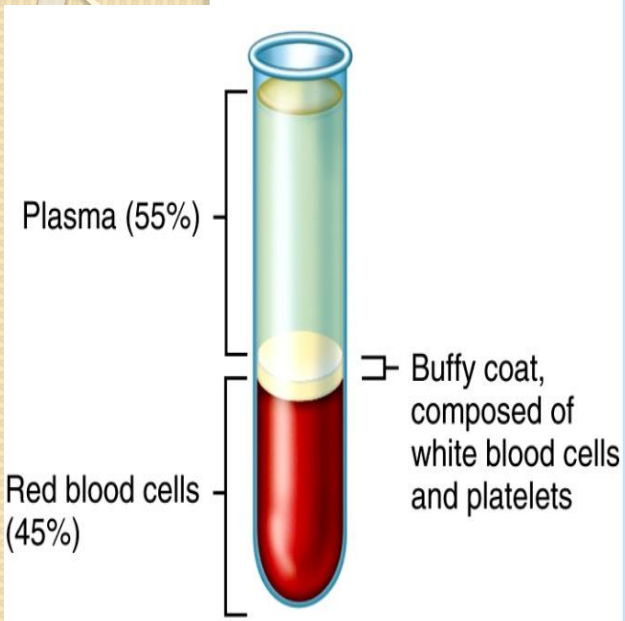
Blood Group and Immunity
Lab 2

Blood

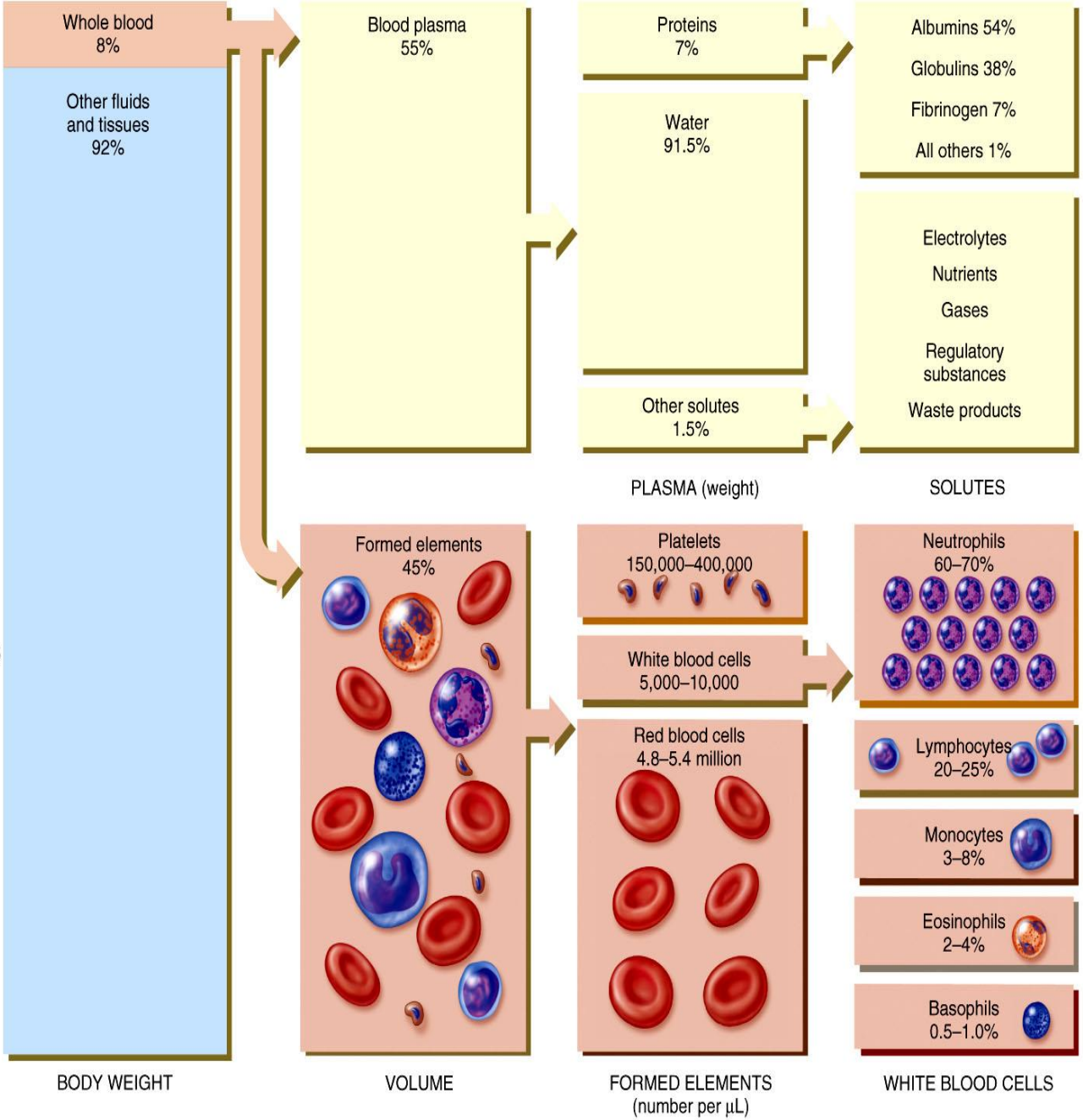
- Blood is a specialized bodily fluid and composed of blood cells suspended in a liquid called blood plasma.

Plasma, extracellular matrix consisting of plasma proteins & ground substance called serum, which constitutes 55% of blood fluid, is mostly water (92%) and contains proteins, glucose, mineral ions, hormones, carbon dioxide (plasma being the main medium for excretory product transportation).

The blood cells are mainly red blood cells essential for transport of oxygen in blood, white blood cells involved in body's defense mechanism and platelets important to process of blood clotting.



(a) Appearance of centrifuged blood



(b) Components of blood

Figure 19.01b Tortora - PAP 12/e

Blood function

- Supply of oxygen and nutrients (such as glucose, amino acids, and fatty acids) to tissues.
- Removal of waste such as carbon dioxide, urea, and lactic acid.
- Protection from blood loss (blood clotting after an open wound in order to stop bleeding)
- Messenger functions, including the transport of hormones.
- Regulation of body pH, temperature and fluid volume.
- Immunological functions, including circulation of WBC, and detection of foreign material by antibodies.

- **Blood Group**
- Blood groups are created by molecules present on the surface of red blood cells. More than 20 blood group systems have been identified, each of which is genetically distinct. the two most important of these systems are the ABO blood groups and the Rh factor.

ABO blood grouping system

- The ABO blood groups are the most important in assuring safe blood transfusions. it is determined by the presence or absence of specific antigens on the surface of red blood cells. These antigens are glycoproteins with their sugar residues exposed at the cell surface. The terminal sugar determines whether the antigen is A or B. The ABO locus has three main allelic forms: A, B, and O on chromosome 9. According to the ABO blood group system there are four different kinds of blood groups:

Blood Group	Antigens on RBCs	Antibodies in Serum
A	**A**	Anti-B
B	**B**	Anti-A
AB	**A** and **B**	Neither
O	Neither	Anti-A and Anti-B

- **Blood group A** have A antigens on the surface of red blood cells and anti-B antibodies in plasma.
- **Blood group B** have B antigens on the surface of red blood cells and anti-A antibodies in blood plasma.
- **Blood group AB** have both A and B antigens on the surface of RBC and no A or B antibodies in plasma.
- **Blood group O** have neither A nor B antigens on the surface of RBC but have both anti-A and anti-B antibodies in plasma.

- •Individuals with **blood group AB** are called **universal recipients** as they can receive blood from any of the ABO groups without the ill effect. This is because they are unable to produce antibodies against the A and B antigens on the donor's red blood cells.

- • Individuals with **blood group O** are called **universal donors** as their blood can be given to people of any of the ABO groups. This is because they have no A or B antigens on their red blood cells to stimulate an immune response.
- • Individuals with the same blood type can safely donate blood to each other because they have matching antigens and antibodies.

The Rh factor

- Rh antigens are transmembrane proteins with loops exposed at the surface of red blood cells. They are named for the rhesus monkey in which they were first discovered. Those who have it are called Rh+ and those who haven't are called Rh-. A person with Rh+ blood does not have Rh antibodies naturally in the blood plasma. Its determined by two alleles at a single locus on chromosome 19.

Blood typing & crossmatching

- The presence of these antigens and antibodies can be readily detected by the agglutination reaction, with a set of standard antibody-containing sera before a blood transfusion, direct crossmatching of donor and recipient is also generally carried out, this involves mixing donor RBCs with the recipient's serum to guarantee that the original typing of donor and recipient was correct.

The primary cause of ABO mismatched transfusion reactions results from ***destruction of donor red cells by the recipient's antibodies***; the reaction between donor antibodies and recipient cells is of less importance, since the small amount of antibody contained in the transfusion is generally diluted to harmless levels in the recipient.

Blood groups and pregnancy

- If the mother is Rh-, and the newborn baby is Rh+, then the mother's immune system may produce anti- Rh antibodies. These may attach and destroy the baby's blood cells and this condition is called ***hemolytic disease of the newborn***. This is rarely a problem in a first pregnancy. However, without treatment, this can become a serious problem in subsequent pregnancies. This disease can be prevented by the administration of anti-Rh antibodies called ***anti-Rh gamma globulin*** to the mother within 72 hours after delivery.

Antibody

- An antibody, also known as an immunoglobulin, is a protein and Y-shaped used by the immune system to identify and neutralize foreign substance such as bacteria and viruses. The antibody recognizes a unique part of the foreign target (antigen). Antibodies are produced by a type of white blood cell called a plasma cell. Antibodies can come in different varieties known as isotypes or classes known as **IgA, IgD, IgE, IgG and IgM**.
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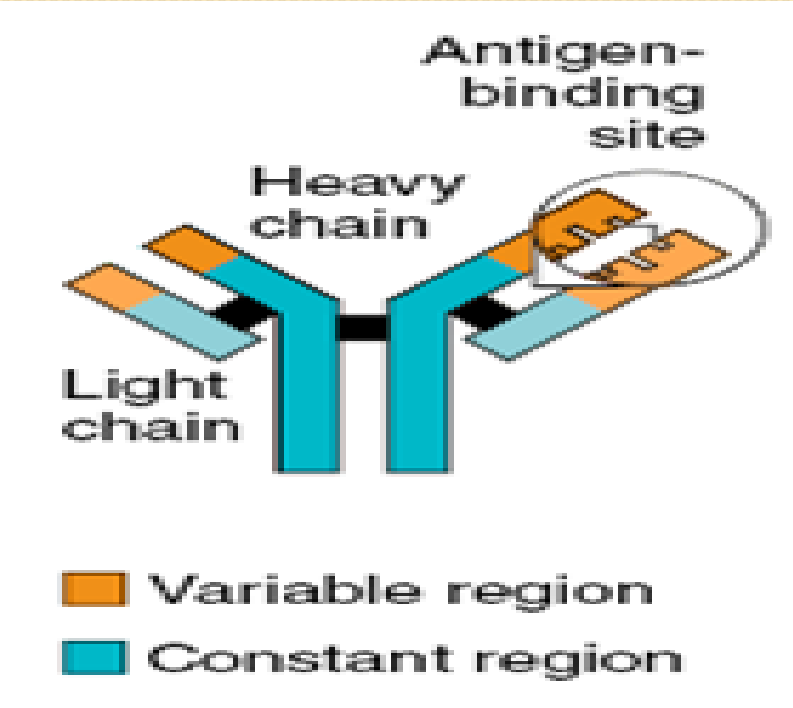
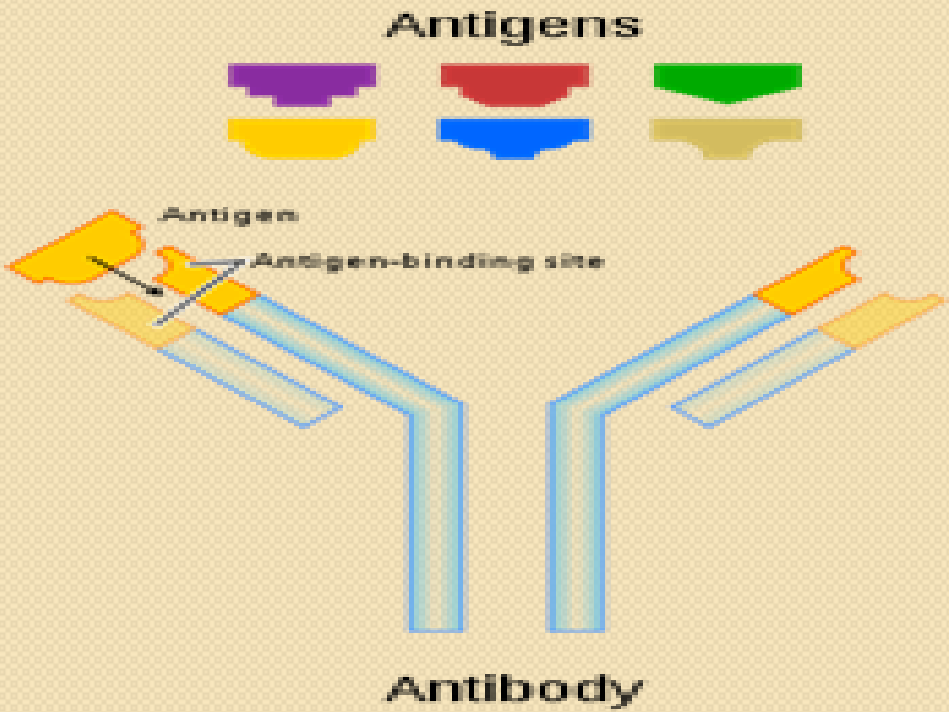
Antigen

- An antigen, also known as an immunogen, is a foreign molecule, when introduced into the body, triggers the production of an antibody by the immune system.
- **The interaction occurs**
- By noncovalent forces (The bonds that hold the antigen to the antibody). These include hydrogen bonds, electrostatic bonds and Van der Waals forces.

Procedure

- Put a drop of blood on each circles of blood group plate.
- Add one drop of anti – A, anti – B, and anti – D on each circle.
- Shake the plate for approximately one minute.
- Record the your result


Antigen-
binding
site
Heavy
chain
Light
chain
Variable region
Constant region


Antigens
Antigen
Antigen-binding site
Antibody