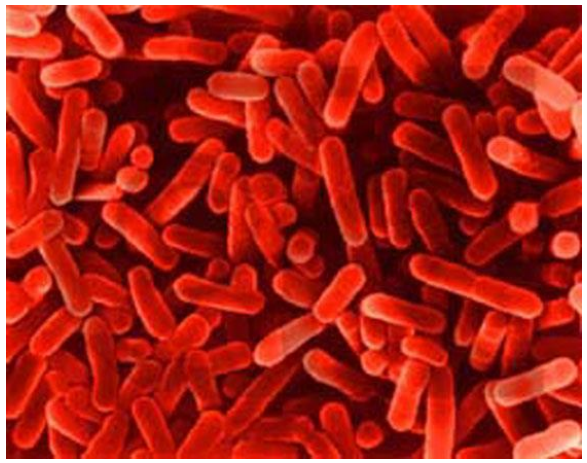
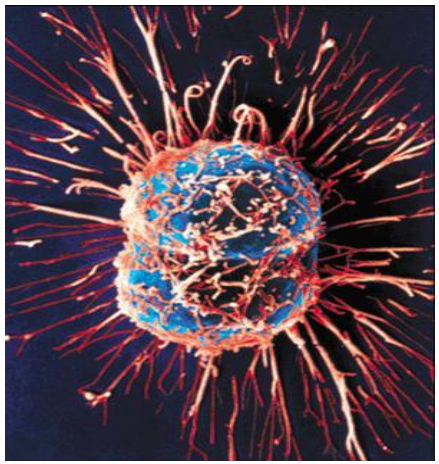
WHAT IS THE IMMUNOLOGY?

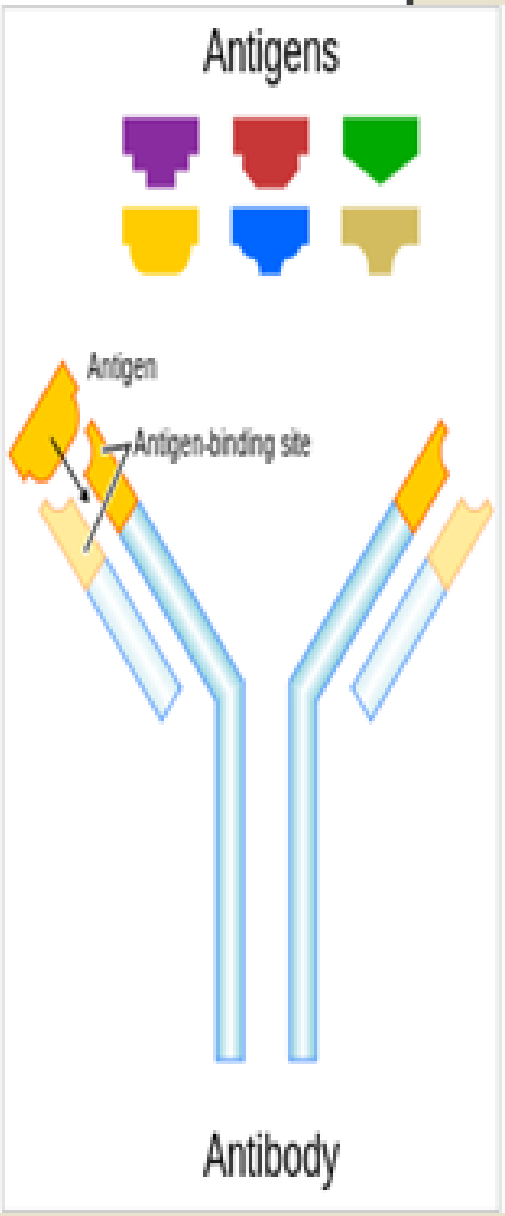
- **Immunology**: is the science which studies bodies defense factors and mechanisms acting to protect, remove or eliminate harmful agents entering the body.
- **Immunity**: protection against diseases, usually infectious diseases caused by non-self agents or altered body cells.



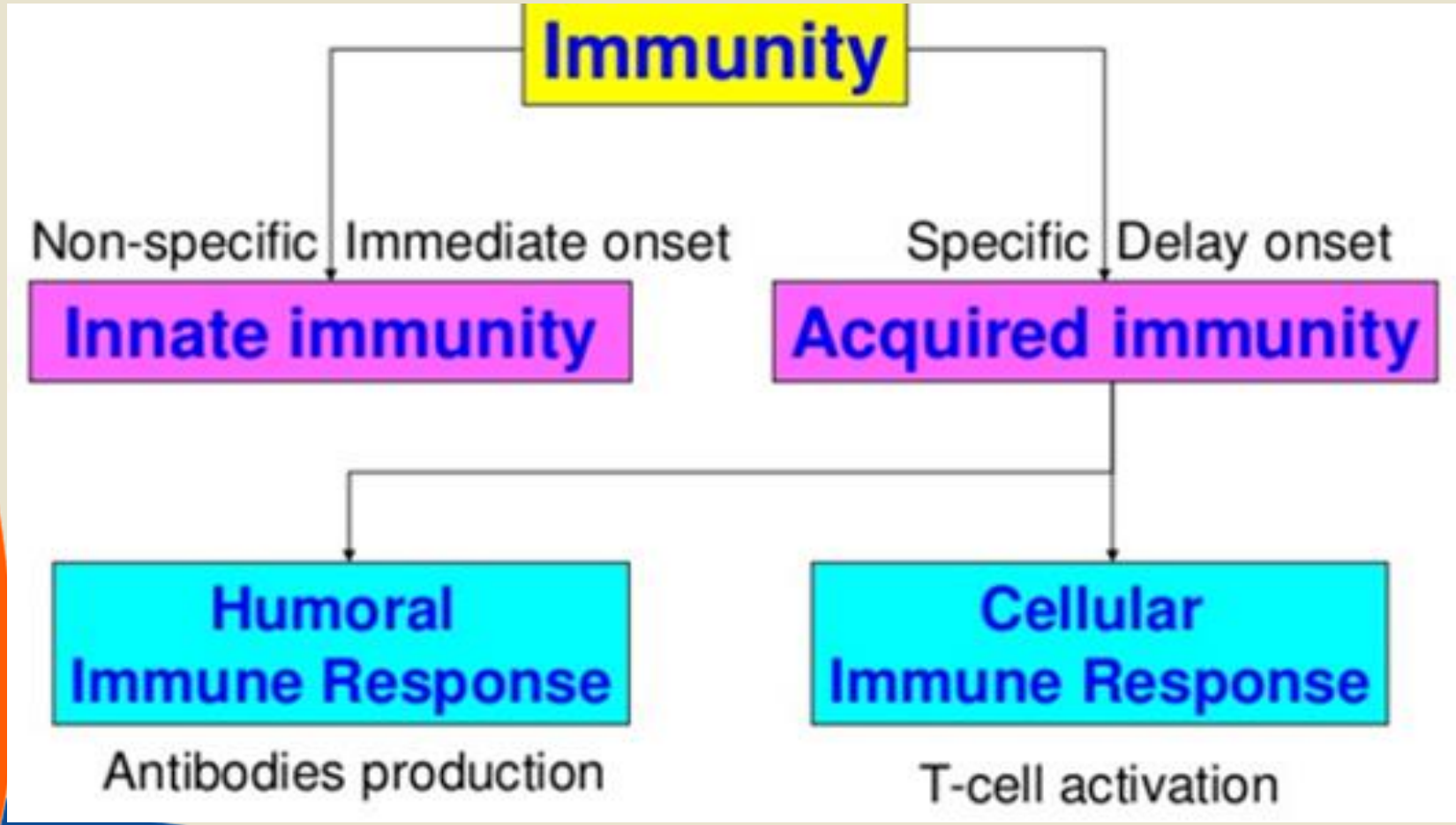


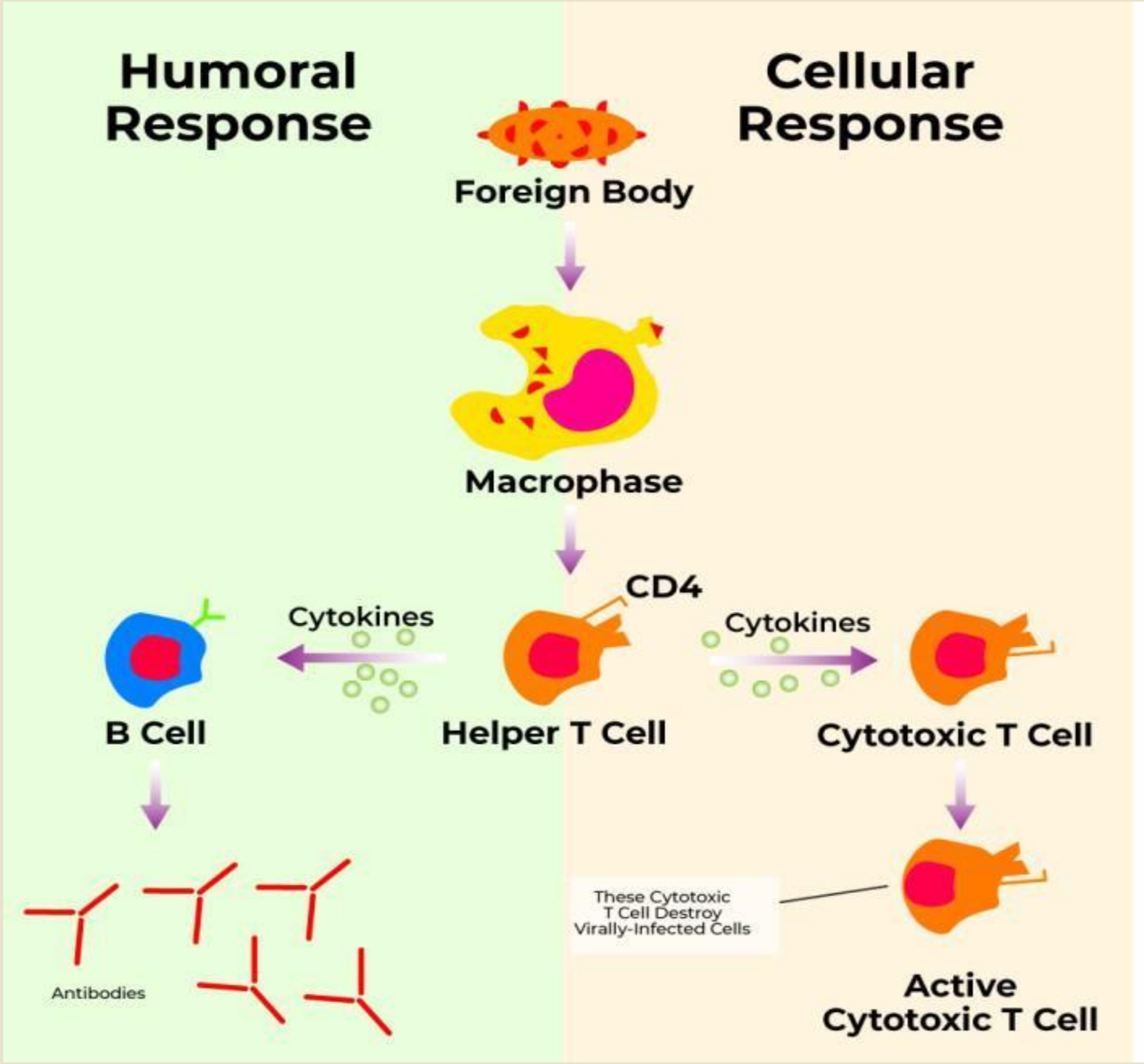
TERMINOLOGY

- **Antibody:** a type of glycoprotein molecule, also called immunoglobulin (Ig) produced by mature B-lymphocyte (**Plasma cell**) that binds to antigen often with high degree of affinity and specify.
- **Antigens:** are substances that provoke and subsequently react with the product of immune response (**antibodies**). These may be enzymes, toxins, microorganisms (bacteria, virus, parasite, fungus), tumors or autoimmune factors.



TYPES OF IMMUNITY




Humoral Response
Cellular Response
Foreign Body
Macrophase
CD4
Cytokines
Cytokines
B Cell
Helper T Cell
Cytotoxic T Cell
Antibodies
These Cytotoxic T Cell Destroy Virally-Infected Cells
Active Cytotoxic T Cell

TYPES OF IMMUNITY:

Innate immunity (non-specific)	Adaptive (specific immunity)
There is immediate response	There is a lag time between exposure and maximal response
It is not Ag - specific	It is Ag - specific
Exposure doesn't result in induction of memory cells.	Exposure results in induction of memory cells.
The cells include phagocytes and Natural Killer (NK) cells.	The cells include lymphocytes (B-cells and T-cells).
Blood protein is (Complement)	Blood protein is (Antibody)

SEROLOGY

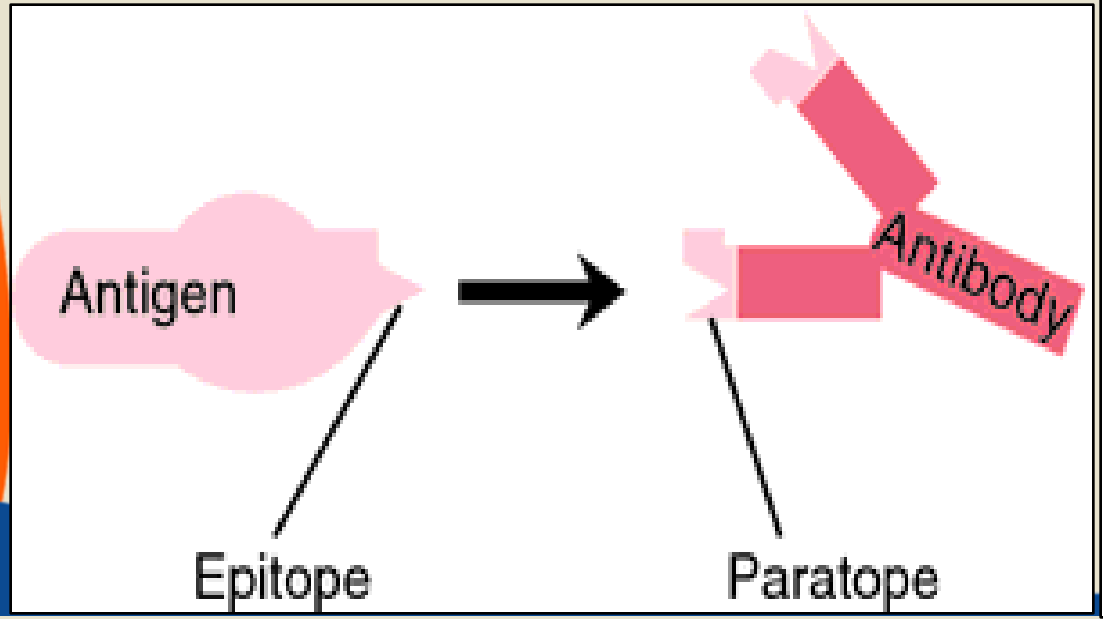
- **Serology:** is the scientific study of blood serum for identification of antibodies or antigens as **indicators** for infectious diseases and other parameters.
- **Serology** is subdivision of immunology concerned with ***in vitro*** **Ag-Ab reaction.**

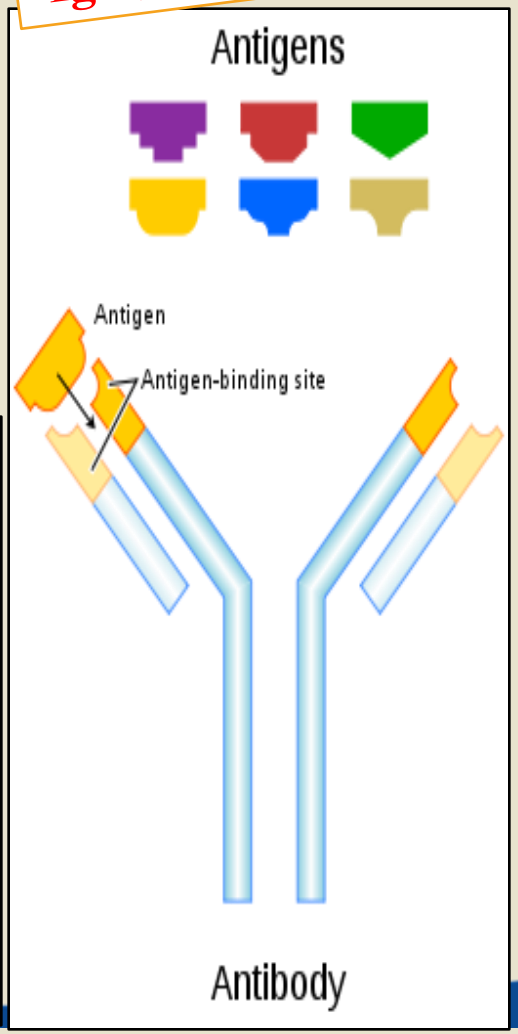
ANTIGEN-ANTIBODY INTERACTION:

IgG, IgM, IgE, IgD, IgA

Epitope: A single antigenic determinant. It is functionally the portion of an antigen that combines with an antibody **paratope/ idiotype.**

Each antibody binds to a specific antigen; an interaction similar to a **Lock and Key.**





ANTIGEN-ANTIBODY INTERACTIONS:

Serological tests are blood tests that look for **antibodies** or **antigens** in blood.

1. Agglutination tests (Widal test)
2. Immunochromatography tests (Strip tests)
3. Precipitation tests (Complement fixation tests (CFT))
4. Enzyme linked Immunosorbent Assay (ELISA)

AGGLUTINATION TESTS:

Agglutination tests are screening tests used for diagnosis of infections and non infections.

Types of agglutination reactions:

A. Direct Agglutination reactions

- Direct agglutination reactions are interaction between antibodies and antigens are found naturally on a particle (**particulate antigens**).
- The general term **"agglutinins"** is used to describe antibodies that agglutinate particulate antigens. When the antigens is an erythrocyte the term **Haemagglutination** is used.
- All antibodies can theoretically agglutinate particulate antigens but **IgM**, due to its high valence, is particularly good agglutinin. the pentameric nature of the **IgM** allows more antigens to bind to one antibody molecule.

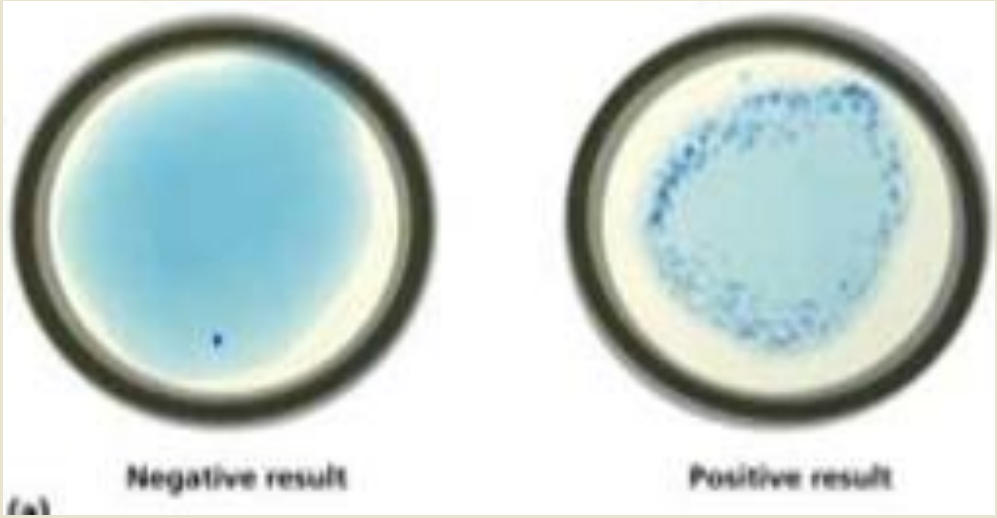
B- Indirect (Passive) agglutination reactions

- ✓Employs particles that are coated with antigens **not** normally found on their surface.
- ✓A variety of particles**, including erythrocytes, latex, gelatin, and silicates ,** are used for this purpose.
- ✓The use of synthetic beads or particles provides the advantages of **consistency**, **uniformity** and **stability**.
- ✓Reaction are easy to **read visually** and give **quick results**.

TYPES OF AGGLUTINATION REACTIONS:

1. Qualitative agglutination test

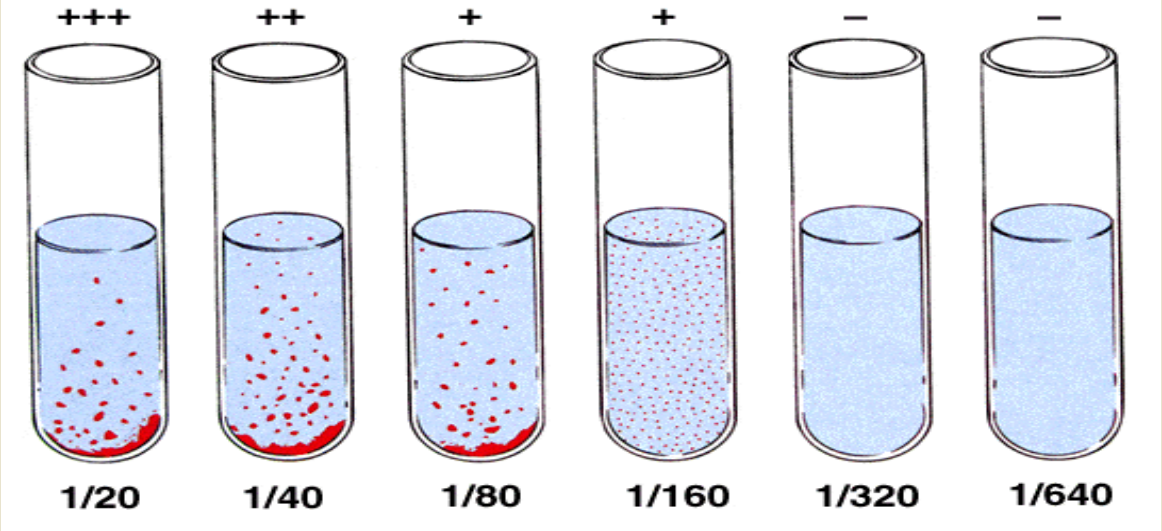
- Agglutination tests can be used in a qualitative manner to assay for the presence of an antigen or an antibody (give only positive or negative)
- The antibodies are mixed with the particulate antigens and a positive test is indicating by the **agglutination** of the particulate antigens.



TYPES OF AGGLUTINATION REACTIONS:

2. Quantitative agglutination test

- Quantitative agglutination tests can be used to measure the level (titer) of **antibodies** to particulate antigens.
- In this test, **serial 2-fold dilutions** are made of a sample to be tested for antibody and then a fixed volume of particulate antigen is adding.
- The maximum dilution of serum that gives visible agglutination is called the **Titre**.



Advantages of Agglutination Techniques

- ✓ They are simple
- ✓ Inexpensive
- ✓ Reliable
- ✓ The visible manifestation of the agglutination reaction eliminates the need for complex procedures and expensive instrumentation

Numerous techniques have been described for agglutination tests, these techniques may be performed using:

- Slides,
- Test tubes,
- or micotiter plates, depending on the purpose of the test

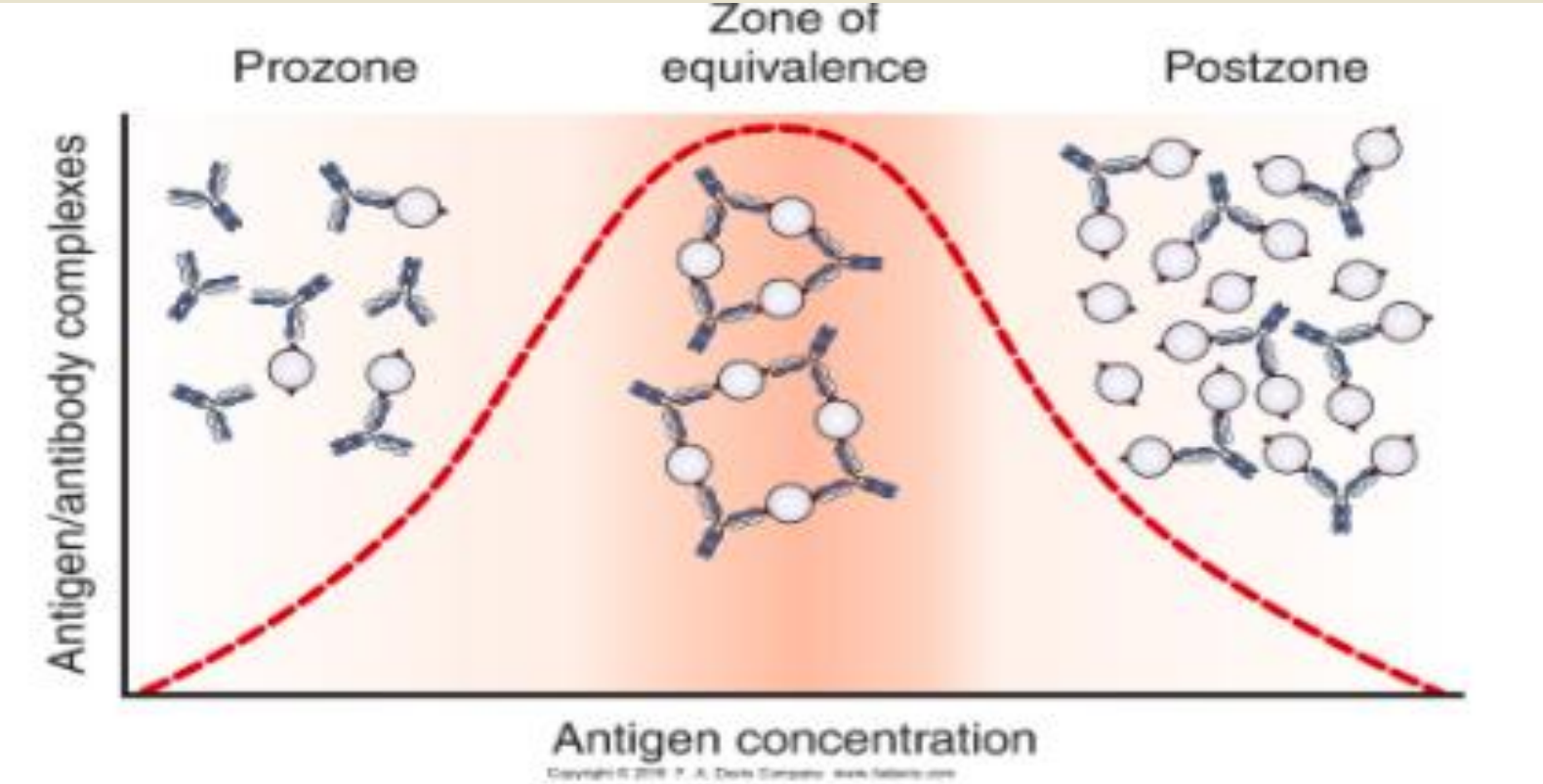
However the principle of the agglutination remain the same

Disadvantages of Agglutination Techniques

- Not accurate tests because characterized by low sensitivity and specificity and can give **false positive** (cross immunization with other agents) and **negative results** (prozone phenomenon and during early infections). So certain infections like **HIV** and **HBV if positive** by **agglutination test** should be **confirmed** by other confirmatory tests like **ELISA** or **PCR** technique**.**
- Rapid agglutination tests cannot **differentiate** between **IgG** and **IgM** so any positive test **cannot** differentiate between **past** and **recent** infection (qualitative tests). In case of quantitative agglutination tests, **2 samples** should be collected from the same patient **at 1-2 weeks intervals** and if there is **2-4 fold increase in antibody titer** (seroconversion) it means **recent infection** (this is also not practical).

AGGLUTINATION TESTS

- **Prozone effect:** Occasionally it is observed, is the zone of relatively high antibody concentrations (i.e. lower dilutions), resulting in very small complexes that do not clump to form visible agglutination and then, as the sample is diluted serially, agglutination occurs.



APPLICATIONS OF AGGLUTINATION TESTS

- Determination of blood types or antibodies to blood group antigens.
- To assess bacterial infections such as **enteric fever**, **brucellosis**, etc.
- For some autoimmune diseases, such as **Rheumatoid Factor** (RF).
- Pregnancy test