

CLS 542

Advanced Immunohaematology (Blood Transfusion)



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Immunohaematology course

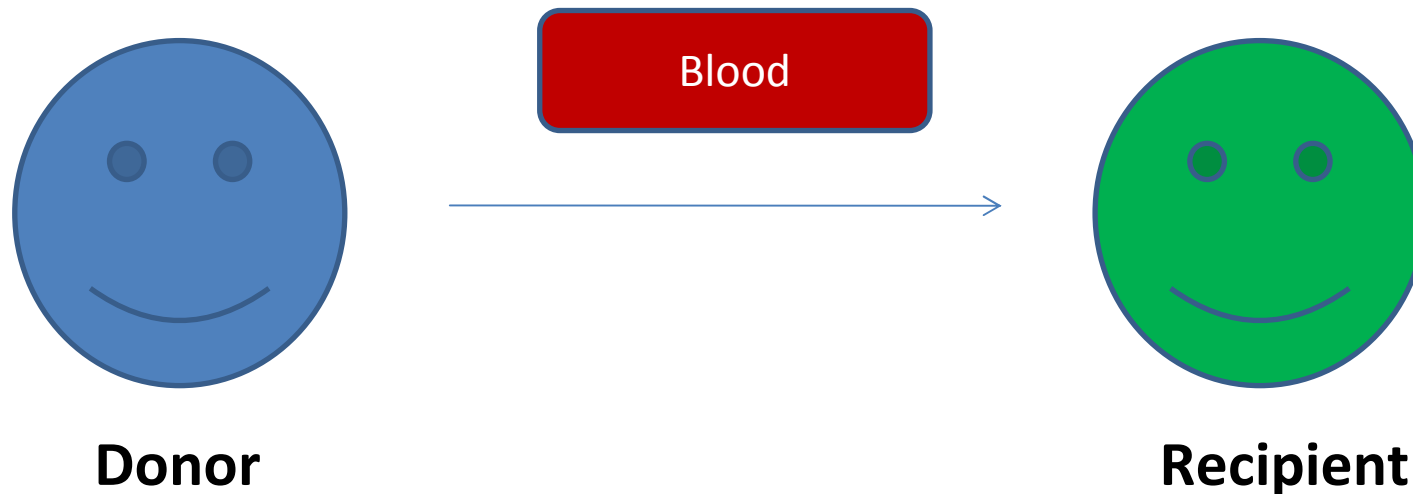
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Blood Transfusion

- What is Blood Transfusion?

Blood transfusion is the act of transferring blood from someone to another



The science of blood transfusion is mainly
concerned with how to provide patients with

SAFE BLOOD

Immunology

- Immunology is the study of how the body defend itself against infection and disease
- The immune system can be regarded as the defence ministry of a country
- Because there is a wide range of potential invaders, the body must develop various mechanisms to protect itself

Immunology

- The immune system must be able to differentiate between:

SELF and **NON-SELF**

Two types of Immunity

1- Natural Immunity
(Also called Primary)

2- Acquired Immunity
(Also called Secondary)

1. Natural Immunity (Primary)

- This is the first line of defence against foreign invaders
- Characterized by:
 - 1- Non specific
 - 2- Fast
- Examples of Natural immunity:

Physical barriers, biochemical effectors (e.g complement), and some immune cells.

Immunohaematology

- **Blood group serology** or immunohaematology includes the study of antigenic molecules present on the various cellular and soluble components of whole blood, together with study of the antibodies and lectins that recognize them and their interactions.
- in practice, the term **blood group serology** generally is restricted to red cell surface antigens and their interactions with specific antibodies.
- (i) the determination of the phenotype of red cells with antibodies and reagents of known specificity;
- (ii) the search for and identification of antibodies with red cells of known phenotype; and
- (iii) compatibility testing of patients' sera against cell samples from donor units of the same ABO and RhD groups.
- Since **Landsteiner's** discovery in 1901 that human blood groups existed, a vast body of serological, genetic, and biochemical data on red cell (blood group) antigens has been accumulated. More recently, the biological functions of some of these antigens have been appreciated.

Complement

(part of natural immunity)

- Group of 20 proteins
- Present in blood in an inactive form (proenzyme)
- Can be activated through many multiple pathways
- When activated undergo a series of reactions that all culminate in the activation of C3 protein which results in cell lysis

Complement

(part of natural immunity)

- Three main functions
 - 1- Final lysis of the invading cell
 - 2- Opsonisation of invading cell to facilitate phagocytosis
 - 3- mediation of inflammation

2. Acquired Immunity

- The second line of defence against invaders
- It protects the body against a repeated attack by the same agent (e.g. vaccination)
- The most important characteristics of the acquired immunity are:
 - 1- Specific
 - 2- Takes time
 - 3- More effective
- Examples of acquired immunity are lymphocytes and antibody formation

In this course we are mainly concerned with
ANTIBODIES

What is an antibody?

- An antibody is a specifically reactive **immunoglobulin** produced in response to immunogenic stimulus
- They are **immuno** (because of their function) and **globulin** because of their nature or composition

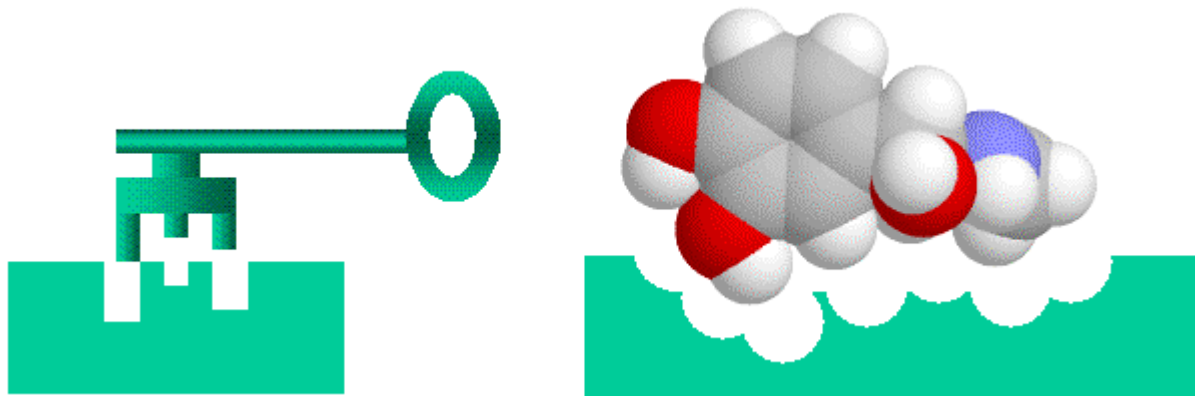
What is an antibody?

- Antibodies are produced by B cells (or plasma cells) in response to a specific agent (or antigen)
- Antibodies react specifically (react only) with the agent that resulted in their production in the first place:

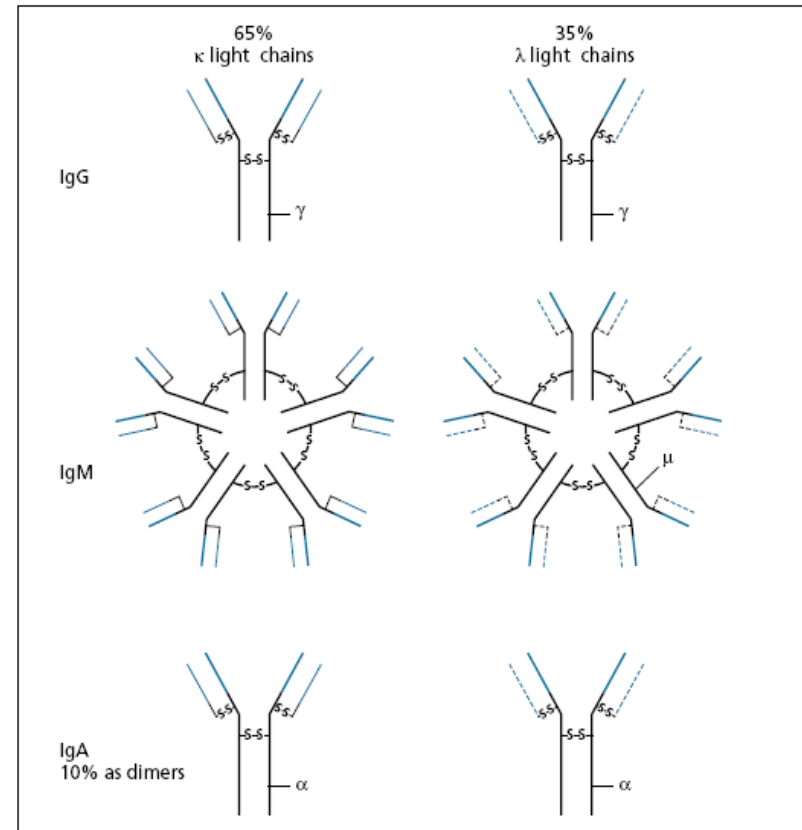
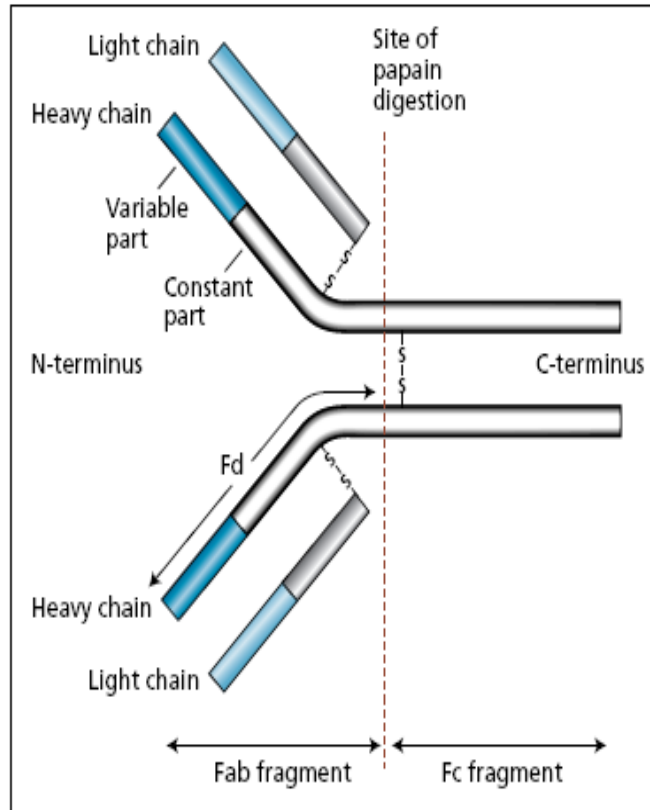
For example an antibody produced to react with HIV will not react with Hep B virus.. Or antibodies react with A type red cells will not react with B type red cell

What are antibodies?

- Antibodies are specific: Antibodies produced because of cells A will not react with cells B
- Like Key and Lock



What is an antibody?



- **Why antibodies are produced?**

Antibodies bind to the invader (or antigen) and then inactivate (or destroy) it and the cell to which the antigen is bound to

What is an antigen?

- Is a substance that when introduced into the circulation of a subject lacking that antigen, can stimulate the production of a specific antibody
- Antigens are mostly of biological origins, such as proteins, polysaccharides, lipids, or nucleic acids
- The antigen is often coupled to a carrier cell (e.g. Blood group A antigen to red cells)

What is an antigen?

- Antigenes that are able to induce immune response are called immunogens.
- **Antigen:** a substance that can stimulate an immune response (immunogenicity).
- Antigenes vary in their immunogenicity (the degree of the immune response they can induce)
- For example: A and B antigenes as compared to some other blood groups (e.g. Kid).
- The parts of an antigen that bind antibodies or cellular receptors are called antigenic determinants or **epitopes**, and those parts of the antibodies that bind to them are called **paratopes**.

Red cell antigens and blood group antibodies

- 400 RBC group antigens.
- Individuals who lack a particular blood group Ag may produce Abs reacting with that Ag → transfusion reaction.
- **Blood group Antibodies:** naturally occurring Abs occur in the plasma of subjects who lack the corresponding Ag (eg. Anti-A and Anti-B).

Ag-Ab reaction

- In blood group serology, the interaction between the antigen sites on the cells and the corresponding antibody is normally detected by observing agglutination.
- Agglutination is the result of the cross-linking of individual red cells by antibody molecules.