Lec (1) Blood transfusion Dr. Ahlam mousa

Blood Bank Introduction

Definition

Blood Banking, is the process of collecting and preparing blood and other blood components for transfusion, as well as selection of appropriate, compatible blood components for transfusion.

The main and major role of blood bank laboratory is to provide the safest and compatible blood and/or blood components to all recipients/patient

BLOOD BANK ANTIGENS AND ANTIBODIES

Antigens

Antigens are defined as substances recognized by the body as foreign, causing the body to produce an antibody to react specifically with it.

Characteristics of antigens:

Autologous antigens are your own antigens (not foreign to you)

Homologous, or allogeneic antigens are antigens from someone else (within the same species) that are foreign to you.

Blood group antigens:

There are over 300 known blood group antigens .These antigens are attached to proteins or lipids on the red cell membrane and are usually complex sugar groups.

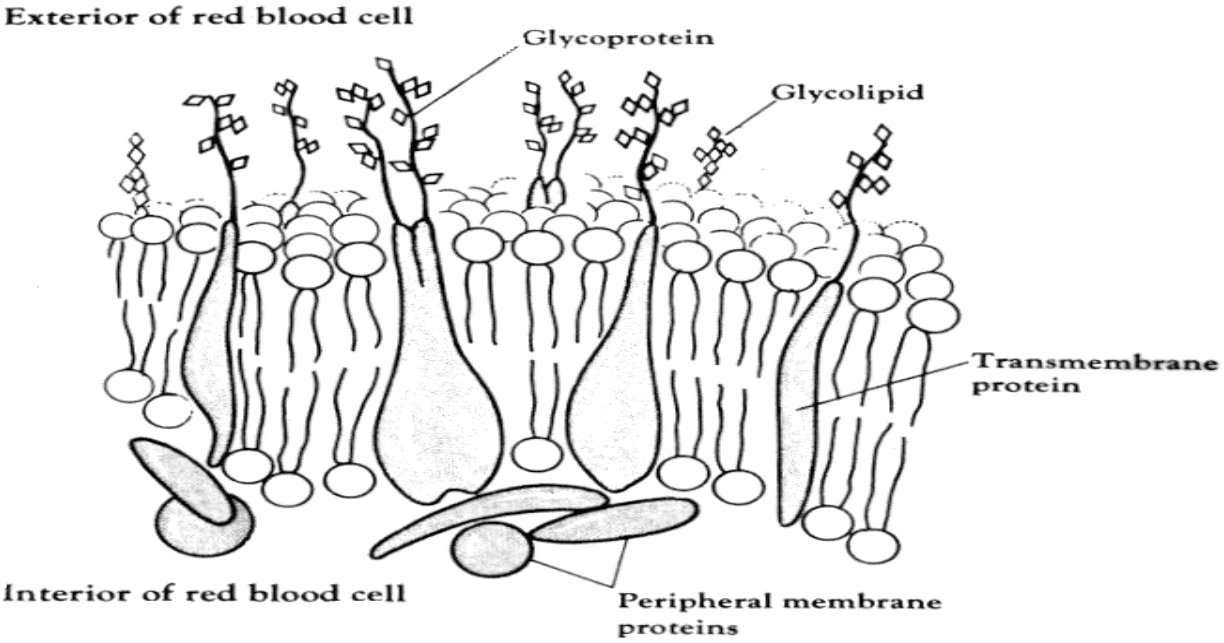
Blood group antigens are chemical structures embedded in or protruding from RBCs, WBCs, and platelets and have three common forms:

Blood group antigen forms

a. **Glycoproteins** - HLA system.

b. **Glycolipids** - ABH, and Lewis blood group systems.

c. **Proteins** - Rh, M, N blood group systems.



Antibodies:

Definition:

Proteins produced by lymphocytes as a result of stimulation by an antigen which can then interact specifically with that particular antigen.

Parts of an antibody:

Heavy chains - made of alpha, gamma, delta, mu, or epsilon chains

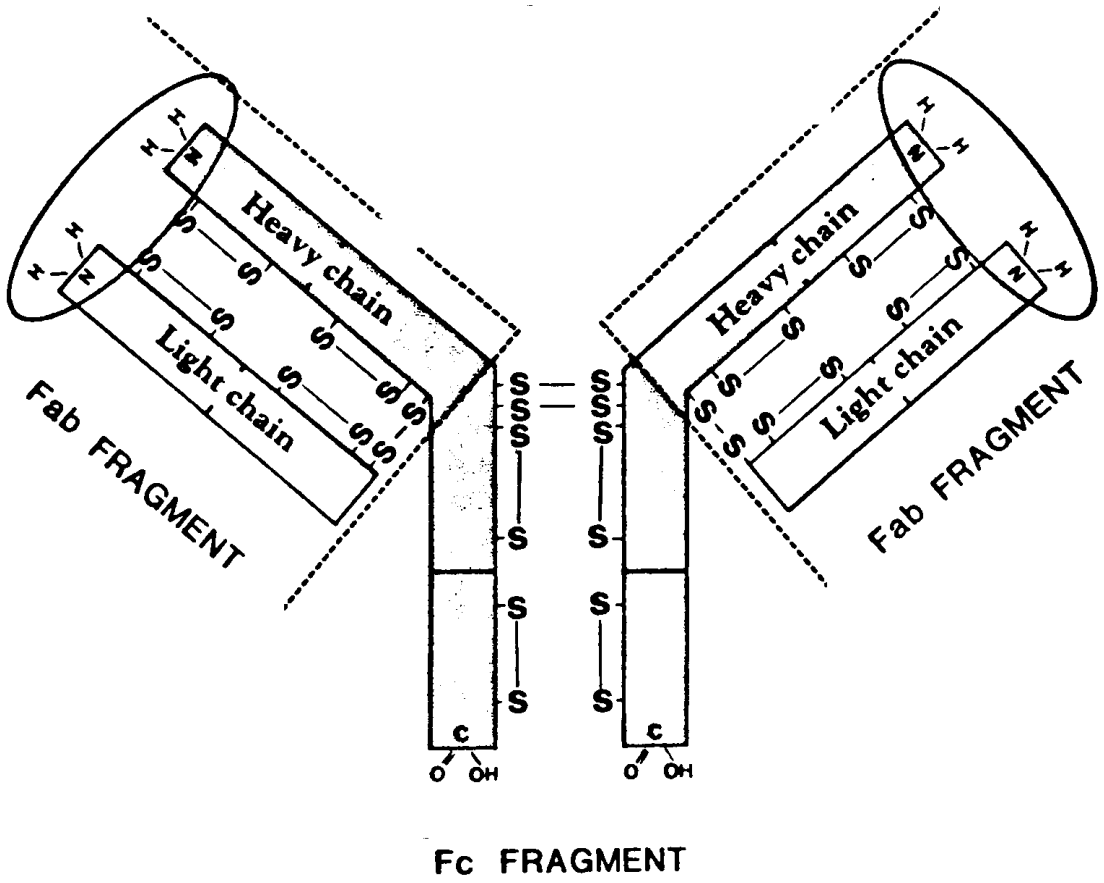
Light chains - made of either kappa or lambda chains

Disulfide bonds – to hold chains together

Hinge region - allows antibody to flex to reach more antigen sites

Fab fragments - contains variable portion of antibody: antigen-binding sites

Fc fragment - contains constant portion of antibody; also site of complement activation



Classes of antibodies

IgG - provides long-term immunity or protection

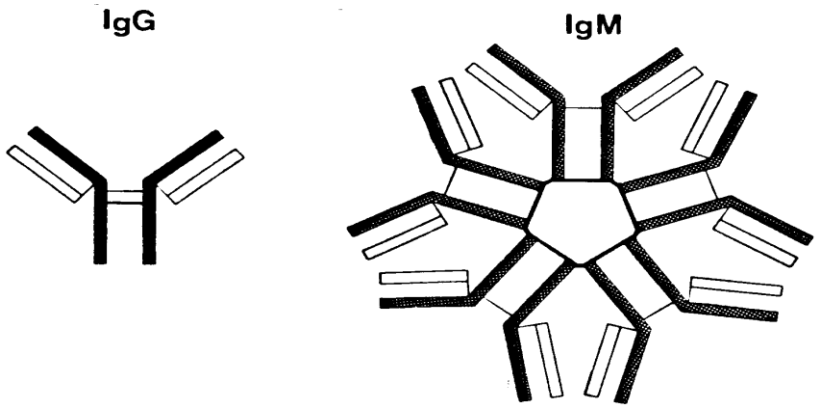
IgM - first antibody produced in response to an antigenic stimulus

IgA - found in secretions. Protects against infections in urinary, GI, and respiratory tracts

IgE - involved in allergic reactions

IgD - not much known about it. Surface receptor of B lymphocytes

Most important classes of antibodies in blood banking are IgM and IgG



Characteristics of IgG and IgM antibodies

Clinical significance:

Clinical of red cell antibodies in blood bank depend on whether they can cause in vivo hemolysis, which in turn will cause transfusion reactions or hemolytic disease of the newborn.

IgG will frequently cause in vivo hemolysis due to antibody coating the red blood cells.

IgM, with a few important exceptions, usually does NOT cause in vivo hemolysis. The most important of these exceptions are ABO antibodies.

1)Size of the antibodies:

IgG is relatively small since it is comprised of only one immunoglobulin subunit. (monomer)

IgM is relatively large since it is comprised of 5 immunoglobulin subunits. (pentamer)

2)Serum concentration

IgG > IgM

3)Complement activation

IgG = will do it if conditions are optimal IgM = Excellent complement fixation

4)Placental transfer

IgG is small enough to easily cross placenta and is the only immunoglobulin capable of doing so.

IgM and the other classes do not cross placenta

5)Optimum temperature of reactivity

a. IgG = 37C b. IgM = 4 C (may react at any temperature below 30C)

6)Number of antigen-binding sites

IgG has 2 binding sites IgM has 10 binding sites

Terms used to describe antibodies

Immunoglobulin:

Antibody formed as a result of immune stimulus (exposure to foreign antigen)

Naturally occurring

Antibody formed without prior exposure to foreign antigen

Autoantibody:

Antibody formed to one's own antigens (abnormal condition)

Alloantibody

antibody formed to foreign antigens, but within the same species

Agglutinin:

Antibody capable of causing agglutination when reacting with corresponding antigen

Hemolysin:

Antibody capable of causing hemolysis when reacting with corresponding antigen

Cold antibody (cold agglutinin):

Antibody whose optimal temperature of reactivity is less than 30C

Warm antibody:

Antibody whose optimal temperature of reactivity is greater than 35C

ANTIGEN-ANTIBODY REACTIONS IN GENERAL

Rules of Thumb For in vivo Antigen-Antibody Reactions

If a person's cell have the antigen, the antibody should NOT be present in that person's serum .

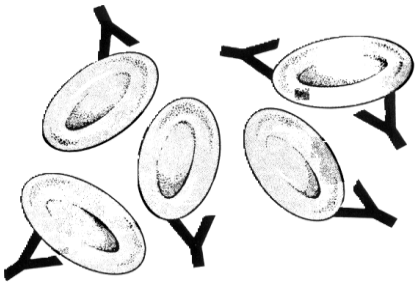
If an antibody to a blood group antigen is present in the serum of a person, his or her cells should lack that antigen

The antigens are on the cells and the antibodies are in the serum

Stages of Antigen-Antibody Interaction

The first stage is sensitization (coating of cells).

Sensitization occurs when antibodies react with antigens on the cells and coat the cells.



Agglutination

The second stage of the reaction is agglutination. Agglutination occurs when antibodies on coated cells form cross-linkages between cells resulting in visible clumping.