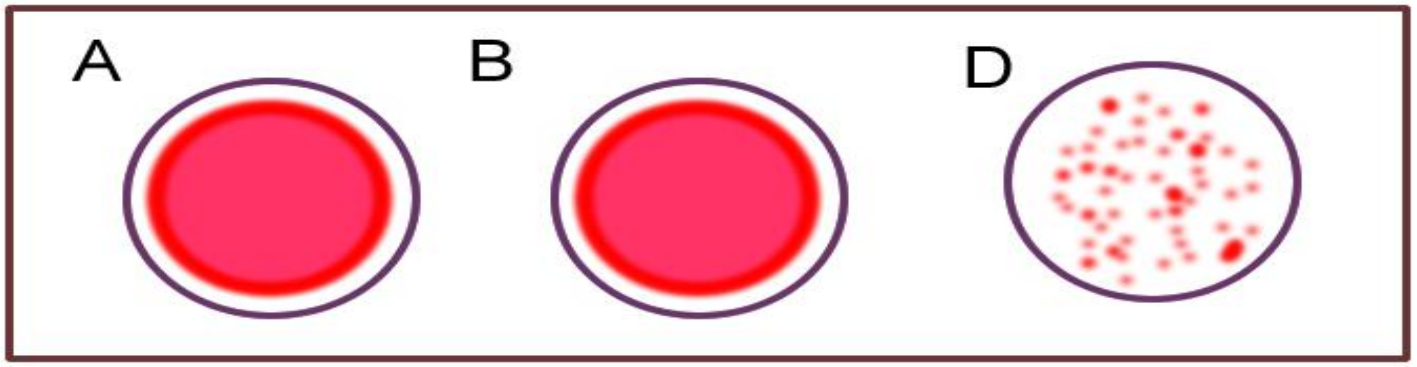



AB +

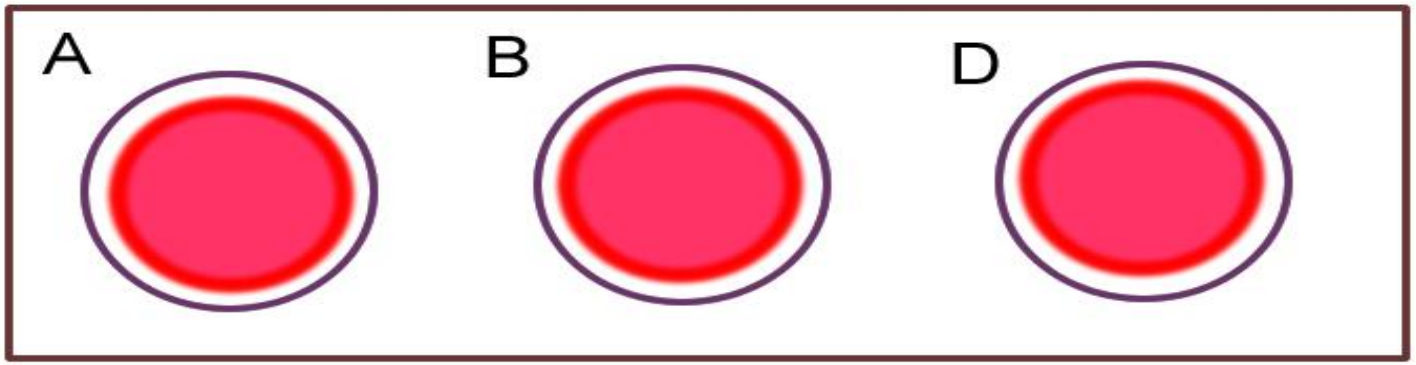



AB -

# Blood Groups




O +




O -

# منيره الدوسري