A study material for M.Sc. Biochemistry (Semester: III) Students
on the topic (CC-12; Unit II)

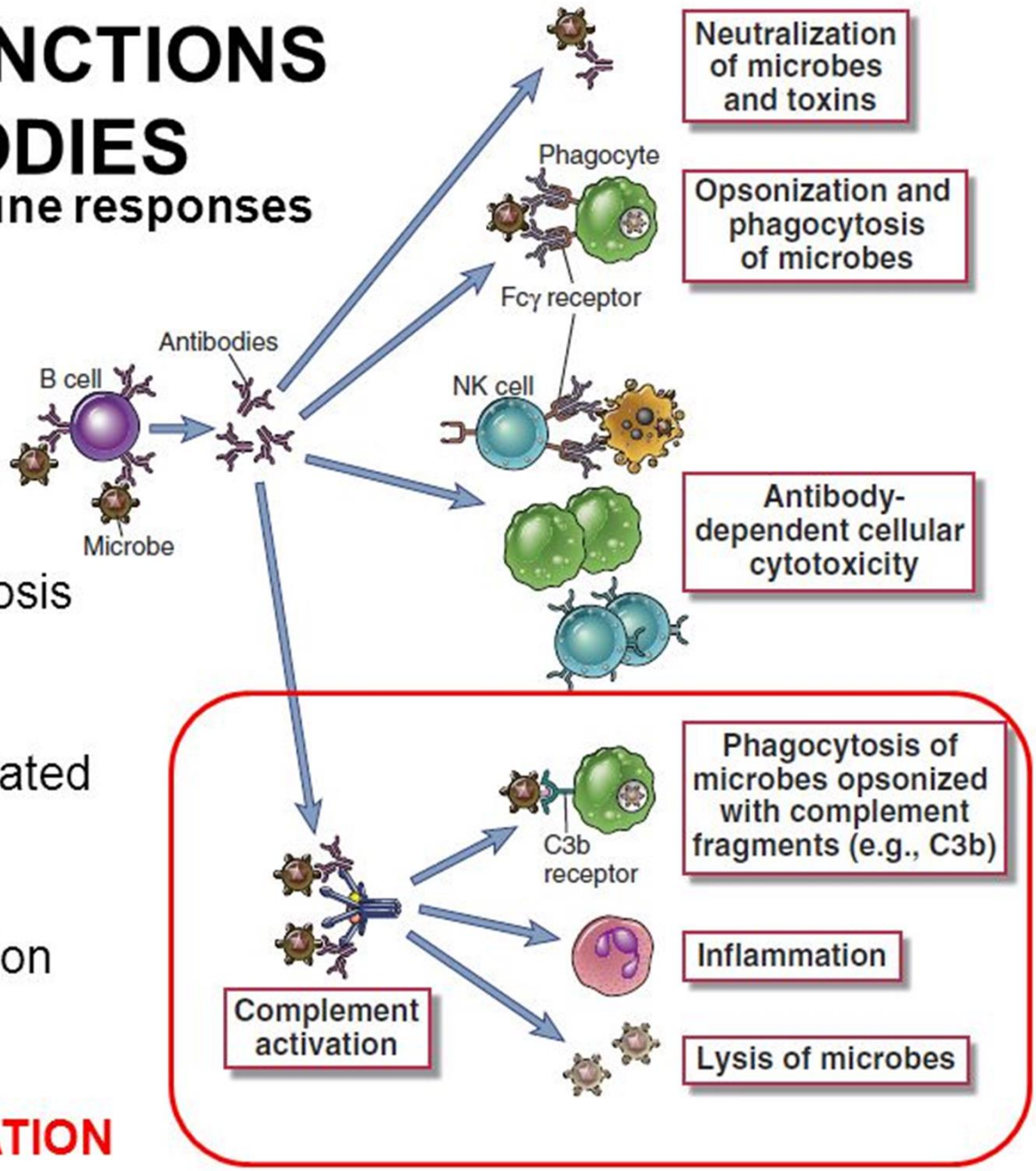
Antibody Mediated Effector Functions - I

Vyomesh Vibhaw
Assistant Professor (Part Time)
Department of Biochemistry
Patna University
Mob. No.:- +91-9708381107, +91-8825217209
E. Mail: vyomesh.vibhaw@gmail.com

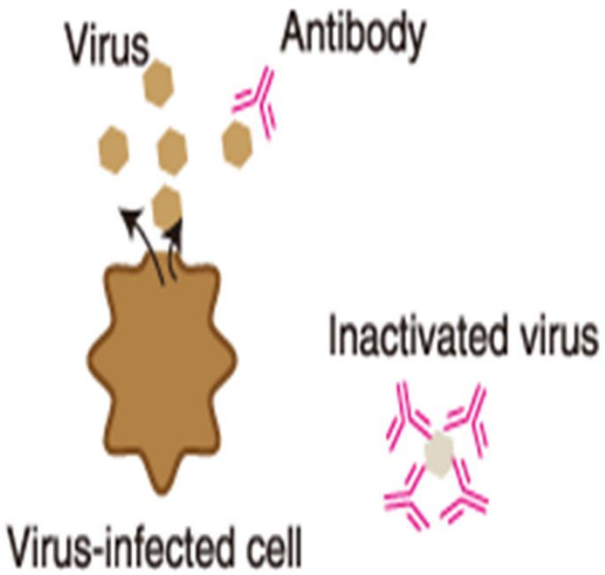
EFFECTOR FUNCTIONS OF ANTIBODIES

Antibody-mediated immune responses

- **NEUTRALIZATION**
- **OPSONIZATION**
  - opsonized phagocytosis (IgG)
  - ADCC (NK cell-mediated killing) (IgG)
  - mast cell degranulation (IgE)
- **COMPLEMENT ACTIVATION**

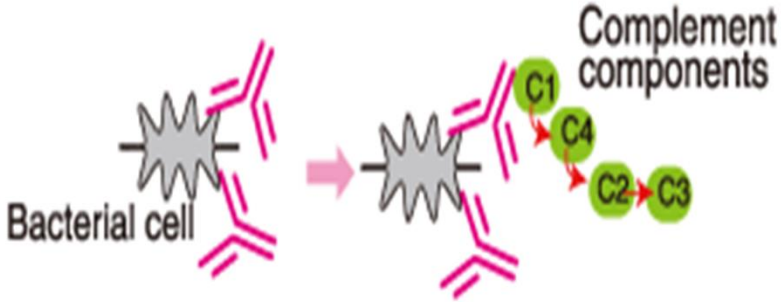


Neutralization



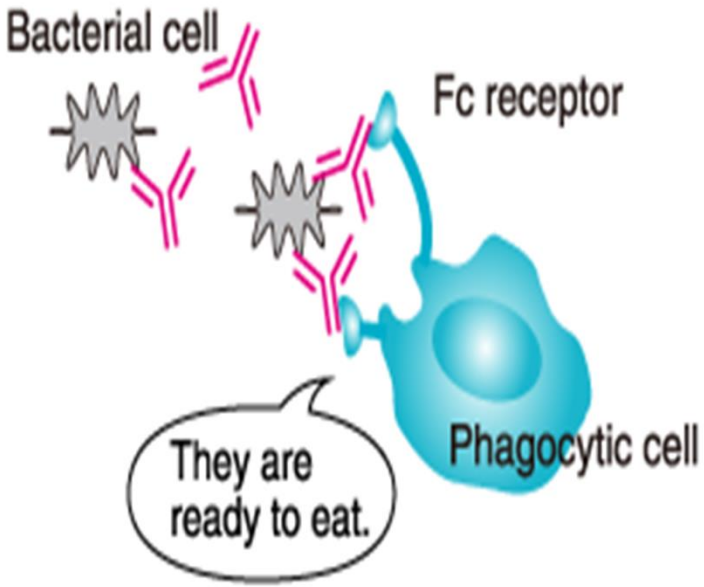
Antibodies bind to and inactivate viruses and toxins.
These antibodies are called "neutralizing antibodies."

Complement recruitment by antibodies



Antigen-antibody complexes activate the complement system (the classical pathway), triggering its antibacterial activity.

Opsonization



Phagocytic cells grab the antibodies bound to the surface of foreign substances, for efficient phagocytosis.

mAb functional characterization: Fab- and Fc-mediated activities

BINDING ACTIVITY

- Fab binding to antigenic drug target determines specificity of drug in vivo.
- Affinity of binding is a critical quality attribute which needs to be very well characterized.

BIOLOGICAL ACTIVITY

- Binding to target triggers the desired biological effect.
- Fab-mediated mechanisms may often be supplemented with Fc region mediated effector functions following binding.

BINDING ACTIVITY

The Fc region can bind to:

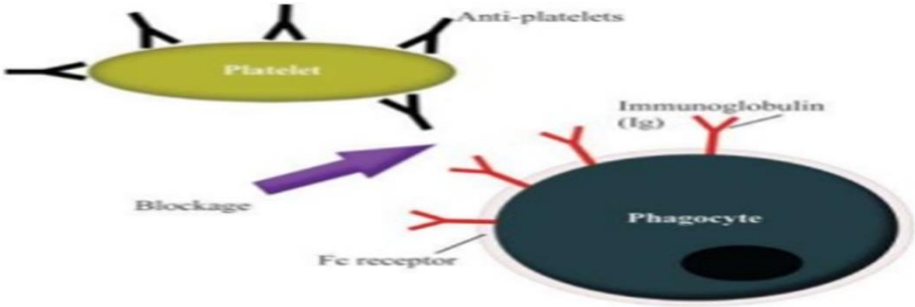
- Fc receptors on immune cells
- The neonatal Fc receptor (FcRn)
- The C1q component of complement

These interactions can bring about 'effector' functions which may be important to mAb therapeutic efficacy.

BIOLOGICAL ACTIVITY

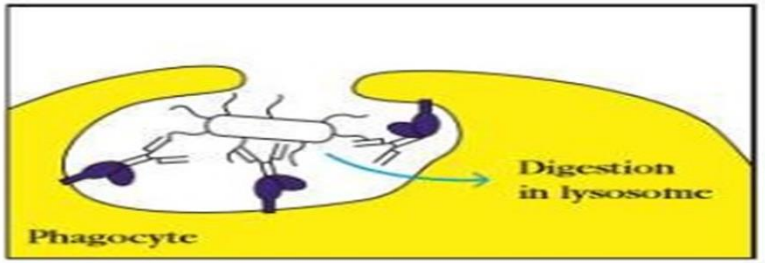
- Antibody-dependent cell-mediated cytotoxicity (ADCC).
- Complement dependent cytotoxicity (CDC).
- Antibody-dependent cell-mediated phagocytosis (ADCP).

Fc receptors



- Fc receptors are responsible for many of the effector functions of antibodies.
- **Phagocytosis** of antibody antigen complexes by macrophages

(b) Opsonization of bacteria and phagocytosis (FcγR and FcαR and IgG or IgA)

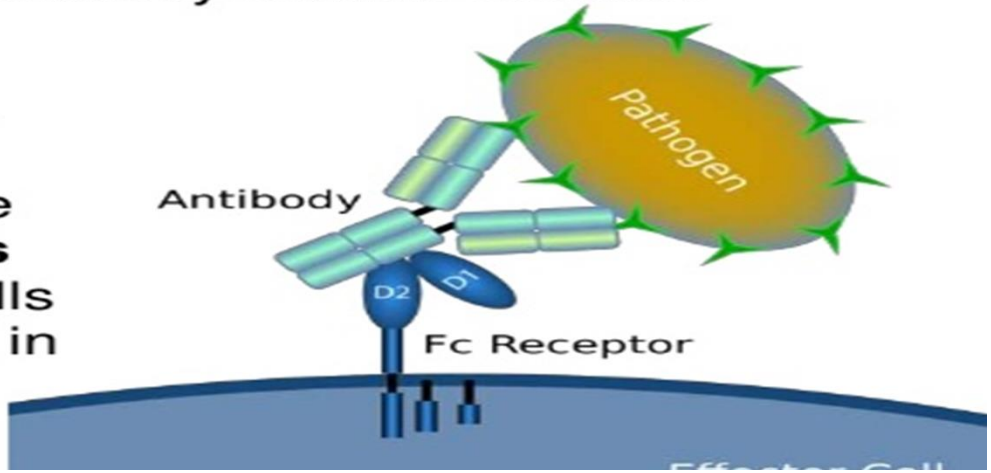


- The **humoral arm** of the immune system refers to the **activities of antibodies** secreted by B lymphocytes.

- **The antigen specificity,**
- **isotype, and**
- **interactions with FcRs**

are all important features of antibody effector function.

Antibody-binding receptors, which bind to the **constant regions** of antibodies and are therefore called **Fc receptors or FcRs,** determine which cells an antibody can recruit to aid in its destructive mission



ANTIBODY MEDIATED EFFECTOR FUNCTIONS

- **Neutralization** – binding of the antibody inhibits the binding of the pathogen to the cell surface, entry to the cell or multiplication
- **Opsonization** – binding of the antibody triggers complement activation and binding to the cell surface by complement (CR1) and IgG (FcγR) receptors
- Cytophylic property - antibody isotypes have distinct complement activating and FcR binding activity

Opsonisation

- It is a process by which a particulate antigen becomes more susceptible to phagocytosis.

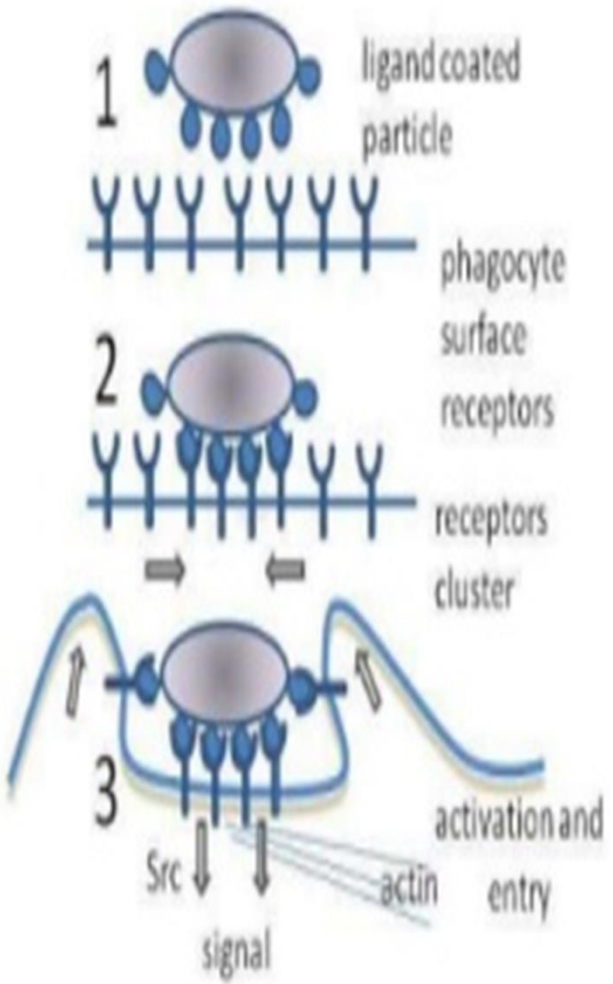
- Opsonic index is defined as ratio of phagocytic activity of the patient's blood for a given bacterium to that of a normal individual.
- Phagocytic index is the average number of phagocytosed bacteria per polymorphonuclear leukocytes from stained blood films.
- Phagocytic index denotes the phagocytic activity of blood and thus helps in measuring opsonic index.

OPSONIZATION

The process whereby opsonins make an invading microorganism more susceptible to phagocytosis

OPSONIN

An antibody or complement protein that enhances phagocytosis by marking an antigen is called opsonin



- Major opsonins are

1. Immunoglobulin (Ig)G antibodies
2. Certain plasma lectin ⟶ MANNOSE BINDING LECTIN
3. C3b and it's cleavage products e.g. iC3b (inactive C3b)

Acknowledgement and Suggested Readings:

1. Kuby Immunology; Sixth Edition; Kindt, Goldsby and Osborne; W. H. Freeman and Company
2. Fundamental Immunology; 5th edition; William E., Md. Paul (Editor) ; Lippincott Williams & Wilkins Publishers
3. Roitt's Essential Immunology; Tenth Edition; Roitt and Delves; Blackwell Science
4. Cellular and Molecular Immunology; 6th Edition; Abbas, Lichtman and Pillai; Saunders Elsevier

Thanks