

Antigen-Antibody **reactions** (1)

Learning **objectives:**

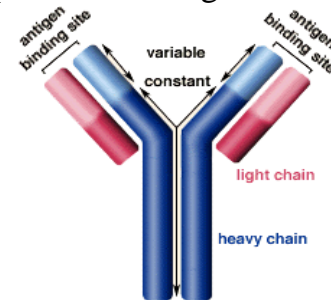
- ❖ introduction to Antigen Antibody reactions.
- ❖ **Antigen Antibody reactions part1:** Precipitation,
Flocculation and Immunodiffusion.
- ❖ **Antigen Antibody reactions part 2:** Agglutination.
- ❖ **Antigen Antibody reactions part 3:** Complement
Fixation Test.

Key Terminology:

Antibodies:

specialized soluble proteins produced by B cells and plasma cells that interacts with antigen; also called immunoglobulin (Ig).

- ✓ Each B-cell makes its own distinct antibody in response to a specific antigen.
- ✓ Each antibody is designed to bind to a specific surface binding site or **epitope** on the antigen.
- ✓ There are millions of different types of antibodies circulating in an individual's bloodstream and they are based on exposure to antigens in his/her environment.



The Organization

What are they?

- **Antibodies** are:
 - "Y"-shaped Immunoglobulins (Ig)
 - Comprised of 2 heavy and 2 light chains
 - 5 different types: IgA, IgD, IgE, IgG, IgM
 - Each have a specific role
 - Contain **Variable Regions** which recognize and bind antigen via "lock and key"



IgM

- 1st class of circulating antibody
- found in pentameric form

IgG

- most abundant antibody

IgA

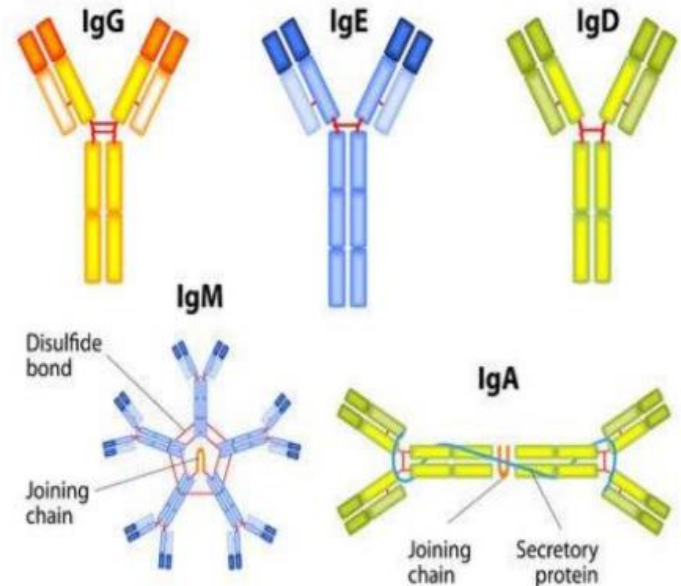
- located in the mucous membranes
- found in dimeric form

IgD

- found on surface of B-cells
- probably involved in memory cell formation

IgE

- involved in allergies, i.e. trigger release of histamine



Key Terminology:

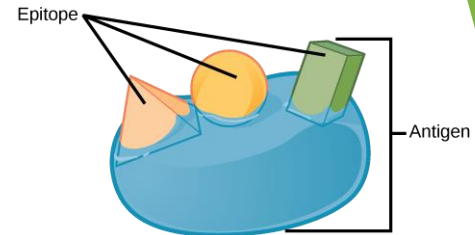
Antigens:

substances that when introduced into the body stimulates the production of an antibody.

Antigens = “non-self” molecules and cells

such as:

- foreign proteins
- viruses
- environmental pollutants
- bacteria and parasites (Protista, Fungi, Plantae, and Animalia cells).
- foreign transplanted tissue
- cancerous cells

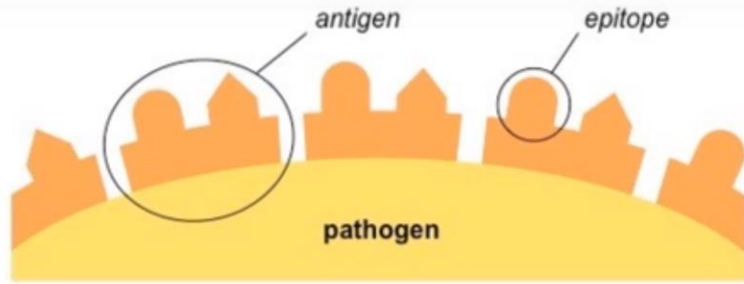


Key terms:

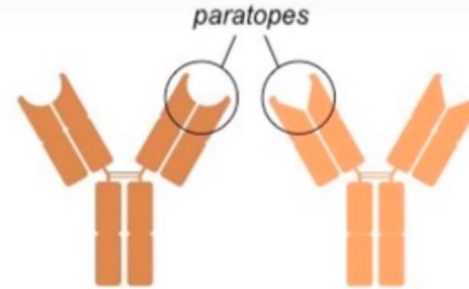
Epitope: also known as (antigenic determinant), is the part of an antigen that is recognized by the immune system, specifically by antibodies, B cells, or T cells. For example, the epitope is the specific piece of the antigen to which an antibody binds.

Key terms:

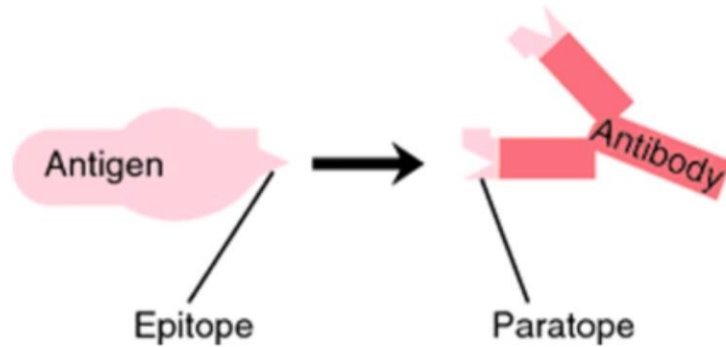
Paratope: also called an (antigen-binding site), is a part of an antibody which recognizes and binds to an antigen. paratope is produced by the complementarity determining regions of the light and heavy chains generating a specific three-dimensional shape. Any light chain can join with any heavy chain to produce a different paratope. Thus, theoretically, with 10^4 different light chains and 10^4 different heavy chains, 10^8 different specificities could be generated.



Pathogens possess highly specific antigenic determinants (epitopes)



Antibody paratopes are complementary to specific antigenic determinants



Key terms:

Affinity measures the strength of interaction between an epitope and an **antibody's** antigen binding site. It is defined by the same basic thermodynamic principles that govern any reversible biomolecular interaction: $K_A = \mathbf{affinity}$ constant.

Key terms:

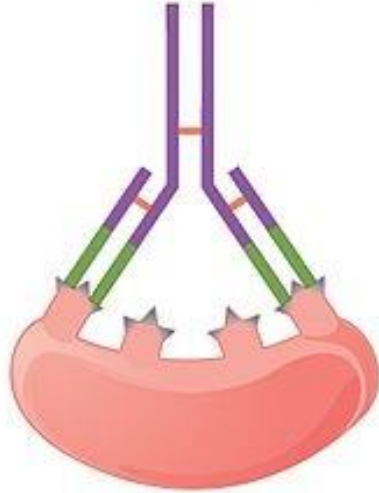
Avidity is a measure of the overall stability of the complex between antibodies and antigens and is governed by three factors, the intrinsic affinity of the antibody for the epitope, the valency of the antibody and antigen, and the geometric arrangement of the interacting components. (is the collective affinity of multiple binding sites (affinity + Valence))

Key terms:

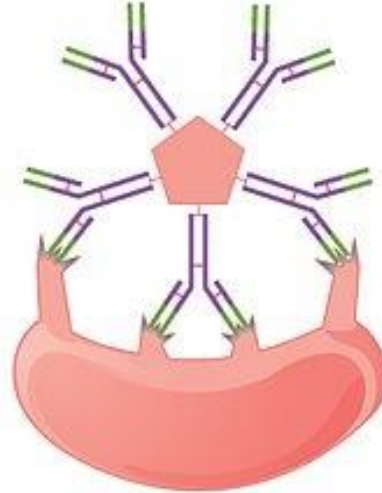
Valency of antibody:

refers to the number of antigenic determinants that an individual **antibody** molecule can bind.

(a) Affinity versus avidity



Affinity refers to the strength of a single antibody–antigen interaction. Each IgG antigen binding site typically has high affinity for its target.



Avidity refers to the strength of all interactions combined. IgM typically has low affinity antigen binding sites, but there are ten of them, so avidity is high.

Pentameric **IgM lower affinity** than IgG, but **higher avidity** of IgM is due to its higher valency, which enables it to bind effectively to the antigen

Key terms:

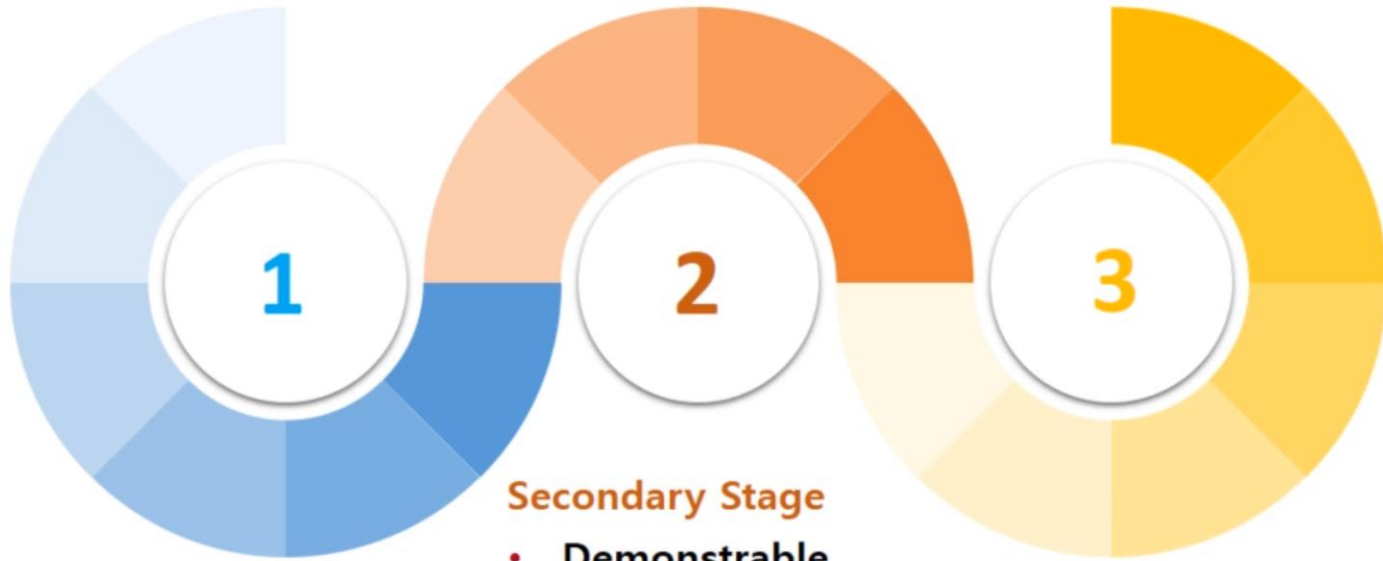
Sensitivity:

Ability to detect minute quantities of antigen/ antibody.

Specificity:

Ability to detect homologous antigen and no other.

Antigen Antibody reactions : 3 stages



Primary Stage

- No visible effect
- reversible
- Van der Waal's forces ionic bond and hydrogen bonding

Secondary Stage

- Demonstrable events

Tertiary Reaction

vivo chain reaction –
neutralisation, destruction of
injurious Ag, tissue damage

General features of Antigen antibody reactions

1

SPECIFIC

Cross reactivity may occur.

2

ENTIRE MOLECULE

Entire molecule react

3

NO DENATURATION

No denaturation of antigen or antibody.

4

SURFACE ANTIGENS

Combination on surface antigens are immunologically relevant.

5

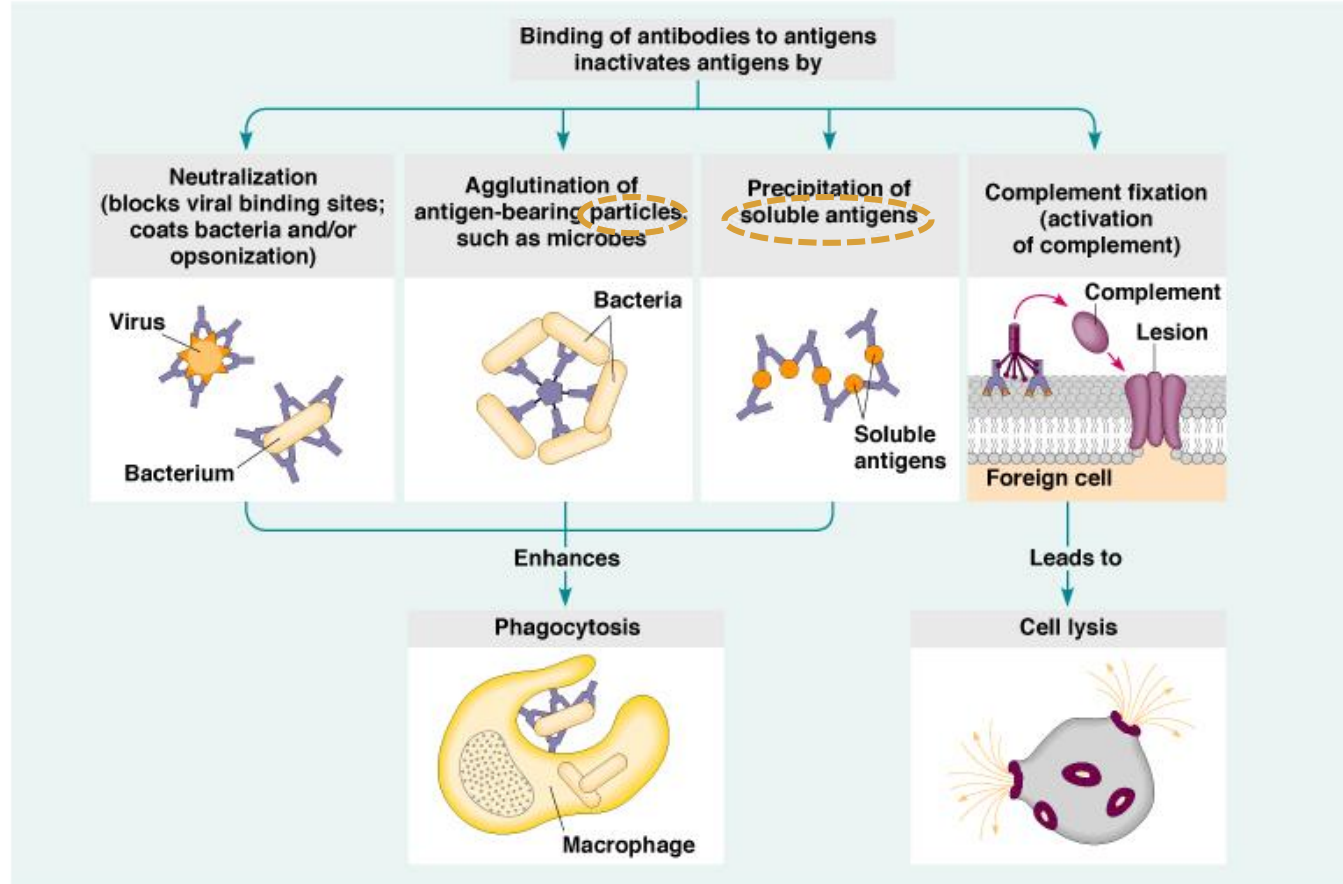
REVERSIBLE

Combination is firm but reversible.

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AFFINITY & AVIDITY

Consequences of Antibody Binding





THANKS!

Any questions?

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