Antigen and Antibody Interactions

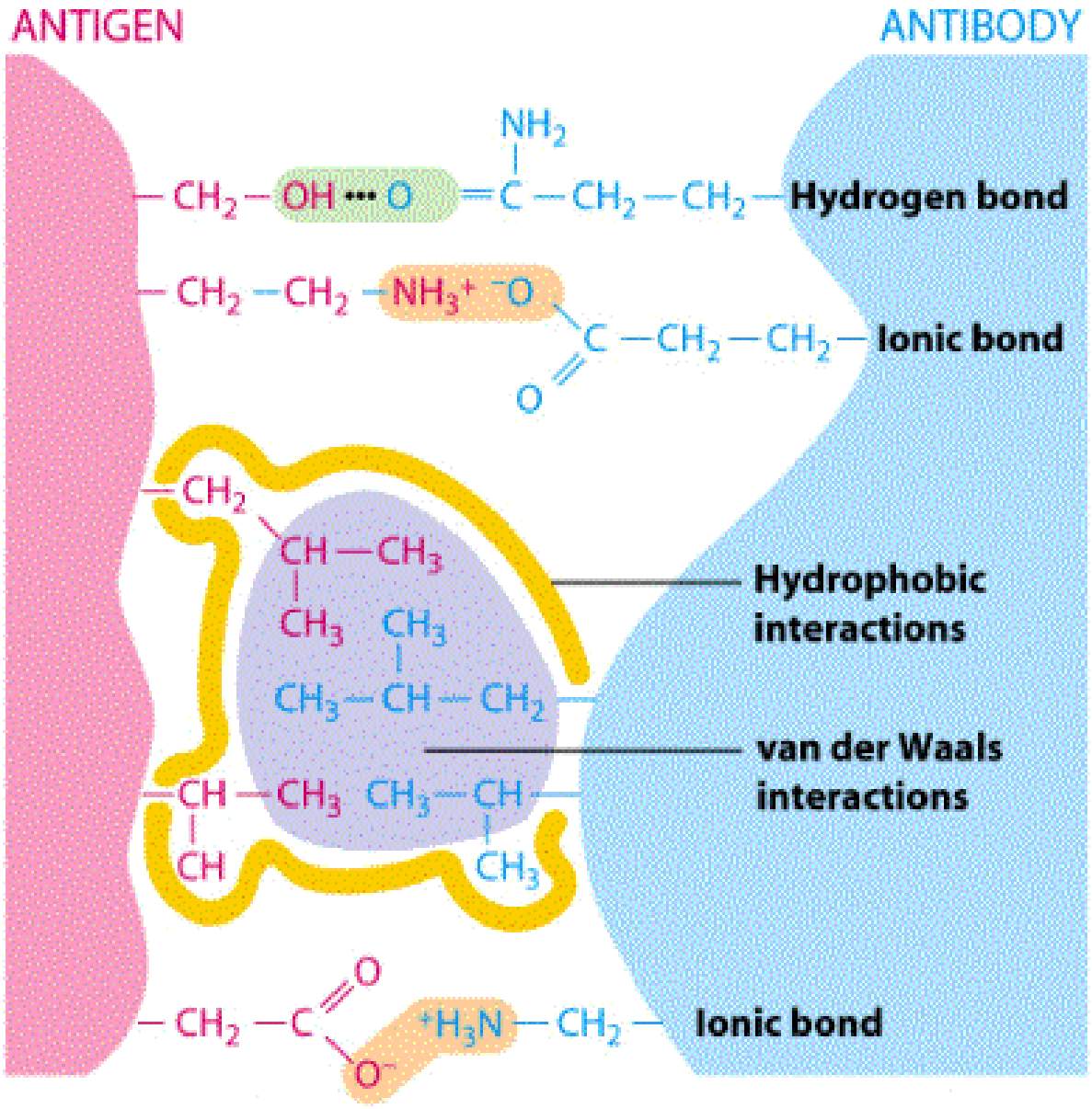
- **Antigen - antibody interactions** are important tools for **research** in immunology.

- They also play a very significant part in **diagnosis** of various diseases because they are very sensitive.

Antigen –antibody interaction requires non-covalent forces:

- Hydrogen bonds
- Ionic bonds
- Hydrophobic interactions
- Van der Waals interactions (When two atoms get too close, they strongly repel each other.)

Strong interactions require a **close fit** and operate best over short distances (1×10^{-7} mm)


ANTIGEN
ANTIBODY
Hydrogen bond
Ionic bond
Hydrophobic interactions
van der Waals interactions
Ionic bond

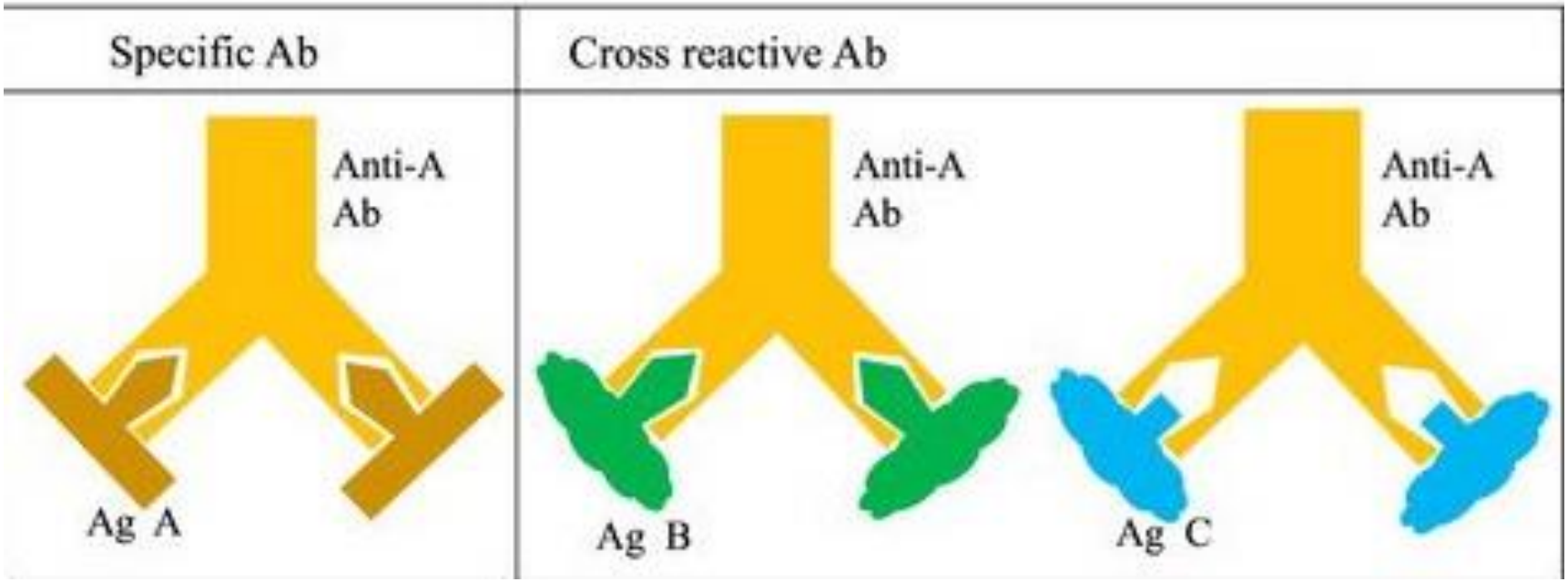
Cross Reactivity

- Antibody elicited by one antigen can **cross react** with an unrelated antigen

- It is caused by an **identical or similar epitope** on the antigens

  Example

  Damage of heart and kidney tissue following *Streptococcus pyogenes* infection


Specific Ab
Cross reactive Ab
Anti-A
Ab
Ag A
Anti-A
Ab
Ag B
Anti-A
Ab
Ag C

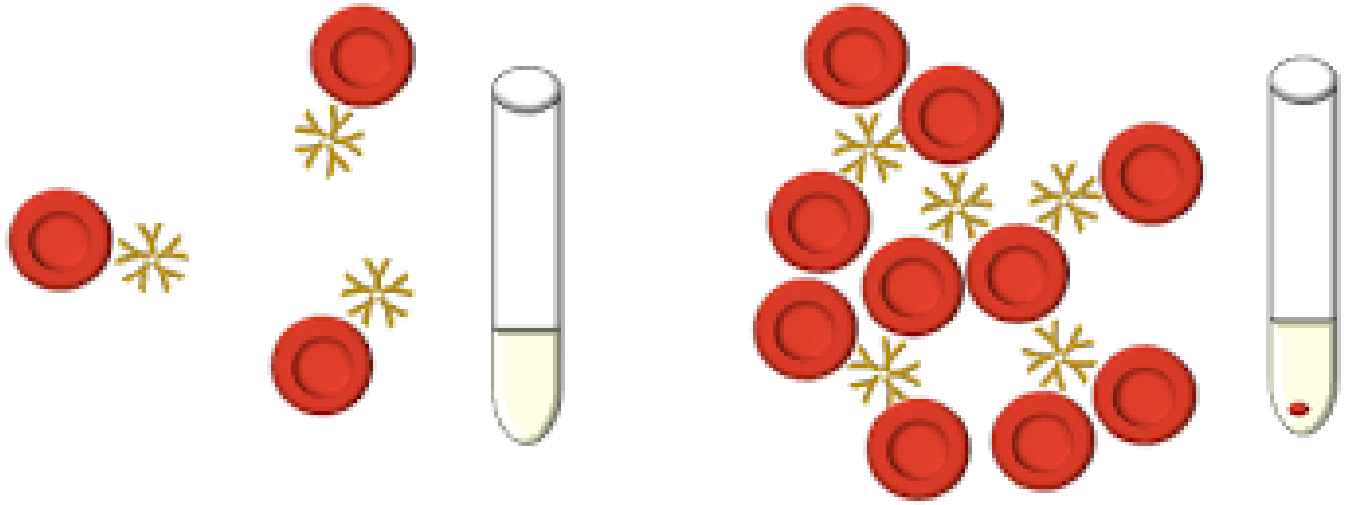
PRECIPITATION REACTIONS

Precipitation Reactions are very important immunological assays.

- By definition **Precipitation** is the formation of a **solid mass** as a result of a **chemical reaction** that occurs between two ionic components (which in this case are antigen and antibody).
- **Both** antigen and antibody are soluble so they are not visible before interaction.
- **Precipitins** are antigens that form a **precipitate** after interacting with antibody.

Precipitation Reactions in aqueous solutions

- Ag-Ab interaction in aqueous solution form **lattice** that can be precipitated.
- Formation of the Ag-Ab lattice depends on the **valency** of the Ab and Ag.
- IgM pentamers have a valency of 10, so they can form a lattice **much more easily** as compared to e.g., IgG which is a monomer and has only 2 valencies.



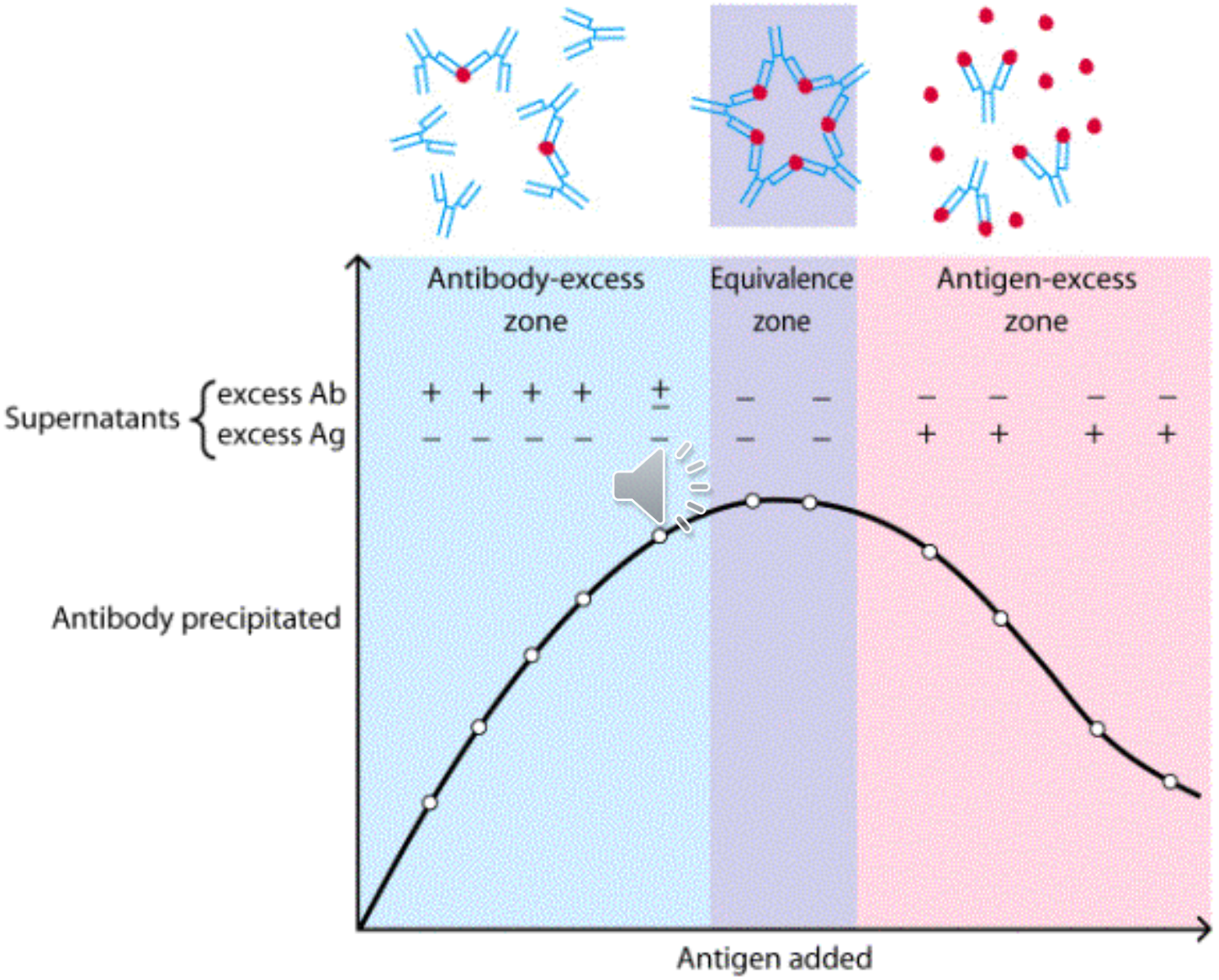
Equivalence zone:

Precipitation curve for an Ag and its Ab's:

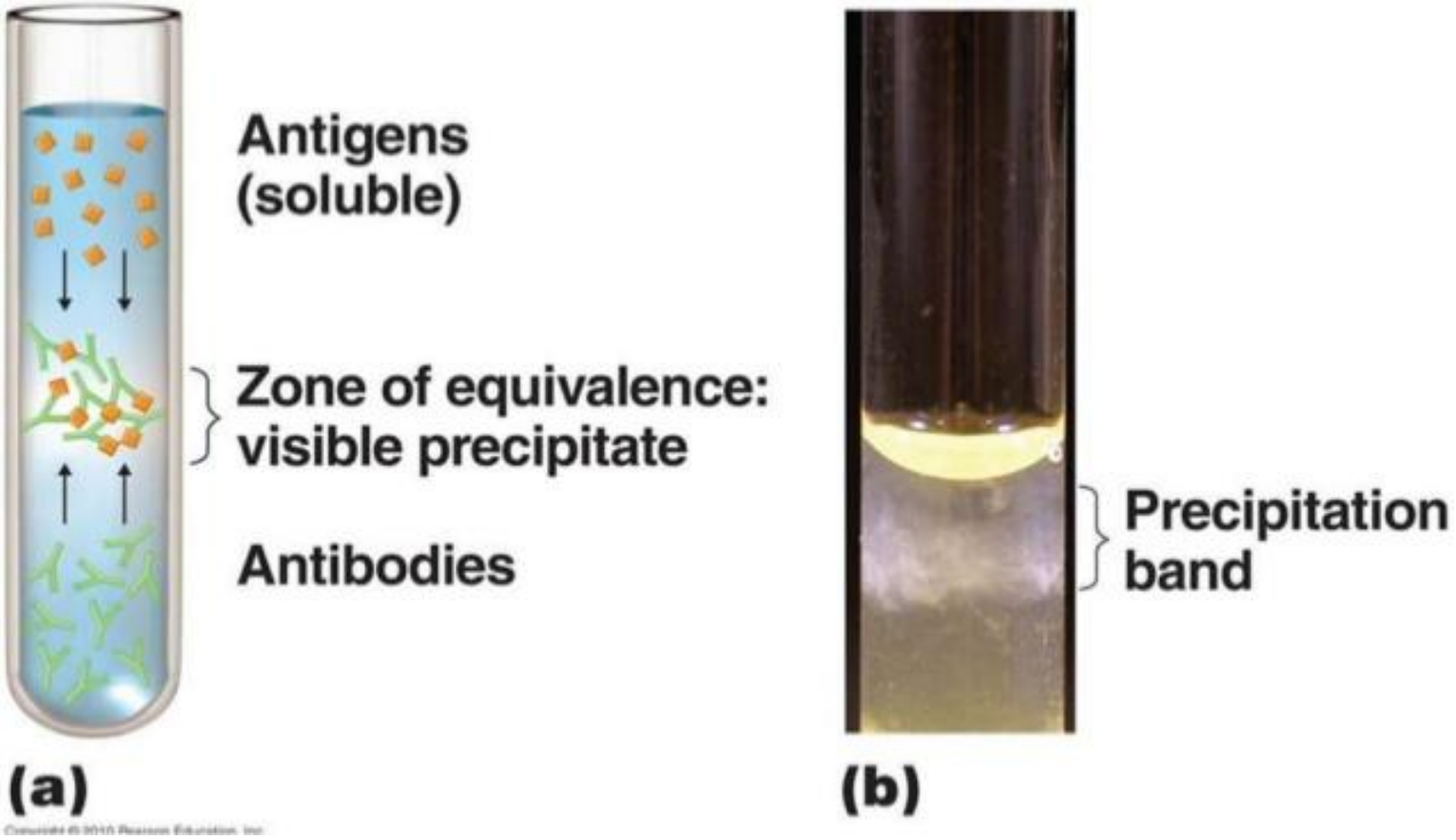
There are **three** zones in an Antigen Antibody reaction.

1. Antigen excess zone
2. Equivalence Zone
3. Antibody excess zone

In **Equivalence Zone** the Antigen and Antibody ratio is **optimal** and a large multimolecular lattice is formed which is **visible with naked eye.**


Antibody-excess zone
Equivalence zone
Antigen-excess zone
Supernatants
excess Ab
excess Ag
Antibody precipitated
Antigen added

Precipitation Reaction as happens in VITRO



Immuno-diffusion reactions

These are **Precipitation reactions** in which a **semi-solid gel** is a medium instead of a liquid.

These are used to determine the **relative concentrations** of antibody and antigen, to **compare antigens** or to determine the **purity of antigen.**

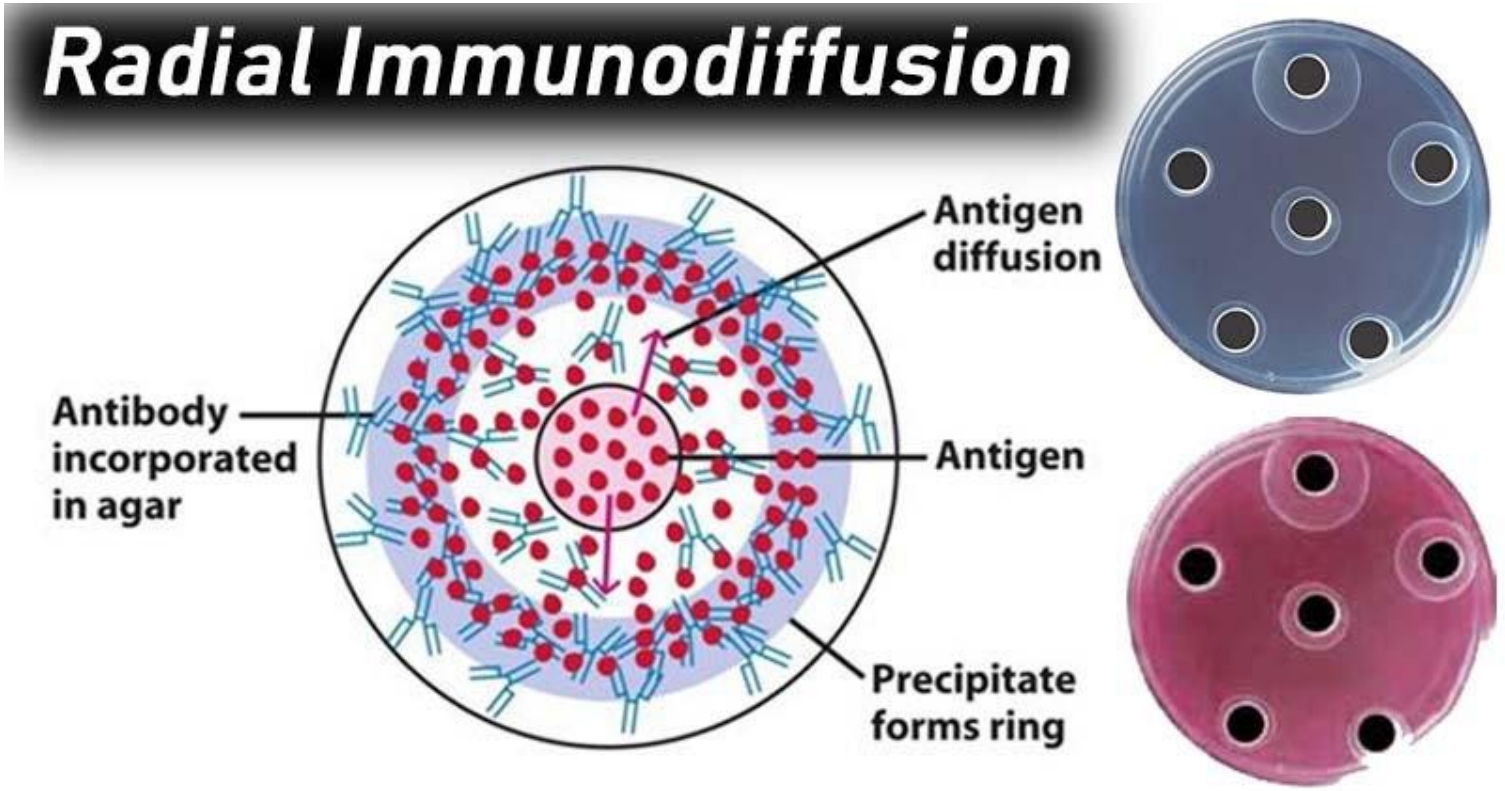
There are two types:

1. **Mancini Radial Immunodiffusion**

2. **Ouchterlony Double Immunodiffusion**

Mancini Radial Immunodiffusion

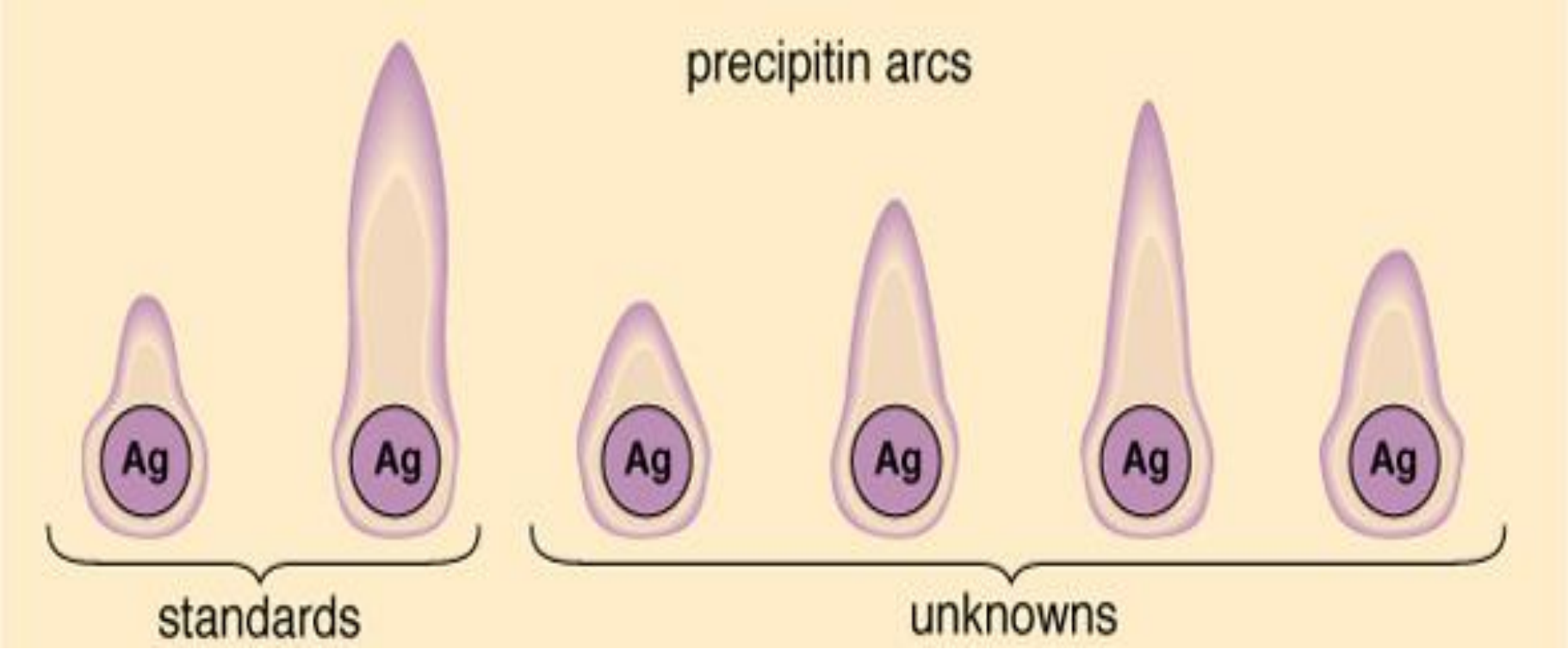
Antigen sample is placed in a **well** within a semisolid medium which contains antiserum. Equivalence zone generates a **precipitin ring.**



Rocket electrophoresis

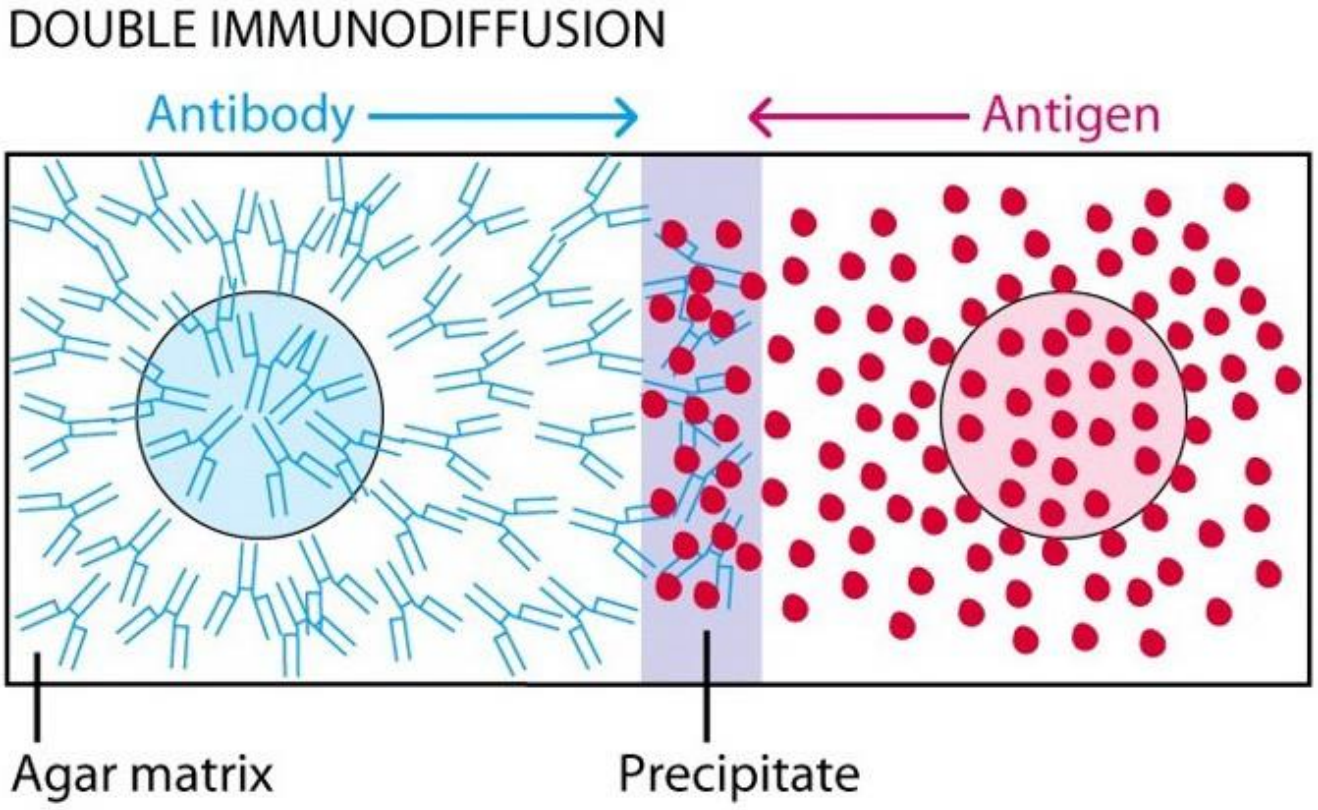
- **Antiserum is incorporated into the agar** which is then poured onto a large plate to cool.
- **Wells are cut along one end** and filled with standard solutions of the **antigen** or with the **unknown solution**.
- An **electric current** is passed which drives the antigen.
- Antigen **precipitates** where its **concentration is equal to that of antiserum (antibody)** in the agar.

- The height of the "rocket" is **proportional** to the concentration of antigen in the well, and the amount of antigen is determined by referring to the standard curve.



Ouchterlony Double Immunodiffusion

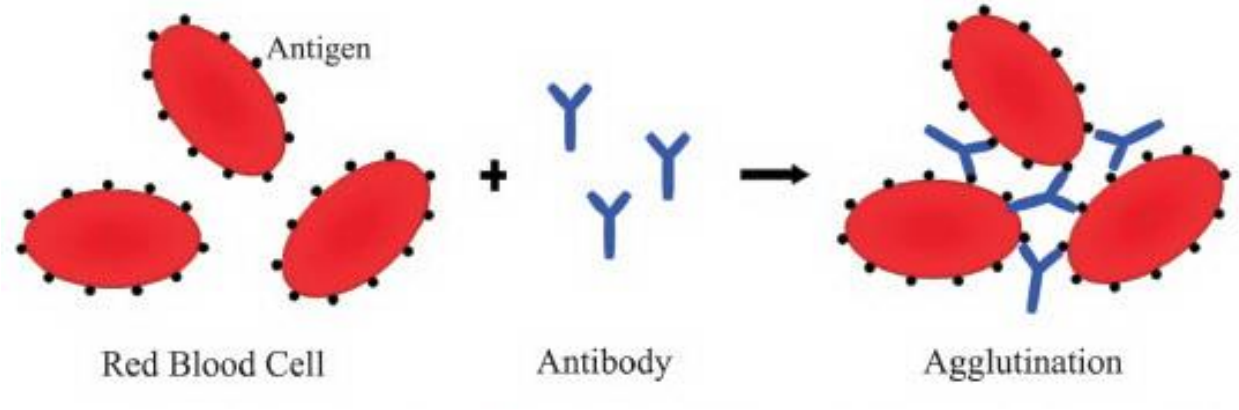
Both antigen and antibody diffuse through semisolid medium. Equivalence zone generates a **precipitin line.**

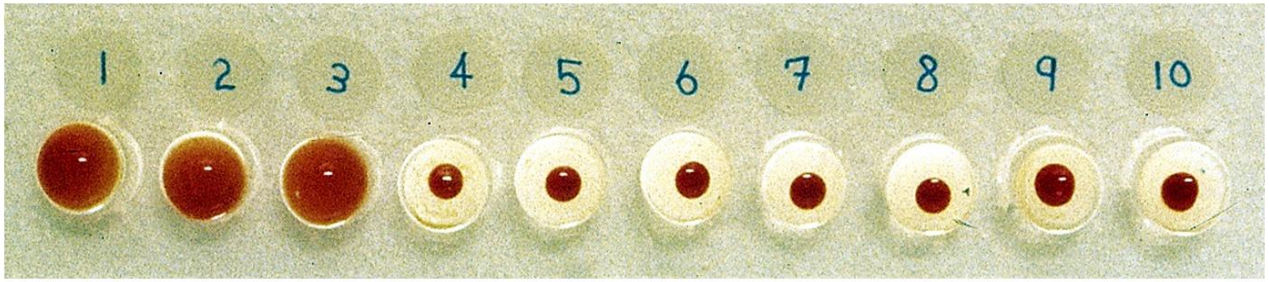


AGGLUTINATION REACTIONS

- **Agglutination** is the formation of a **solid mass** by **aggregating** suspended particles in a solution.
- Agglutination involves the combination of **particulate antigens** (for example cells) and specific antibodies to form a clump.
- In contrast, **precipitation** involves **soluble antigens** which interacts chemically with specific antibodies.

- Agglutination- interaction between antibody and antigen results in **visible clumping.** Reactions depend on **crosslinking**.





Applications:

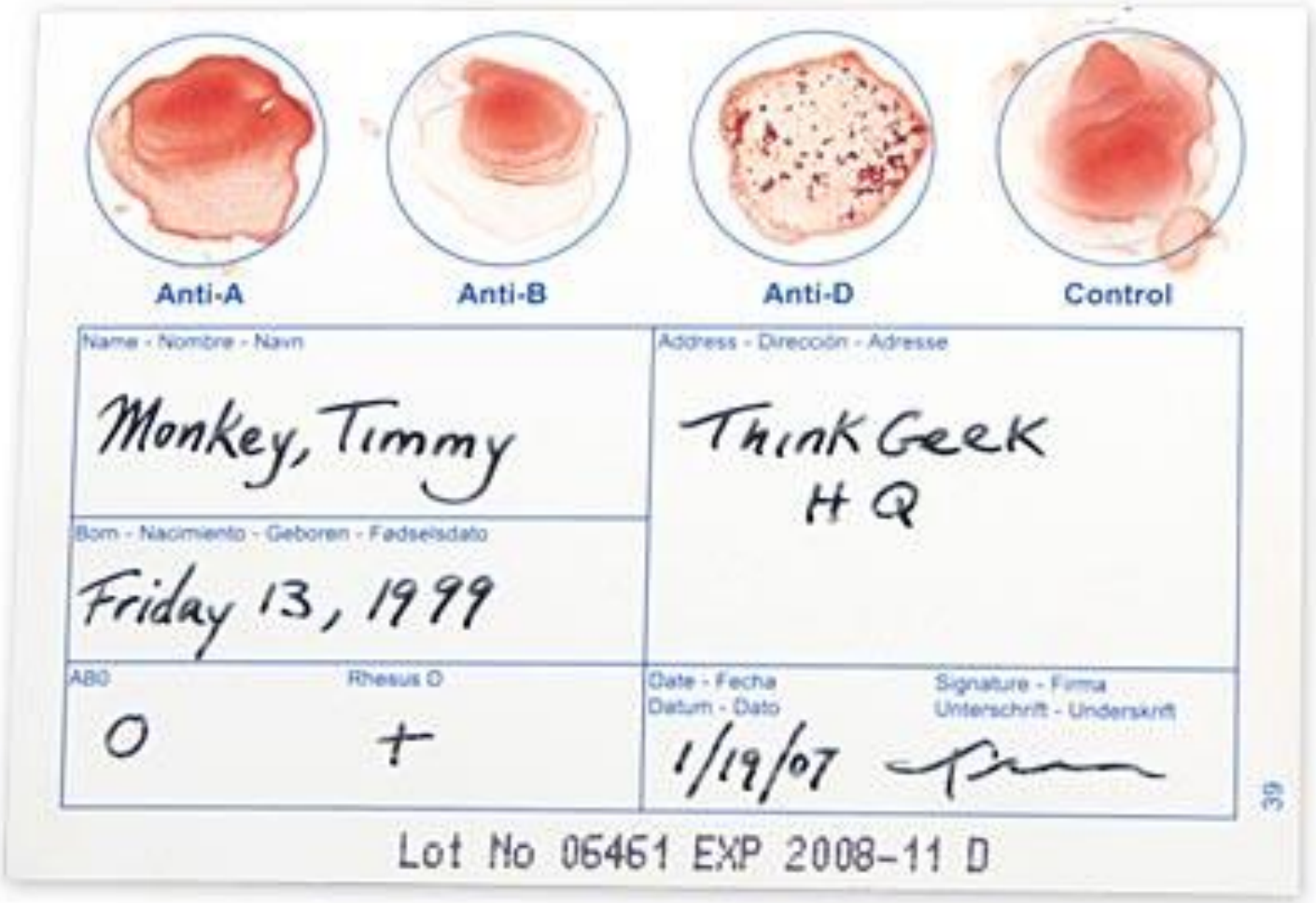
Hemagglutination

Hemagglutination, is a specific form of agglutination that involves **red blood cells** (RBCs).

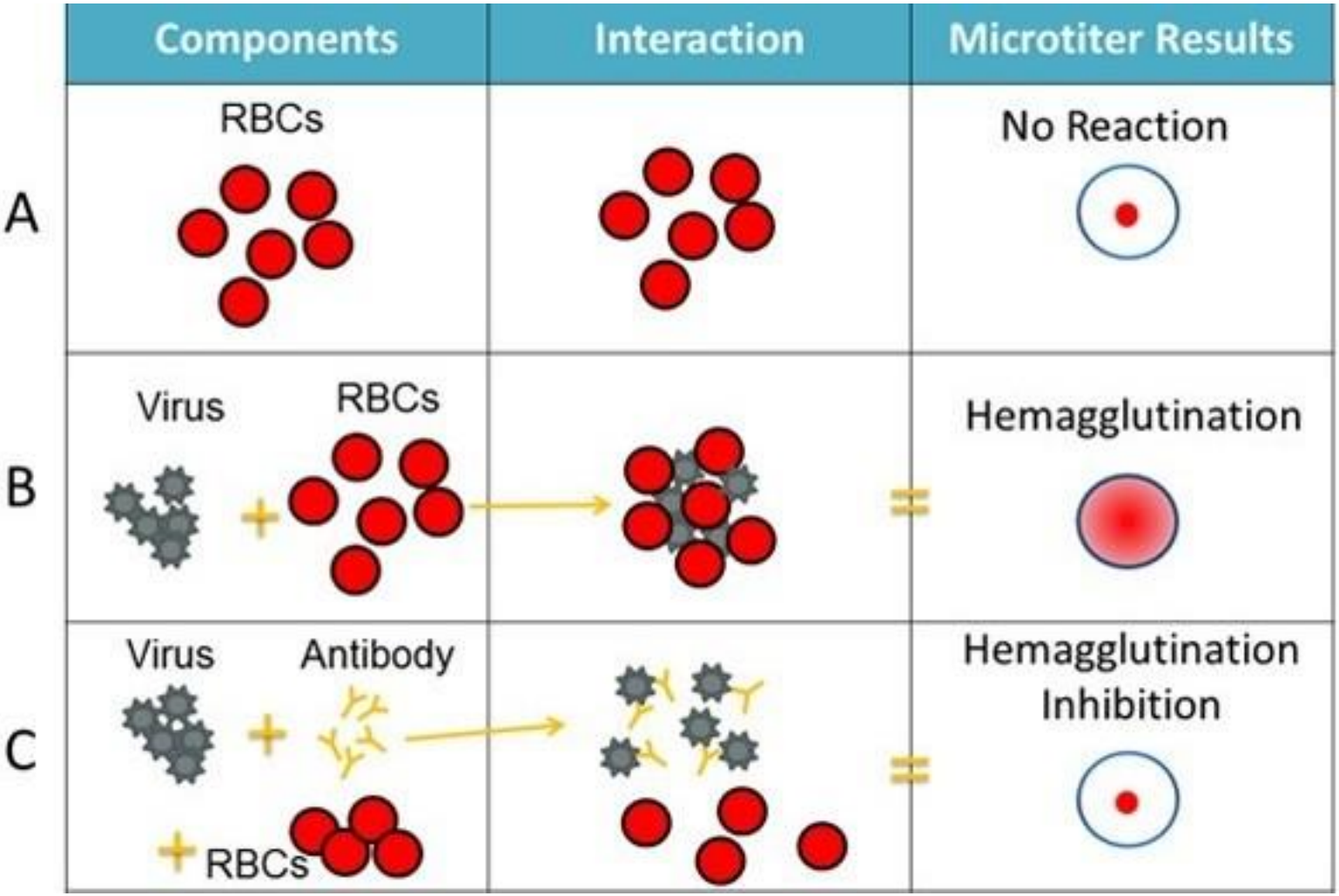
It has two common uses in the laboratory:

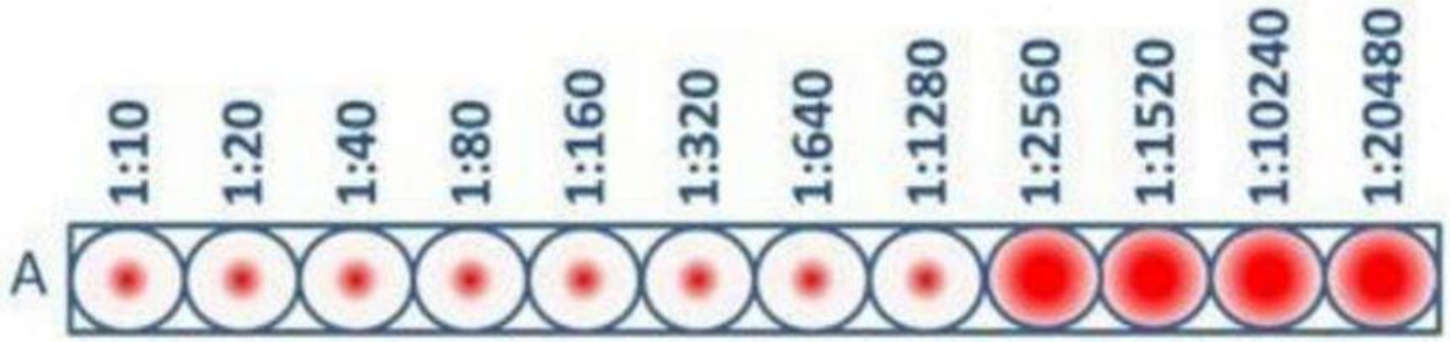
- **blood typing**
- **quantification of virus dilutions**

Blood typing



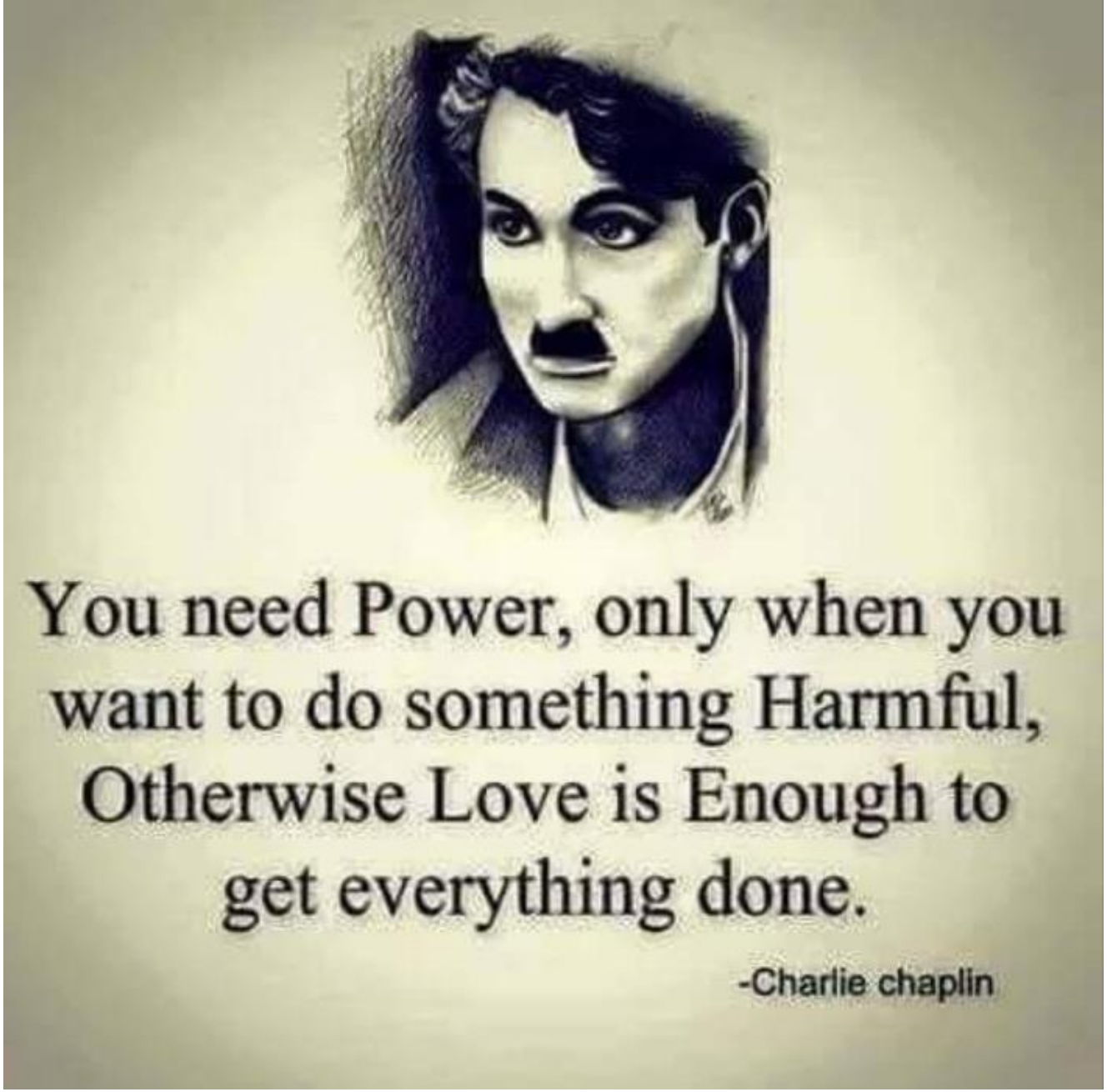
Viral quantification





- *This virus sample has an HAI titer of 1280, which means that the greatest dilution of antibody that still blocked hemagglutination from occurring was at 1280 dilution. At this dilution, the antibodies were still capable of recognizing and binding to the antigens on the virus.*

Bacterial agglutination to diagnose infection


You need Power, only when you want to do something Harmful, Otherwise Love is Enough to get everything done.
-Charlie chaplin

My Award winning Photography: Hunza peak and Lady Finger Peak


Thank You!