P. G. SEMESTER - III,

(CC-10),Vertebrate Immunology,

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Function of Antibodies

An antibody, also known as an immunoglobulin, is a large Y-shaped protein produced by B- cells and used by the immune system to identify and neutralize foreign objects such as bacteria and viruses.

Five isotypes of antibodies are found in different locations and perform different specific functions.

Once they are secreted into the bloodstream, these antibodies can circulate freely and can act independently of plasma cells. It has also been noticed that these antibodies can be transferred from one individual to another. It has also been noticed that an individual who has immune response against the disease, can donate to another non individual and hence confer temporary immunity through antibodies present in his/her blood stream. This phenomenon is called **passive immunity** which helps in combating the disease. Antibodies are known to coat extracellular pathogens and neutralized key sites on the pathogen in the host cells. Antibody **neutralization** can prevent pathogens from entering host cells. The

neutralized antibody coated pathogen can then be filtered out by the screen and eliminated in urine or feces.

The antibody has a range of functions and uses, both in biological defense and as a clinical tool.

1. Host Defence

i) Defend against microorganisms (bacteria, viruses).

ii) The first antibody, which appears, is IgM and followed by IgG.

iii) In foetal life, IgM appears at 6 months of intrauterine life.

iv) Mother (milk) is a rich source of IgA and IgG.

v) Recruits another component like complement which destroys the antigen.

vi) Causes neutralization of toxins.

vii) Leads to the removal of foreign antigen from the circulation.

2. Clinical Medicines Used in the diagnosis of diseases and monitoring of the progress of disease

3. Diagnosis and Research

These can be used for diagnostic and research purposes.

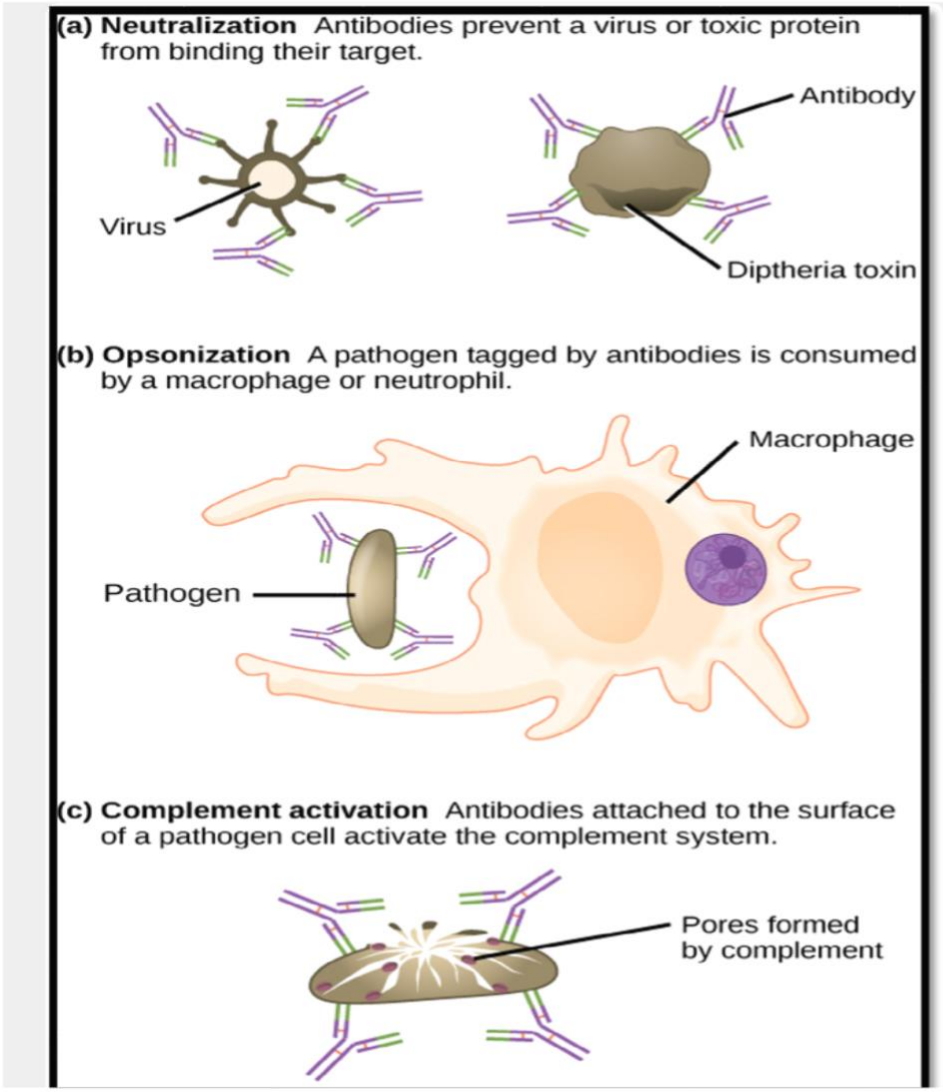

Fig :Neutralization, Opsonization, Complement activation: Important functions of antibodies.

- Antibodies or Immunoglobulins have a basic four peptide structure of two identical heavy and two identical light chains joined by interchain disulfide

links. Papain splits the molecule at the exposed flexible hinge region to generate two identical univalent antigen binding fragments- Fab and a fragment Fc. Pepsin proteolysis gives a divalent antigen binding fragment $F(ab)_2$ lacking the Fc segment.

- There are 10^8 or more different IgG molecules in normal serum . Analysis of myeloma protein which are homogenous Ig produced by single clones of malignant plasma cells, has shown the N-terminal region of heavy and light chains to have variable amino acid structure and the remainder to be relatively constant in structure.

- Isotypes of Ig variants are based on different heavy chain constant structures, all of which are present in each individual. Examples are the Ig classes IgG ,IgA etc. Allotypes are heavy chain variants encoded by

  alternative genes or allelic genes, at single loci and are therefore genetically disturbed, example GM groups. An idiotype is the collection of antigenic determinants on an antibody, usually associated with the hypervariable regions, recognized by other antigen specific receptors, either antibody or T cell receptors.

- The Isotype antibodies can show variety within an individual as they are developed specific to different antigens and they form the Idiotype (Ab1, Ab2, Ab3) of one individual.

- Such idiotypic antibodies can be specific to several epitopes of antigens which are also called polyclonal antibodies, or be specific to only one epitope of the antigen which are called the monoclonal antibody.

- The polyclonal antibodies are formed in response to invading pathogens or intoxicants whereas monoclonal antibodies are engineered in the laboratory.

- The variable region domains bind antigen and three hypervariable loops on the heavy chain and three on the light change from the antigen binding site. The constant region domain of the heavy chain carries out a secondary biological function after the binding of antigens i.e., complement fixation and macrophage binding.

- Flexibility at both the hinge and the V and C junction enables both arms of the antibody molecule to bind two sites that are distant apart e.g., sites on bacterial cell wall polysaccharides .This flexibility also helps the antibodies to interact with antibody binding proteins that mediate immune effector mechanism.

- Antigens can bind in pockets or groves or on extended surfaces in the binding site of antibodies. Antigen binding to antibodies usually takes place in the cleft between the V regions of the heavy and light chain where they make special specific contacts. Binding between antigen and antibody is a reversible non covalent interaction.

- Overall surface complementarities, has an important role in antigen antibody interaction in most antibodies that have been studied in detail and it has been found that only few residues make a major contribution to the binding energy and hence to the final specificity of the antibody.

- Genetic engineering can felicitate with site directed mutagenesis for the antigen and antibody binding to its complementary epitope. The antibodies are particularly significant against extracellular toxins and pathogens. Once they are secreted into the bloodstream these antibodies can circulate freely and can act independently of plasma cells.

- Antibodies are known to coat extracellular pathogens and neutralized key sites on the pathogen in the host cells. Antibody neutralization can prevent pathogens from entering host cells. The neutralized antibody

coated pathogen can then be filtered out by the screen and eliminated in urine or feces.

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