جامعة الانبار
كلية العلوم
قسم التقنيات الأحيائية

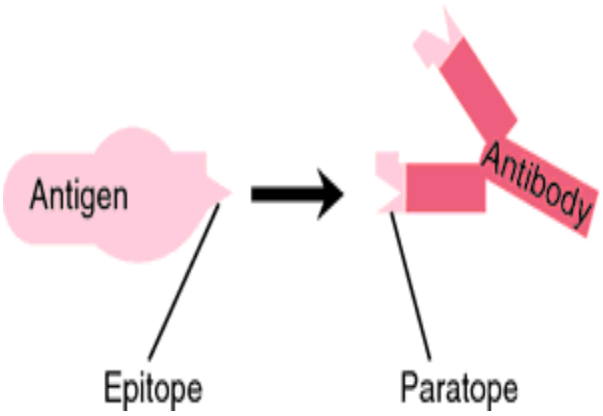
اسم المادة: المناعة
عنوان المحاضرة : Antigen –antibody reaction
الاستاذ المساعد الدكتور صفاء عبد لطيف المعيني

ANTIGEN-ANTIBODY REACTIONS

NATURE OF ANTIGEN-ANTIBODY REACTIONS

- **Lock and Key Concept**

The combining site of an antibody is located in the Fab portion of the molecule and is constructed from the hyper-variable regions of the heavy and light chains. X-Ray crystallography studies of antigen-antibody interactions show that the antigenic determinant nestles in a cleft formed by the combining site of the antibody. Thus, our concept of antigen-antibody reactions is one of a key (*i.e.* the antigen) which fits into a lock (*i.e.*the antibody).



- **Non-covalent Bonds**

The bonds that hold the antigen to the antibody combining site are all non-covalent in nature. These include **hydrogen bonds**, **electrostatic bonds**, **Van der Waals forces** and **hydrophobic bonds**. Multiple bonding between the antigen and the antibody ensures that the antigen will be bound tightly to the antibody.

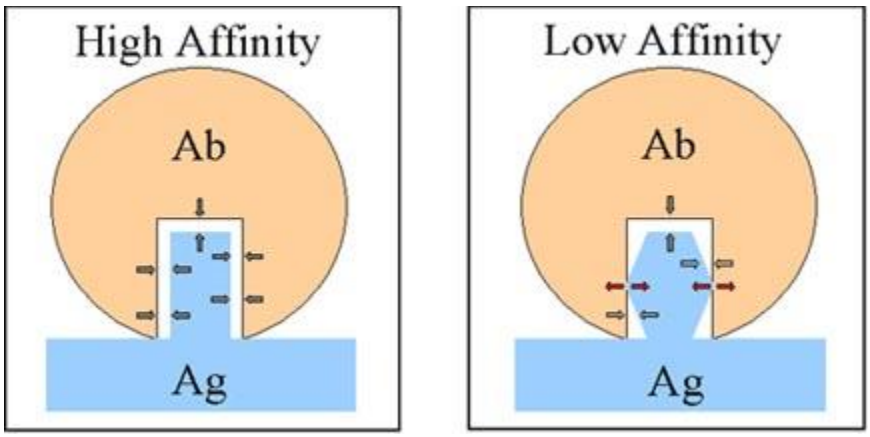
- **Reversibility**

Since antigen-antibody reactions occur via non-covalent bonds, they are by their nature reversible.

AFFINITY AND AVIDITY

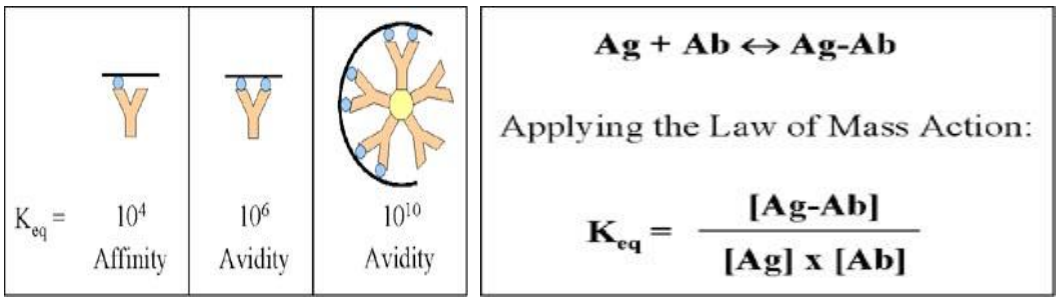
Affinity

Antibody affinity is the strength of the reaction between a single antigenic determinant and a single combining site on the antibody. It is the sum of the attractive and repulsive forces operating between the antigenic determinants.



Avidity

Avidity is a measure of the overall strength of binding of an antigen with many antigenic determinants and multivalent antibodies.



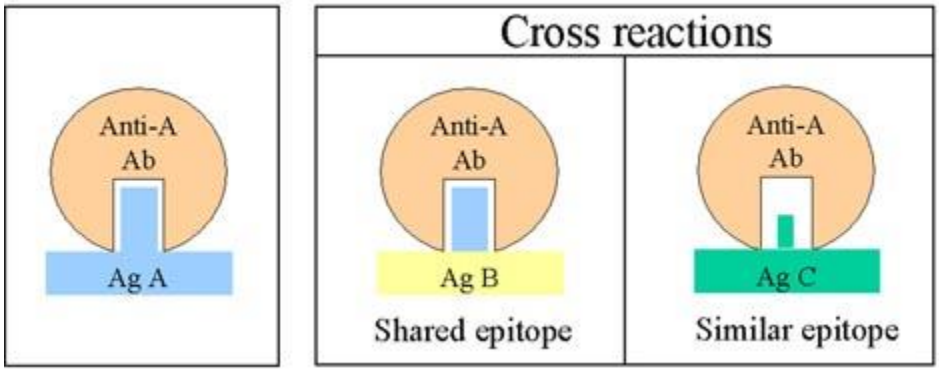
SPECIFICITY AND CROSS REACTIVITY

Specificity

Specificity refers to the ability of an individual antibody combining site to react with only one antigenic determinant or the ability of a population of antibody molecules to react with only one antigen. In general, there is a high degree of specificity in antigen-antibody reactions.

Cross reactivity

Cross reactivity refers to the ability of an individual antibody combining site to react with more than one antigenic determinant or the ability of a population of antibody molecules to react with more than one antigen.



Factors affecting measurement of antigen-antibody reactions

The only way that one knows that an antigen-antibody reaction has occurred is to have some means of directly or indirectly detecting the complexes formed between the antigen and antibody. The ease with which one can detect antigen-antibody reactions will depend on a number of factors.

1. **Affinity**

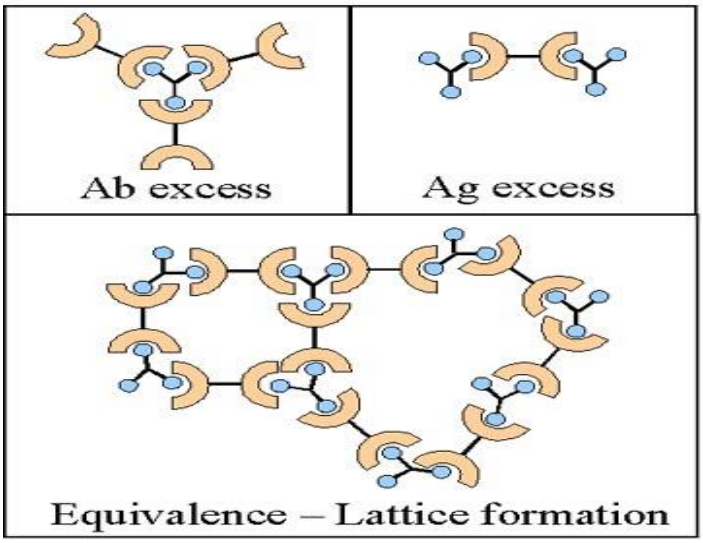
   The higher the affinity of the antibody for the antigen, the more stable will be the interaction. Thus, the ease with which one can detect the interaction is enhanced

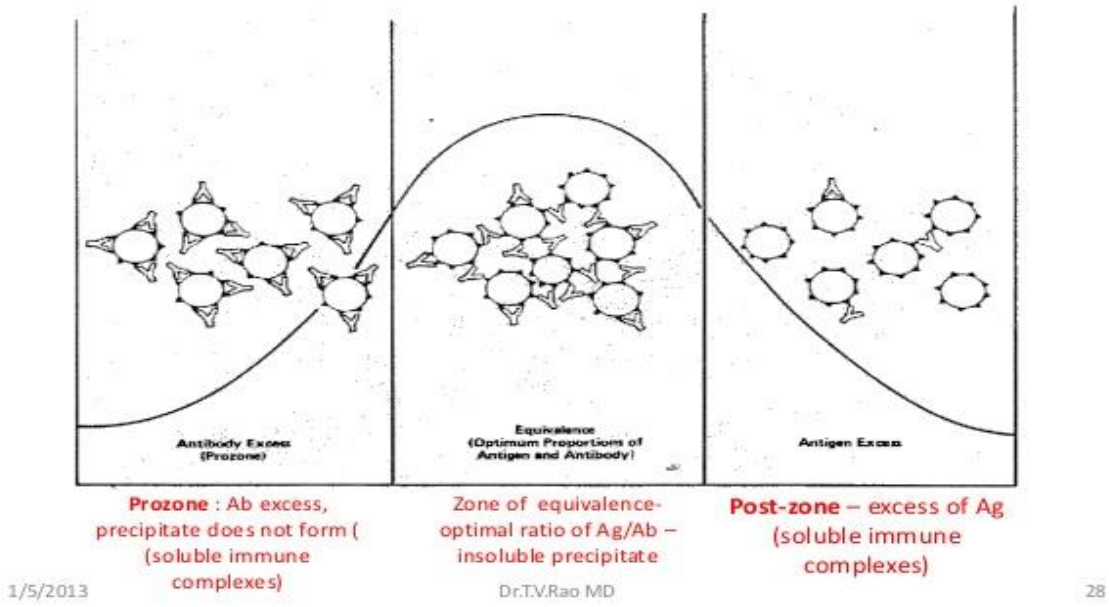
2. **Avidity**

   Reactions between multivalent antigens and multivalent antibodies are more stable and thus easier to detect

3. **Antigen to antibody ratio**

   The ratio between the antigen and antibody influences the detection of antigen-antibody complexes because the size of the complexes formed is related to the concentration of the antigen and antibody





4. **Physical form of the antigen**

The physical form of the antigen influences how one detects its reaction with an antibody. If the antigen is a particulate, one generally looks for agglutination of the antigen by the antibody. If the antigen is soluble one generally looks for the precipitation of the antigen after the production of large insoluble antigen-antibody complexes.

TESTS FOR ANTIGEN-ANTIBODY REACTIONS

1- Agglutination Tests

a) Agglutination/Hemagglutination
b) Passive hemagglutination
c) Coomb's Test (Antiglobulin Test)
d) Hemagglutination Inhibition

2- Precipitation tests

a) Radial Immunodiffusion (Mancini)
b) Immunoelectrophoresis
c) Countercurrent electrophoresis

3- Radioimmunoassay (RIA)/Enzyme Linked Immunosorbent Assay (ELISA)
4- Complement Fixation

What are antibody tests?

Antibody tests involve analysing a patient's sample (usually blood) for the presence or absence of a particular antibody (qualitative) or for the amount of antibody that is present (quantitative)

Why are antibody tests done?

The main reasons that antibody tests are done or antibody concentrations are measured are to:

- Document exposure to an infectious or foreign agent

- Evaluate protection level (immune status) against a particular microorganism
- Diagnose an autoimmune condition
- Diagnose the reason for a transfusion reaction or a rejection of a transplanted organ
- Diagnose an allergy
- Monitor the course of an infection or autoimmune process

References:-

1- Richard Coioco and Geoffery Sunshine (2014). Immunology.Seventh edition.Wiley Blackwell.