

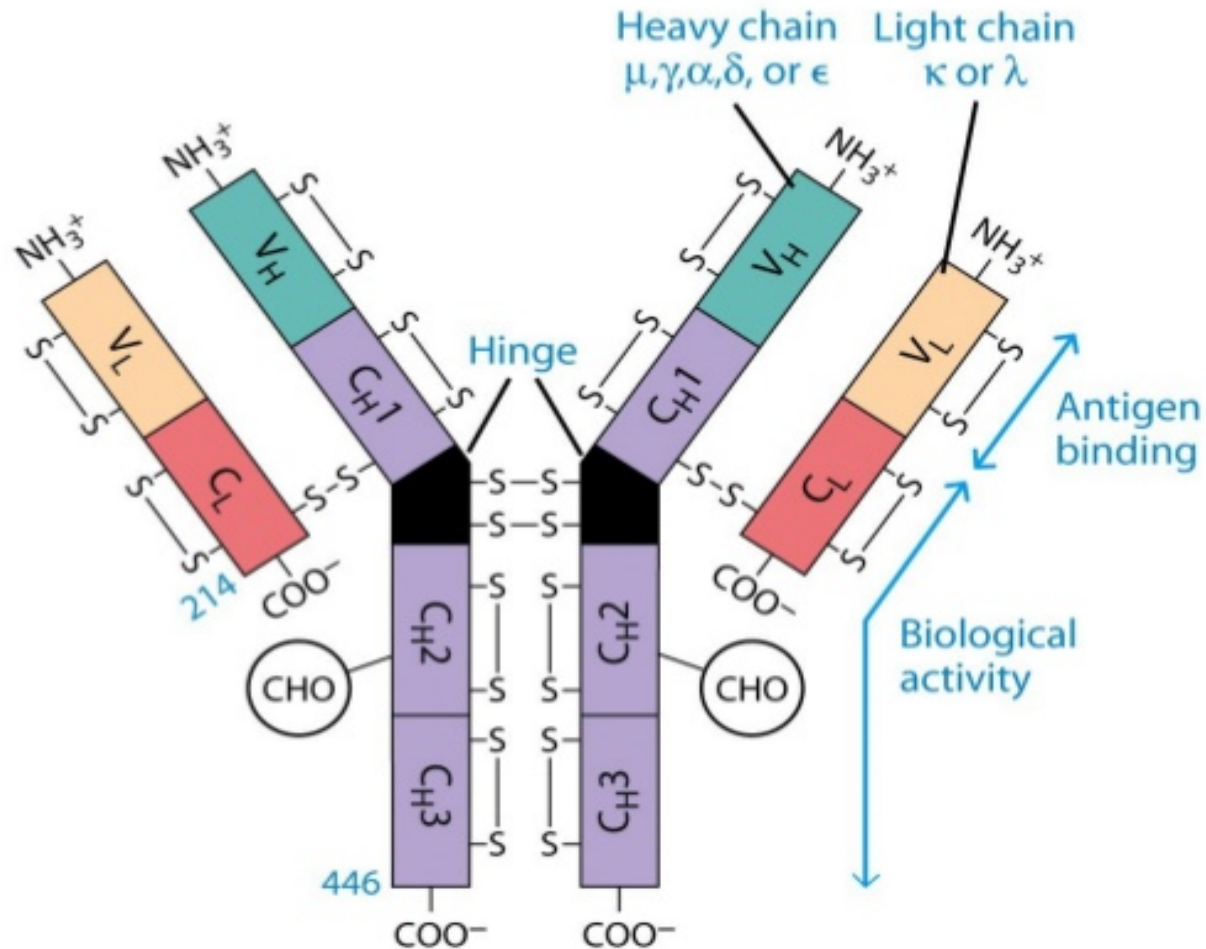
Immunoglobulin: Ab-Ag Interactions

Learning outcome

Student should be able to:

1. Explain the difference between antibody variation; **isotype**, **allotype** and **idotype**
2. Compare between **polyclonal** and **monoclonal** antibody.
3. Compare between **affinity** and **avidity** meaning

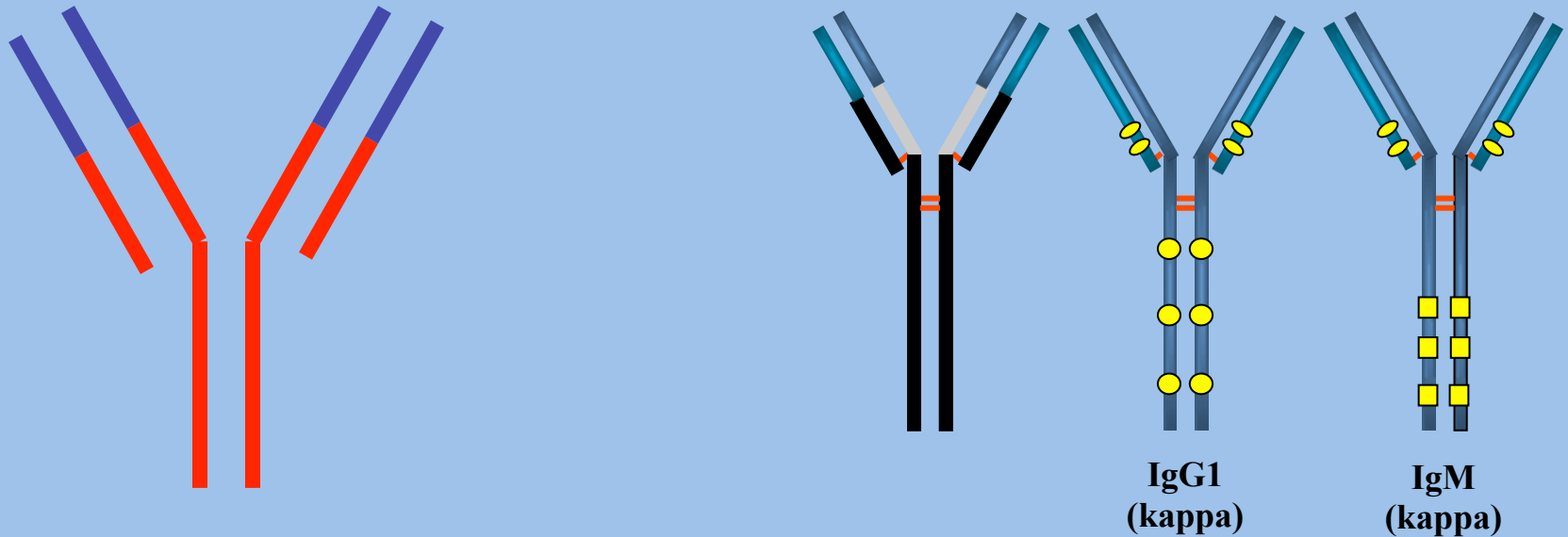
Antibody structure



Types of Ig variation

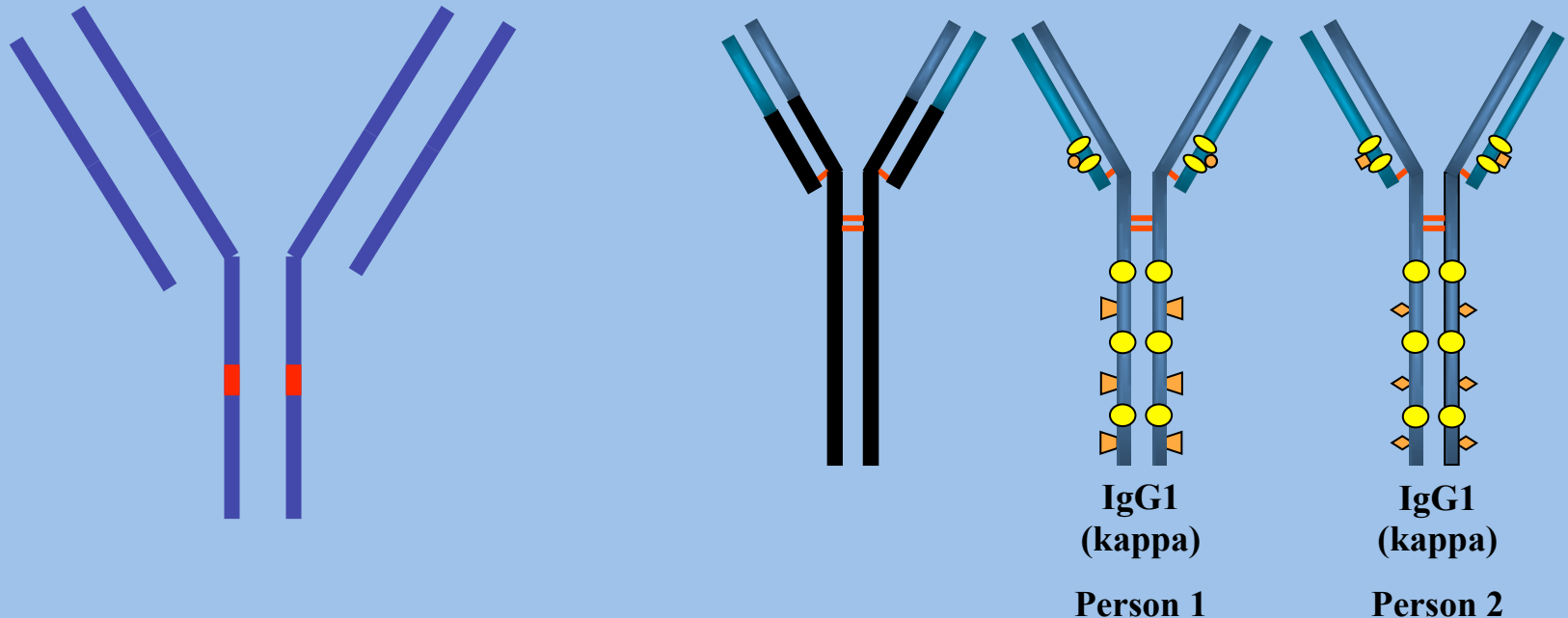
1. Isotype
2. Allotype
3. Idiotype

1. Isotypic variation



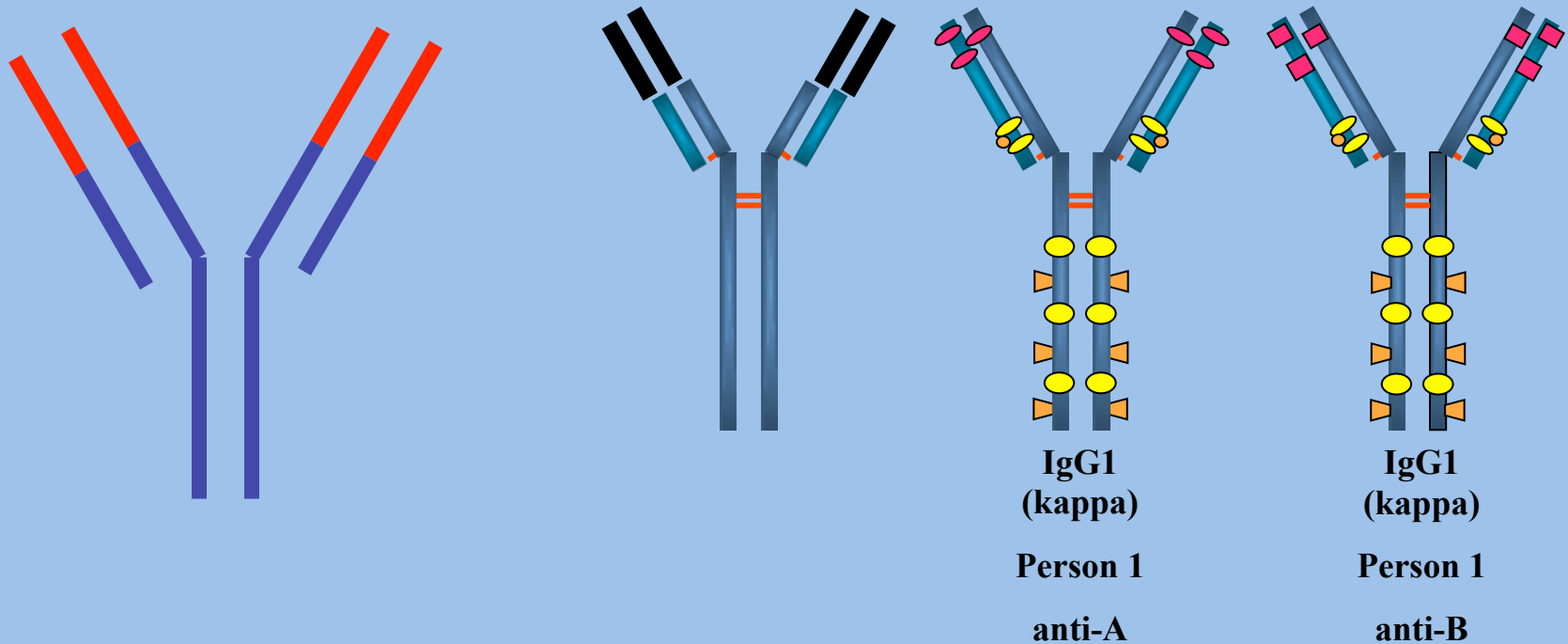
Isotypic variation (Iso, the same). The genes for isotypic variation are present in all members of a given species. Examples include alternative λ or κ alternative forms of light chain and the different heavy chains $\gamma 1$ $\gamma 2$ $\gamma 3$ $\gamma 4$ μ δ $\alpha 1$ $\alpha 2$ and ϵ .

2. Allotypic variation



Allotypic Variation (allos, other) This refers to variation in a population present in some individuals but not others. This variation is encoded in alternative alleles of a given gene . Most Ig allotypes are due to one single amino acid differences or might be two particularly in the heavy chain gene sequences.

3. Idiotypic variation



Idiotypic variation (idios, own or personal). Differences in structure of the antibody variable region or Ag binding site give rise to idiotypic variation. Hypervariable regions contribute strongly. Abs of the same class but different specificity will have different idiotypes.

Summary

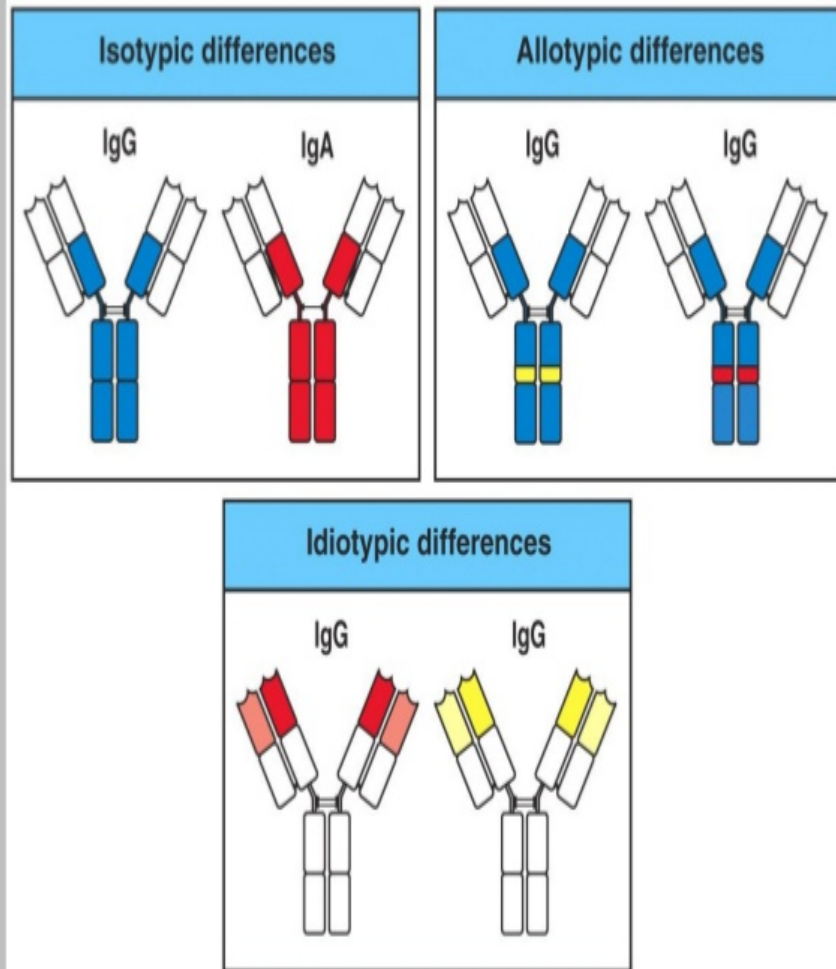


Figure 4-24 Immunobiology, 6/e. (© Garland Science 2005)

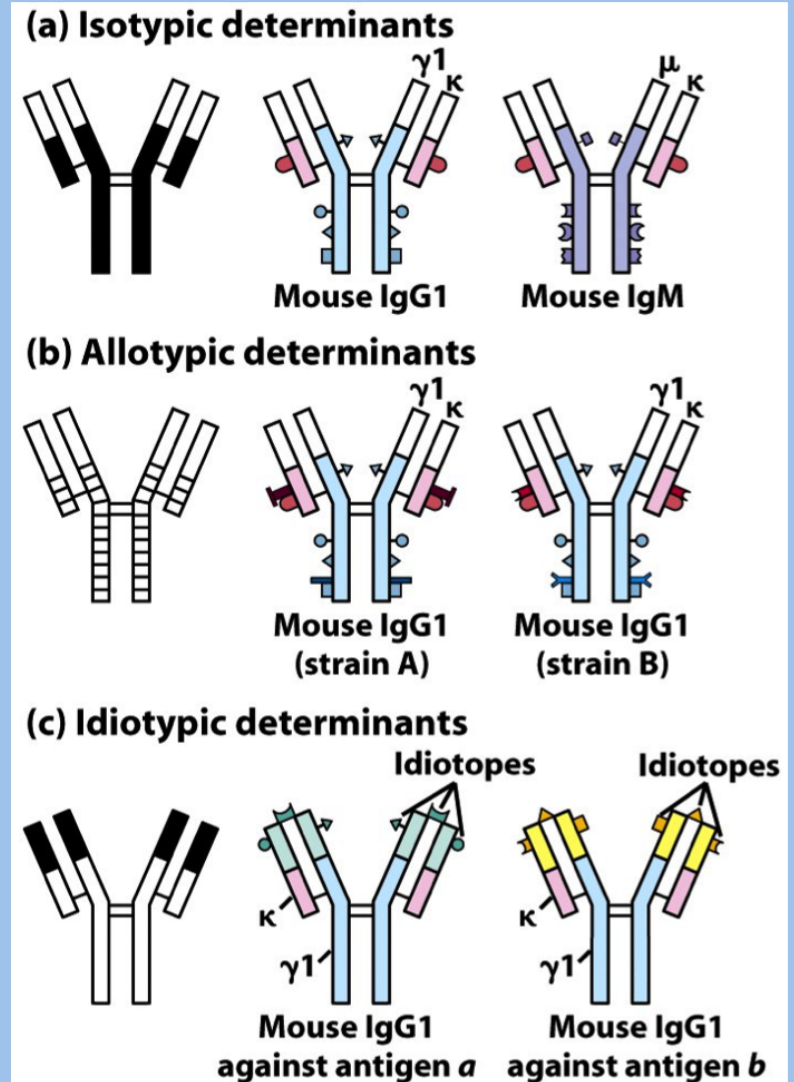


Figure 4-21

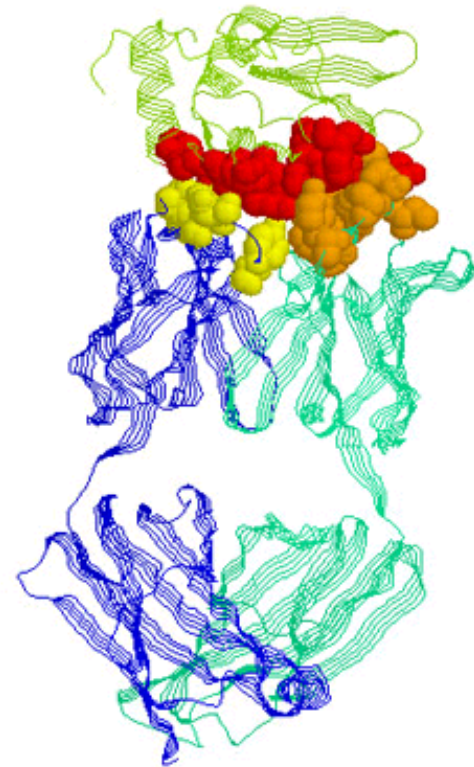
Kuby IMMUNOLOGY, Sixth Edition

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Nature of Ag/Ab Reactions

- **Lock and Key Concept**
- **Non-covalent Bonds**
 1. Hydrogen bonds
 2. Electrostatic bonds
 3. Van der Waal forces
 4. Hydrophobic bonds
- **Multiple Bonds**
- **Reversible**

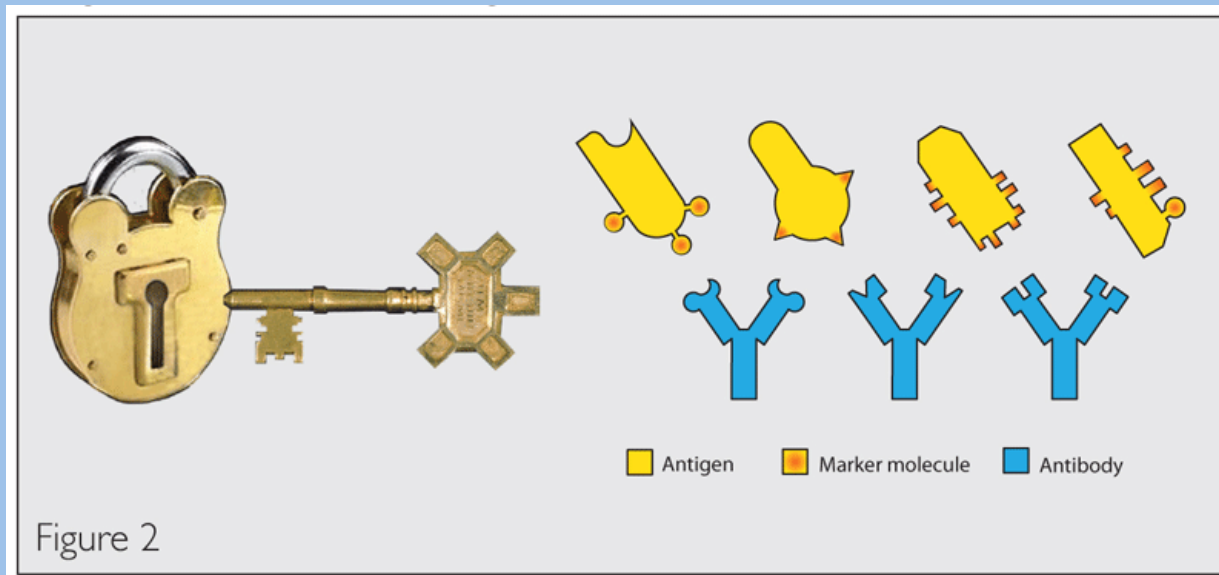
<http://www.med.sc.edu:85/chime2/lyso-abfr.htm>



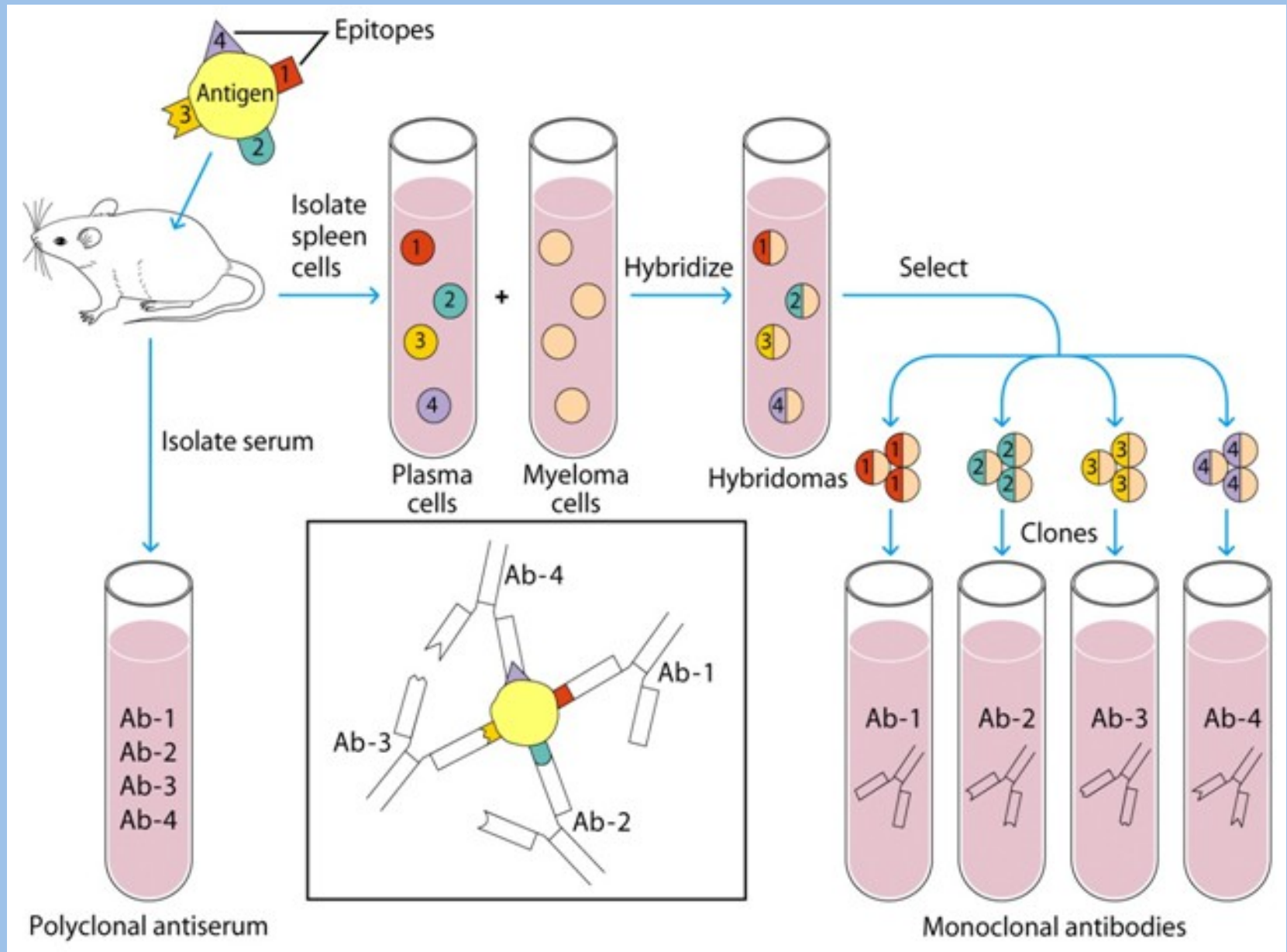
MDL

Ab/Ag interactions

Binding of an antibody to a specific antigen is one key characteristic of the antibody molecule.



Polyclonal vs. Monoclonal antibody



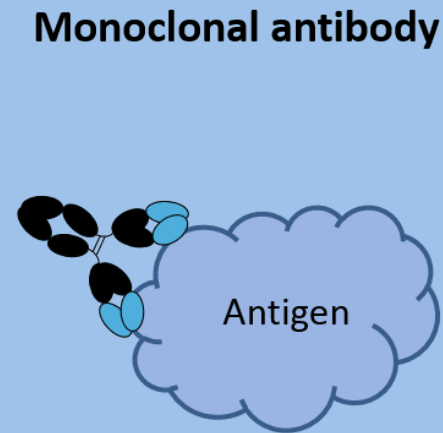
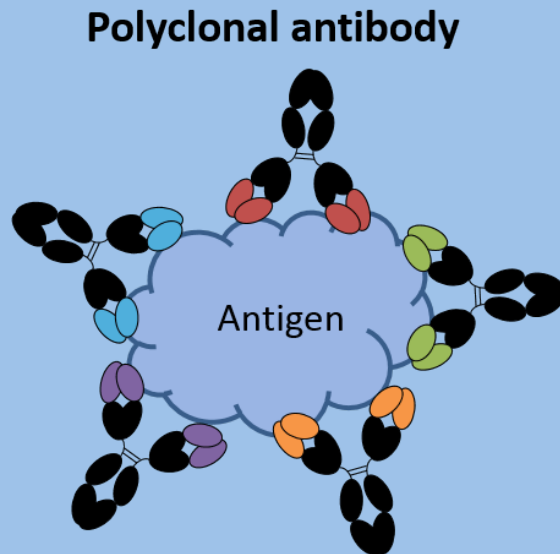
Polyclonal Vs Monoclonal antibody

In vivo Most antibody responses are polyclonal. That is we respond by producing a range of antibodies each with different antigen binding sites.

Polyclonal antibody represents a collection of antibodies from different B cells that recognize multiple epitopes on the same antigen

Polyclonal vs. Monoclonal antibody

Monoclonal antibody represents antibody from a single antibody producing B cell and therefore only binds with one unique epitope.

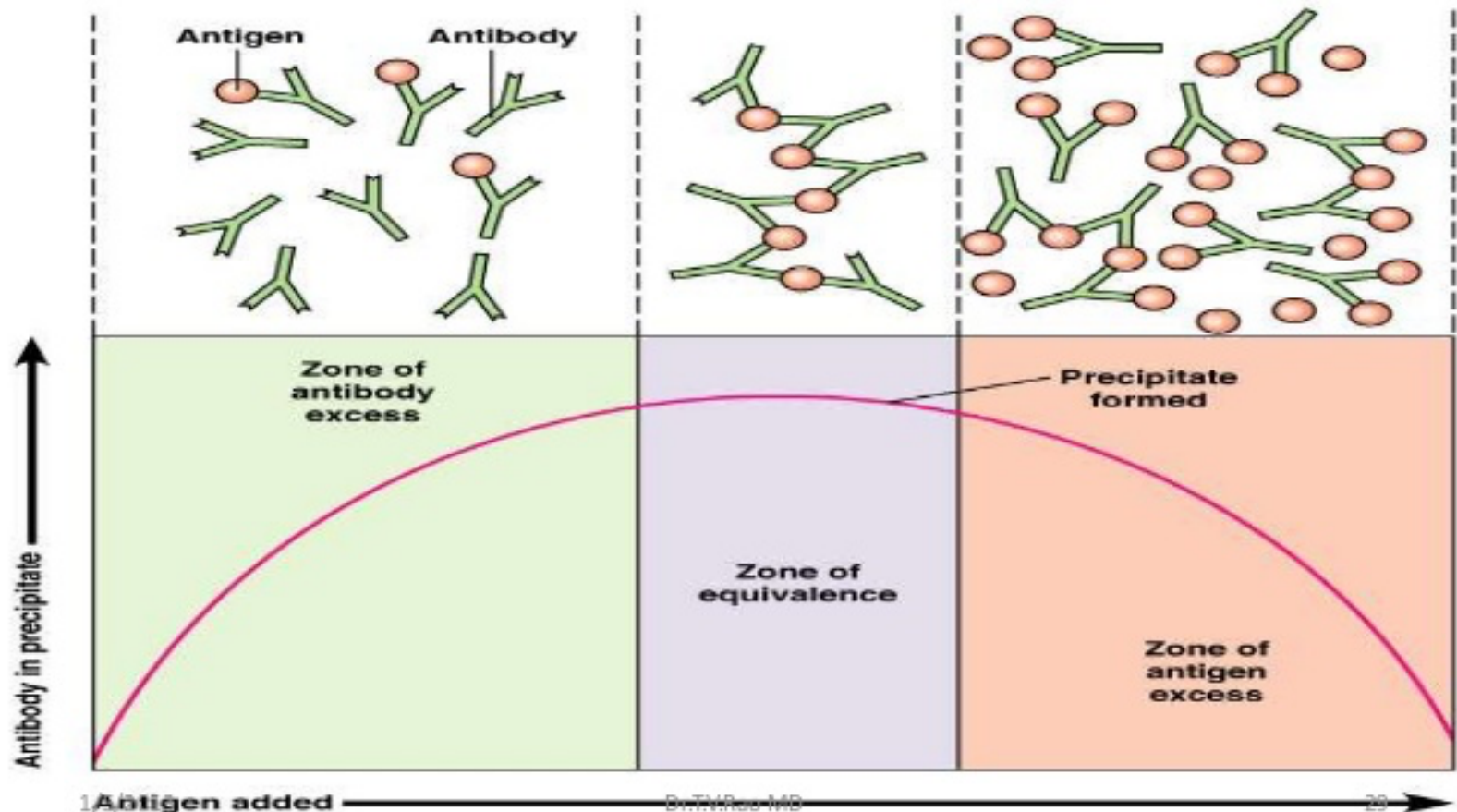


Factors Affecting Measurement of Ag/Ab Reactions

1. Affinity
2. Avidity
3. Ag:Ab ratio
4. Physical form of Ag

Ag:Ab ratio

Precipitation Curve



Antibody Affinity

Refers to the interaction of:

1. Monovalent Ag or single determinant with
2. Single Ab combining site
3. $\text{Ab} + \text{Ag} \xrightleftharpoons{\hspace{1cm}} \text{AbAg}$

Affinity is a measure of the binding strength between a single antigenic determinant and a single Ab combining site

Antibody Avidity

1. Ab are multivalent (IgM)
2. Multivalent Ag

Avidity is overall the strength of binding between multivalent antigen and antibody



Affinity



Avidity IgG

10^4 x greater



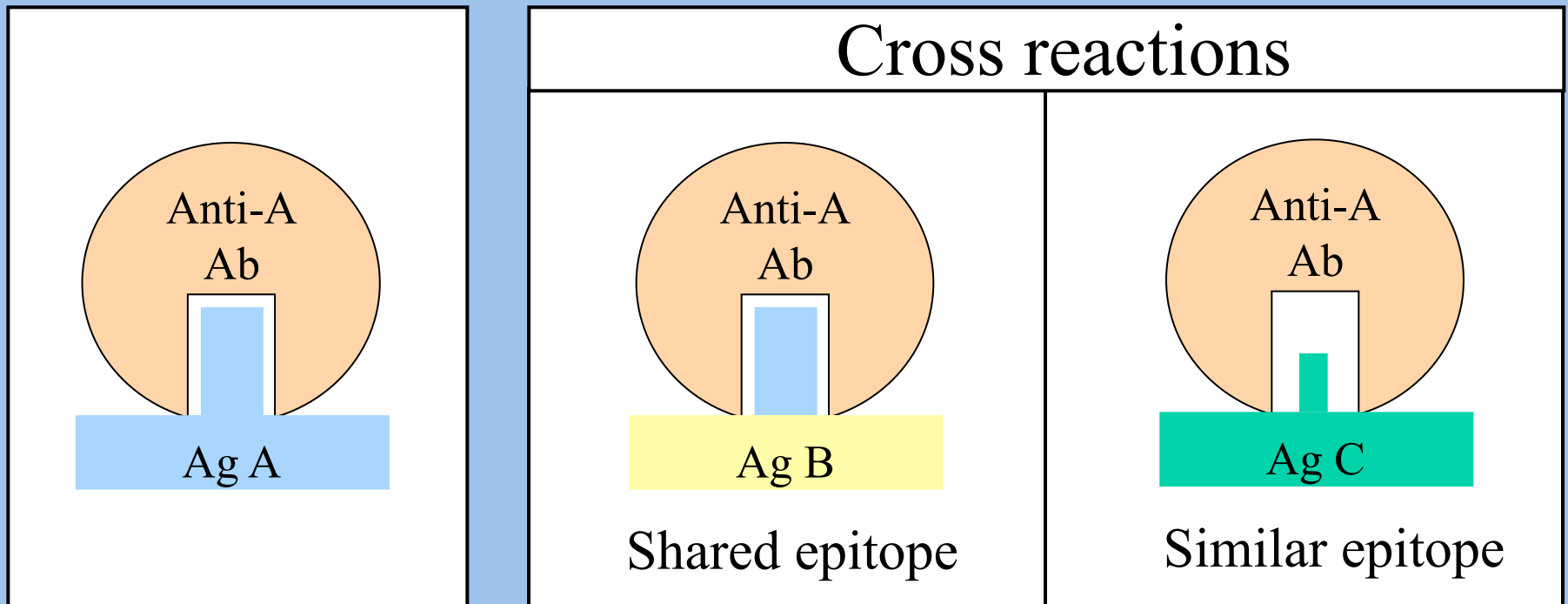
Avidity IgM

10^7 x greater

- In practice the **divalency** of IgG increases its binding to a **multimeric** Ag by around 10^4 times.
- The **pentameric** structure of **IgM** to around 10^7 times.

Cross Reactivity

- The ability of an individual Ab combining site to react with more than one antigenic determinant.
- The ability of a population of Ab molecules to react with more than one Ag



Any question