

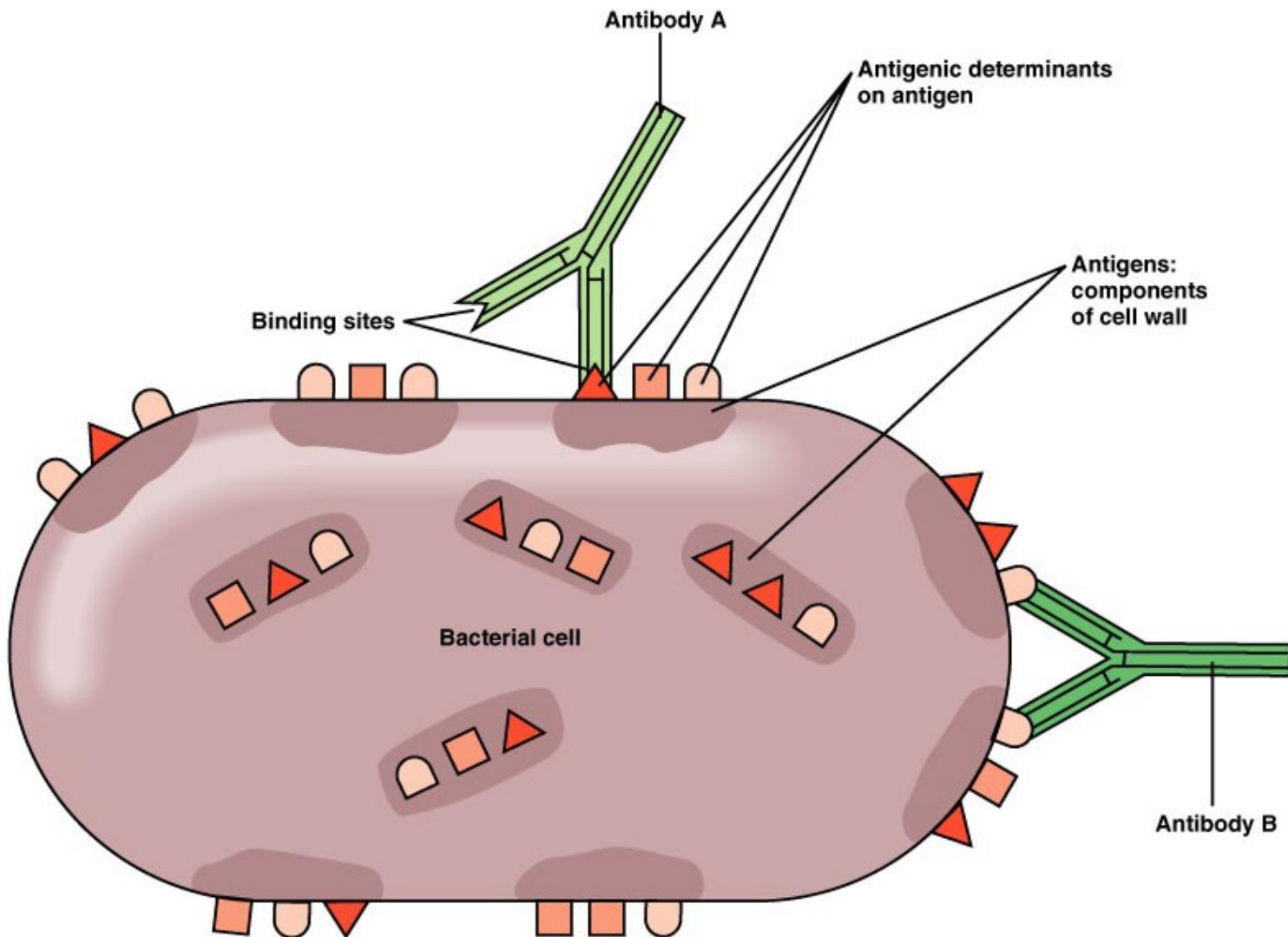
Imunoglobulins – structure and function

Production of immunoglobulins

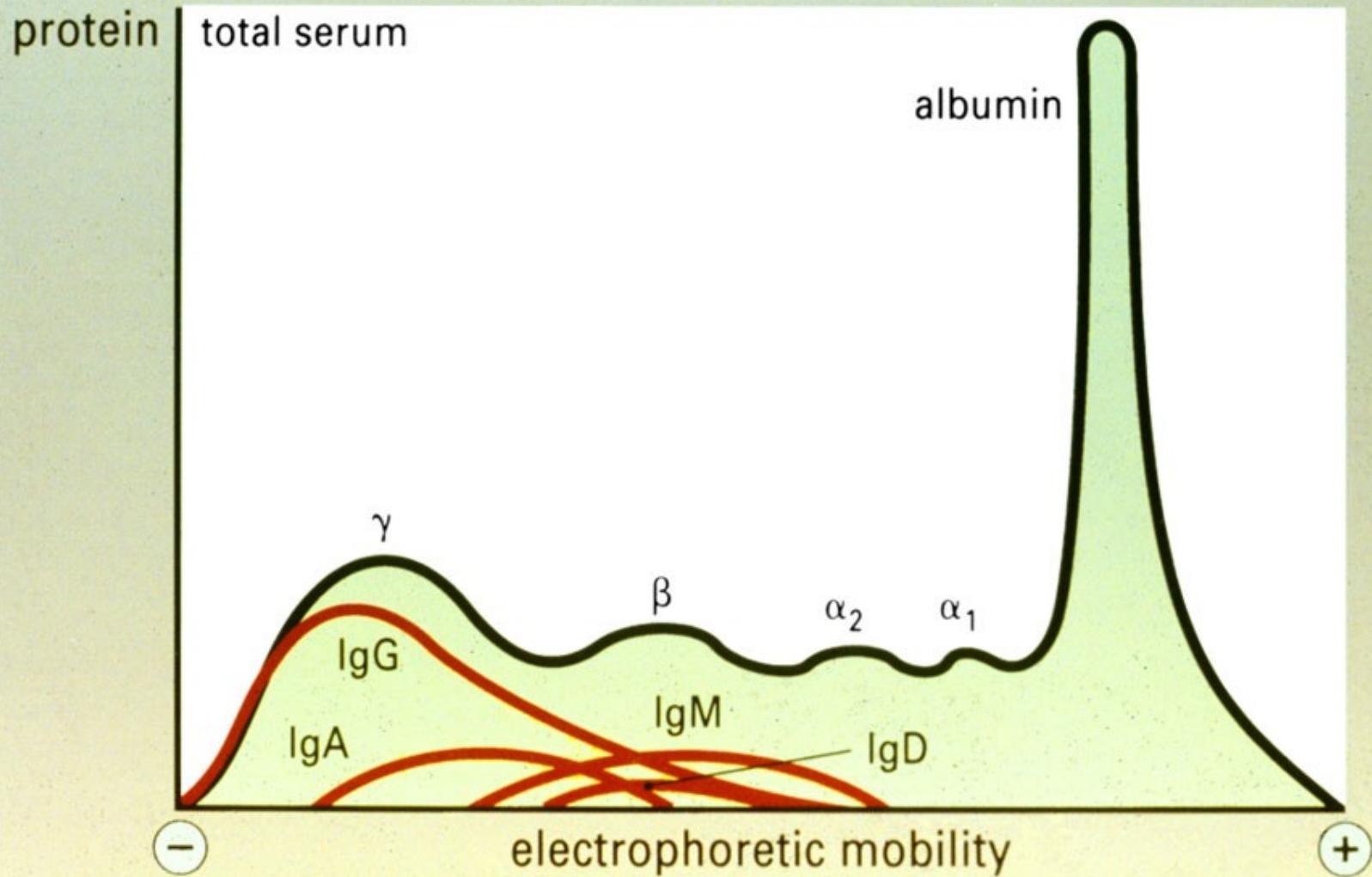
Genetic determination of immunoglobulin production

Clonal selection theory

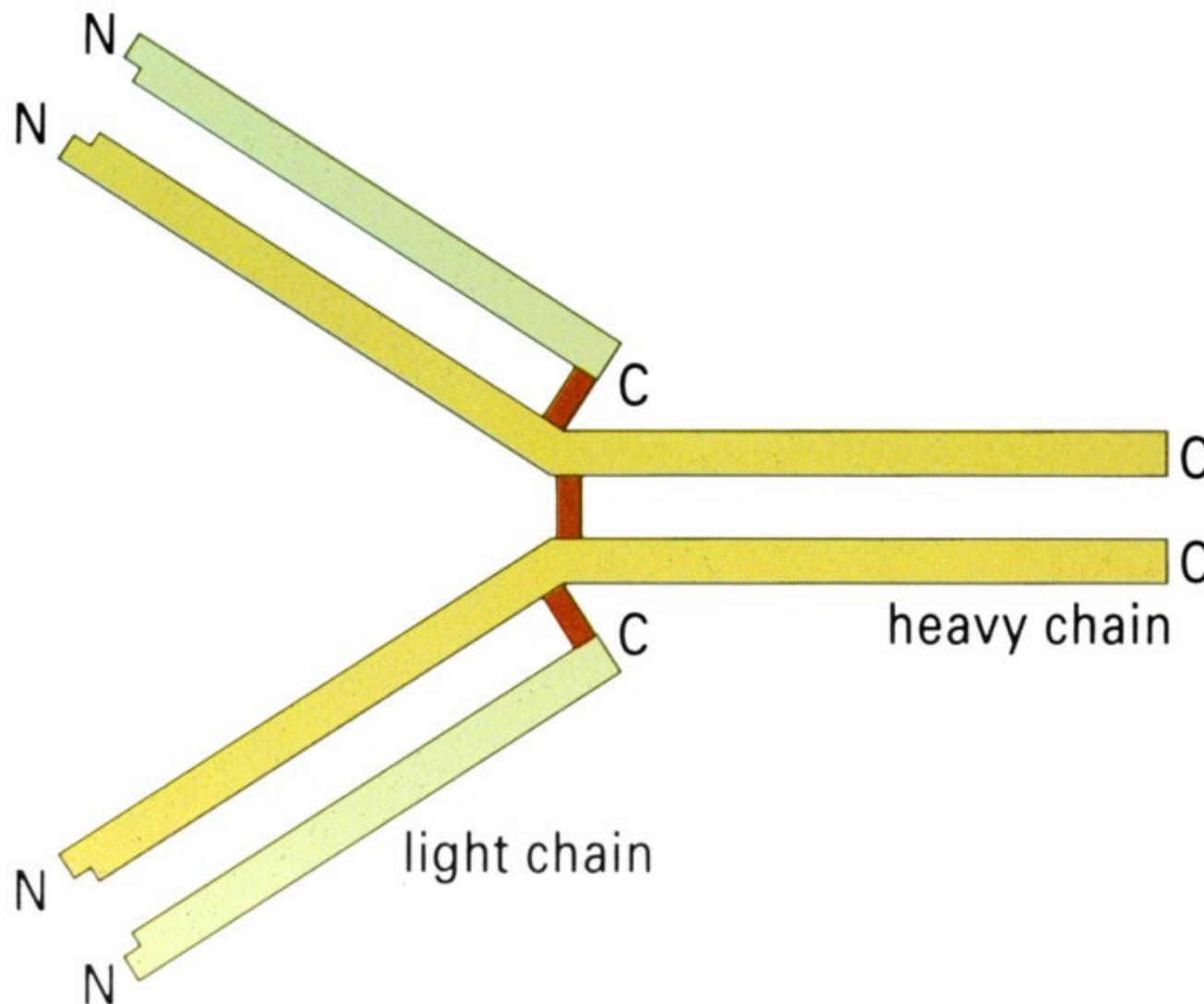
Antigen and epitope



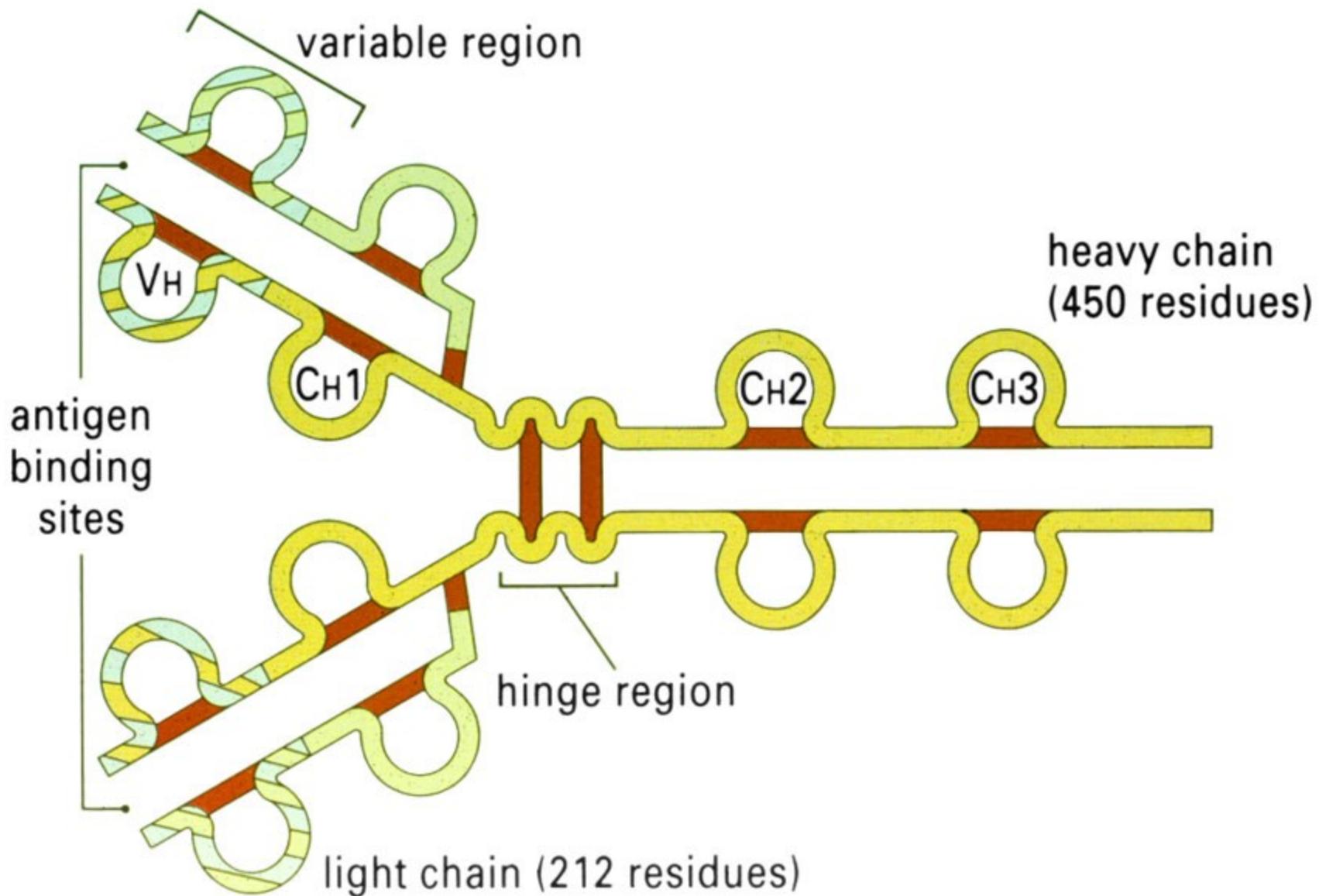
Distribution of the major human immunoglobulins



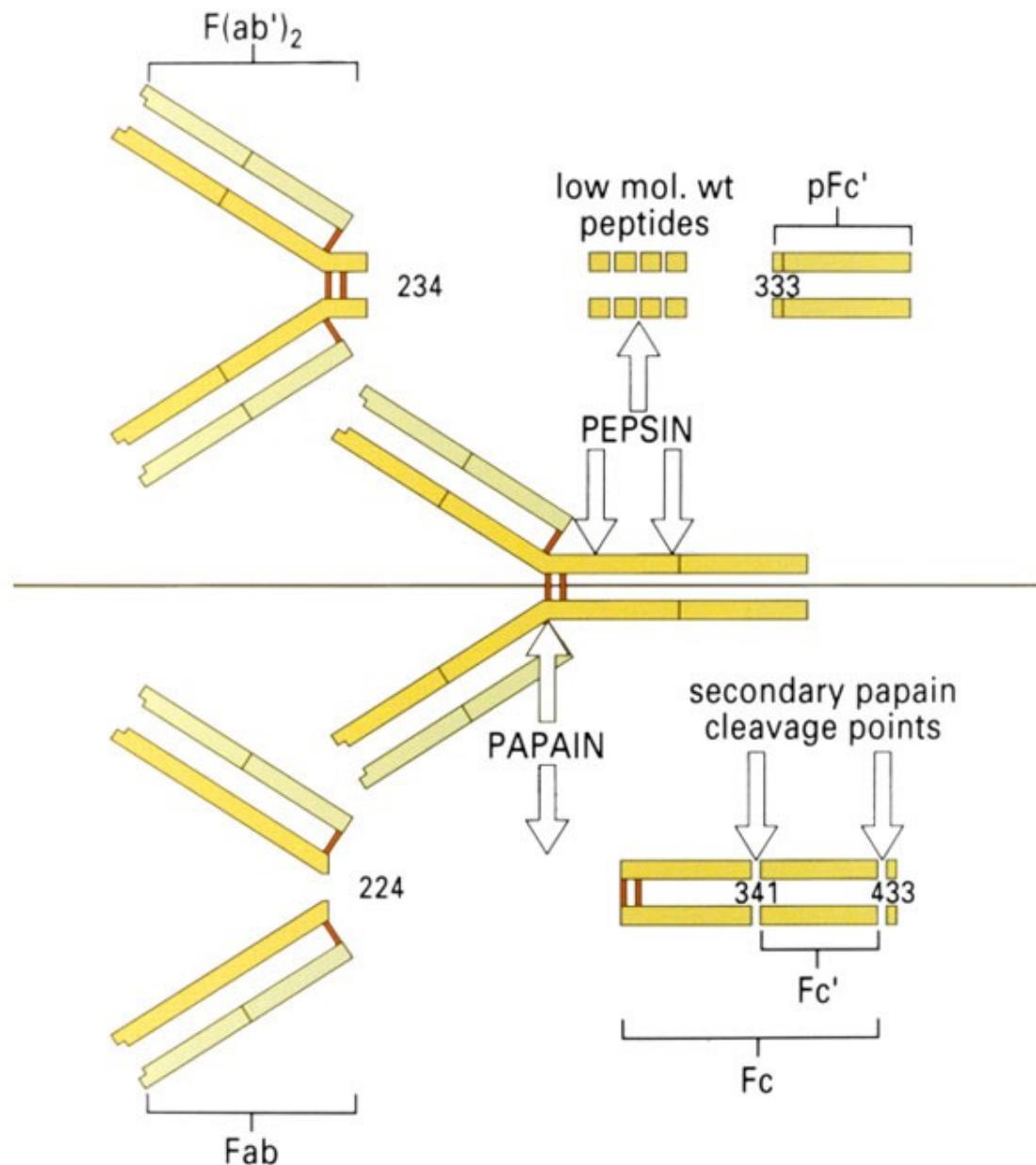
The basic chain structure of immunoglobulins

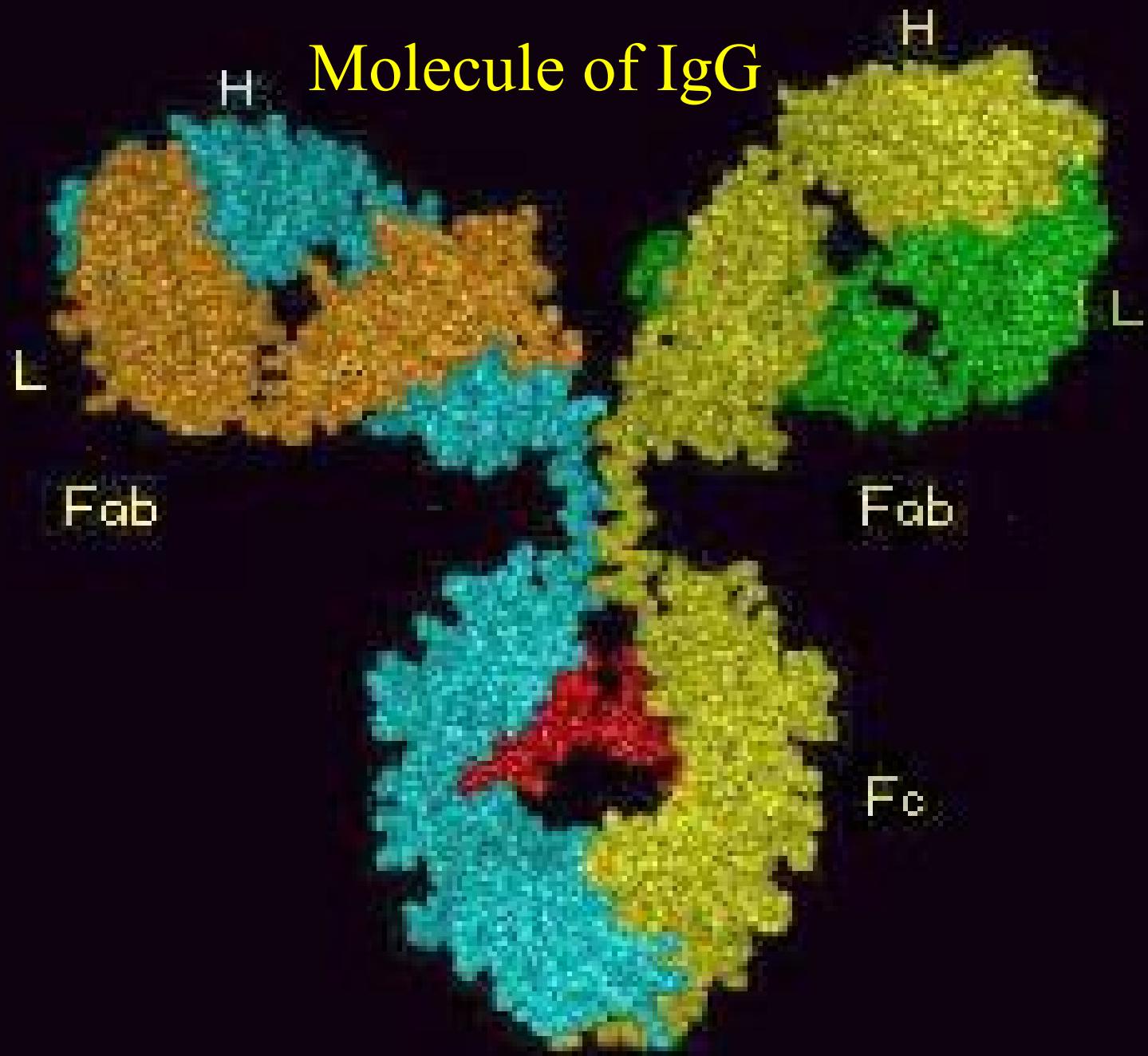


The basic structure of IgG1

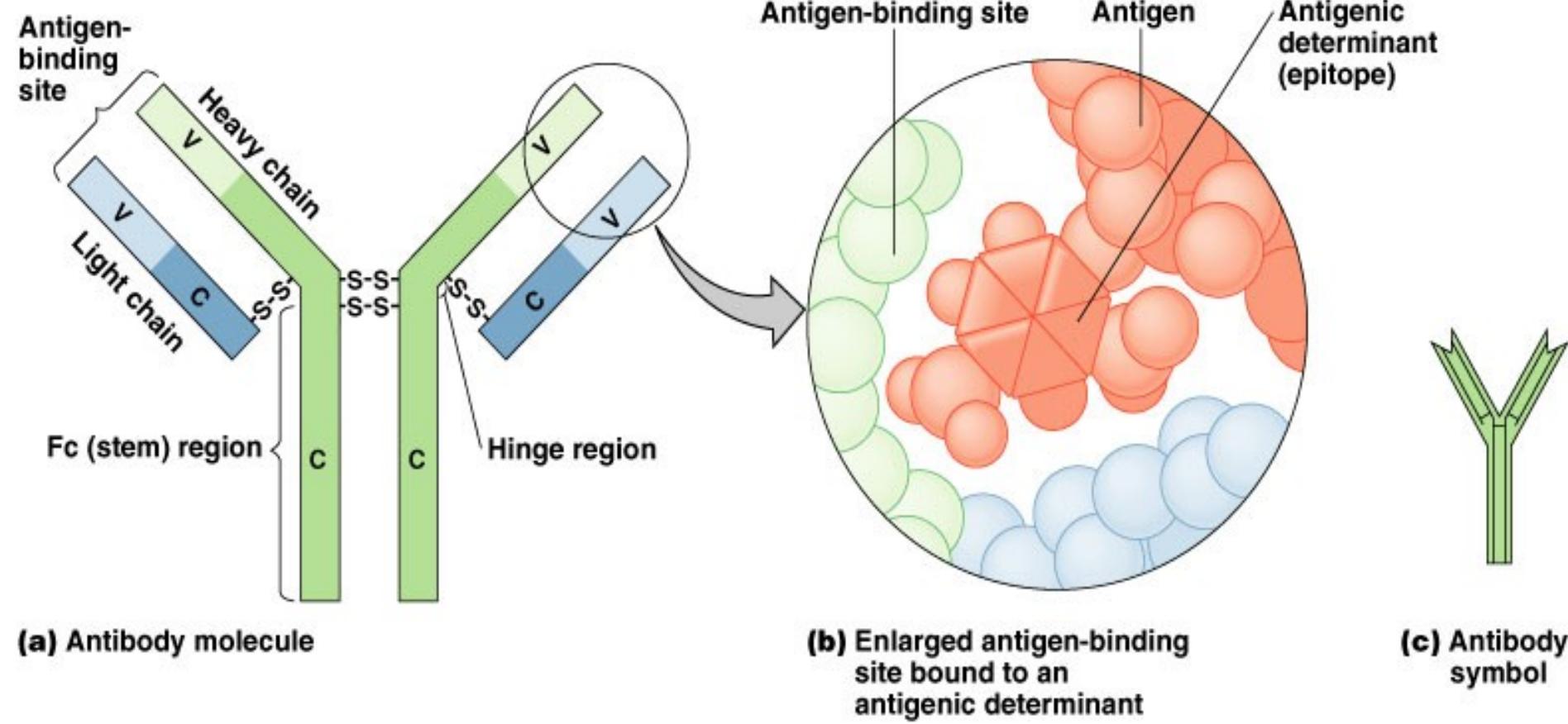


Enzymic cleavage of human IgG1



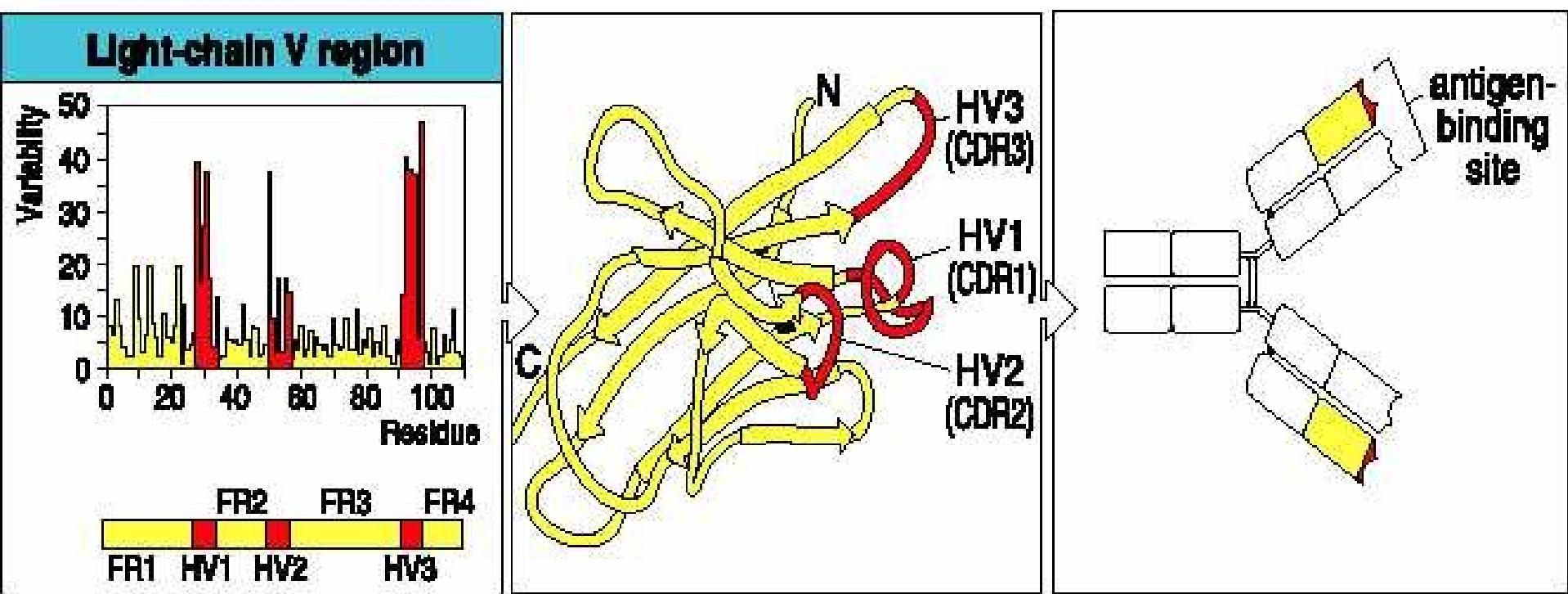


Hypervariable region of immunoglobulin molecule binds epitope of the antigen

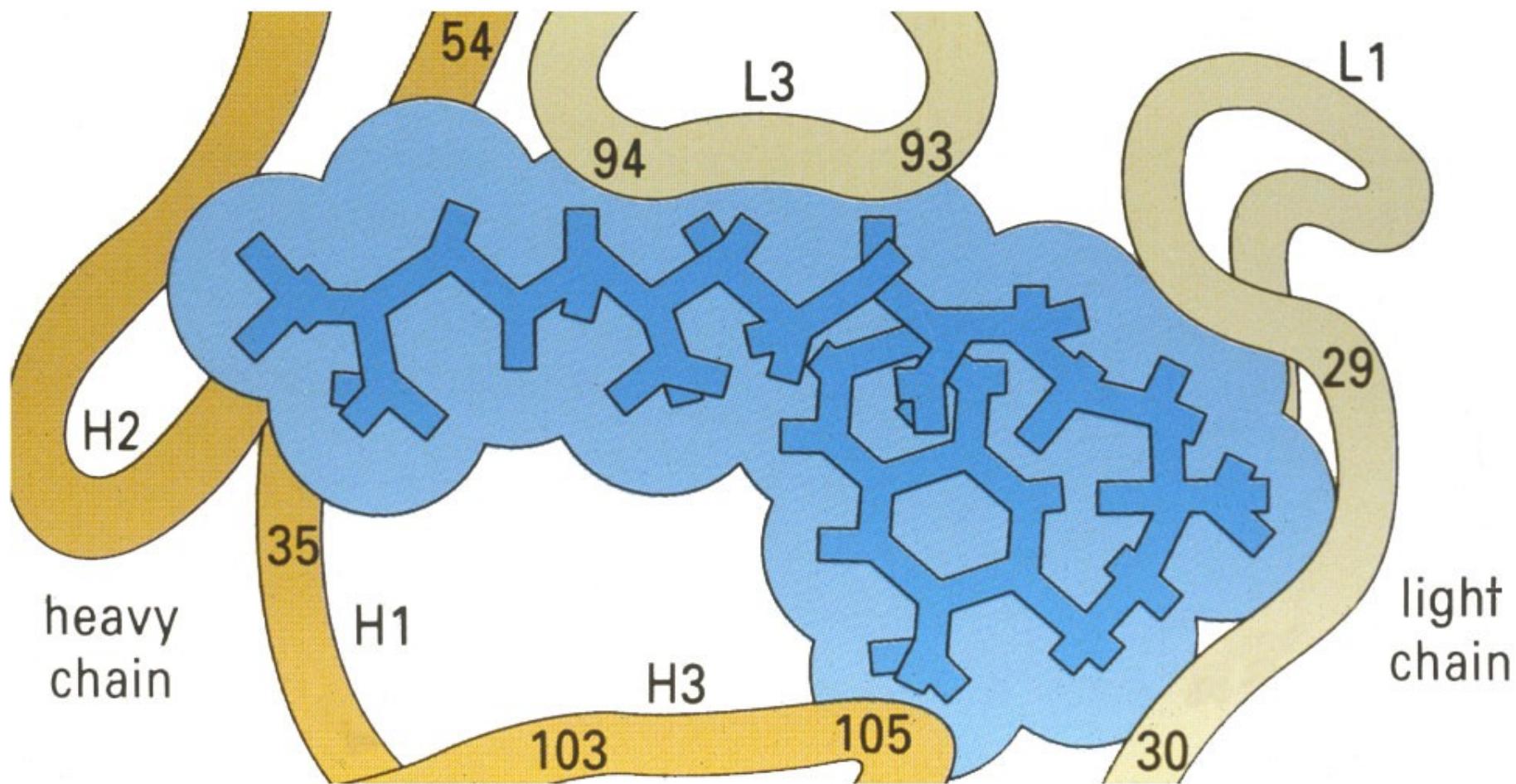


Variable region of immunoglobulin molecule

Figure 2.7



The antibody combining site



heavy
chain

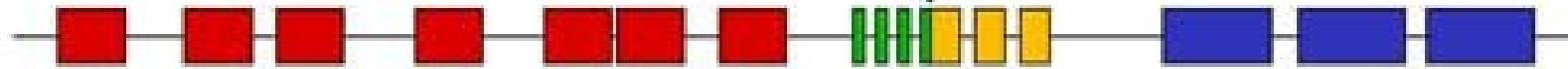
light
chain

Figure 5: V(D)J Recombination

Germline configuration



D to J recombination



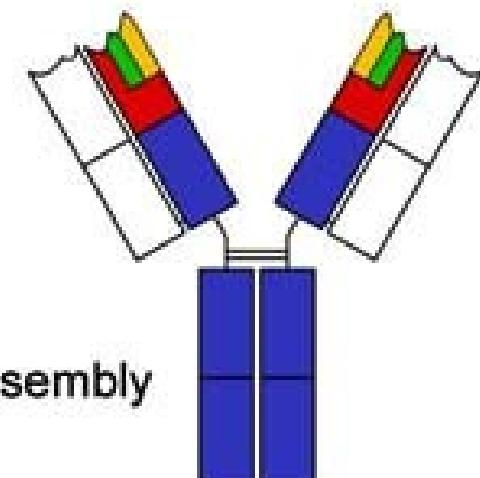
V to DJ recombination



transcription, splicing



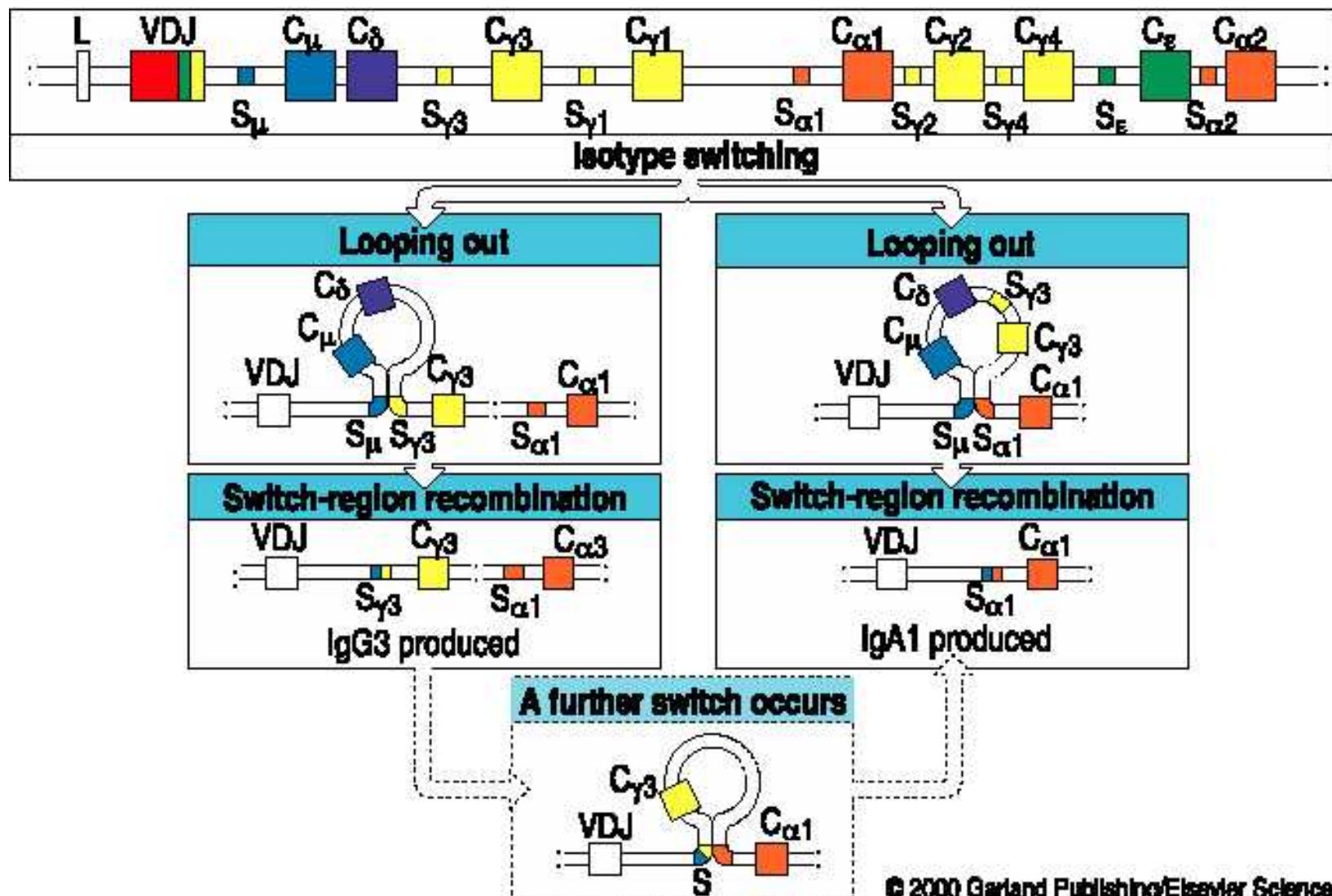
translation, assembly



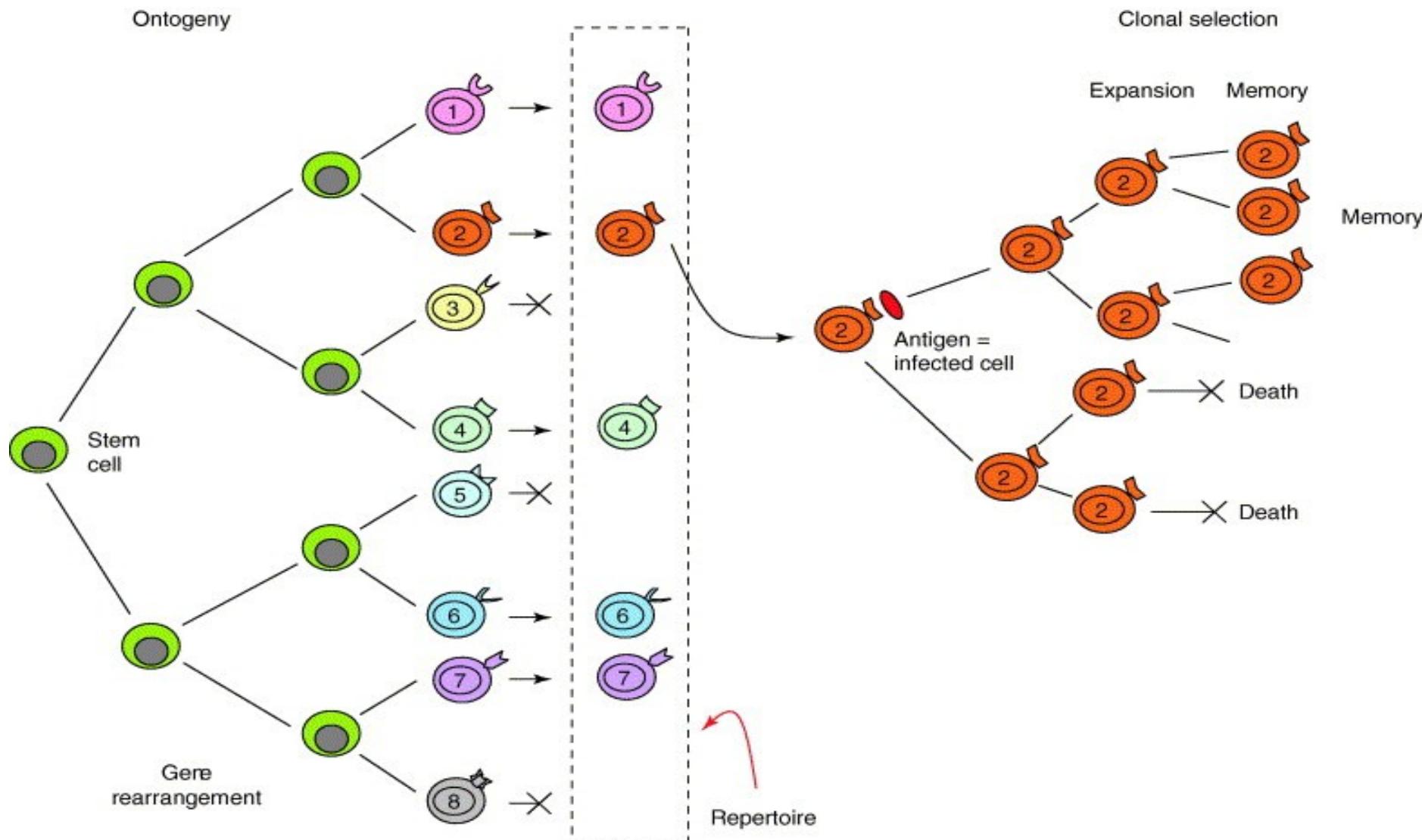
(adapted from Janeway 2001)

Isotype switching

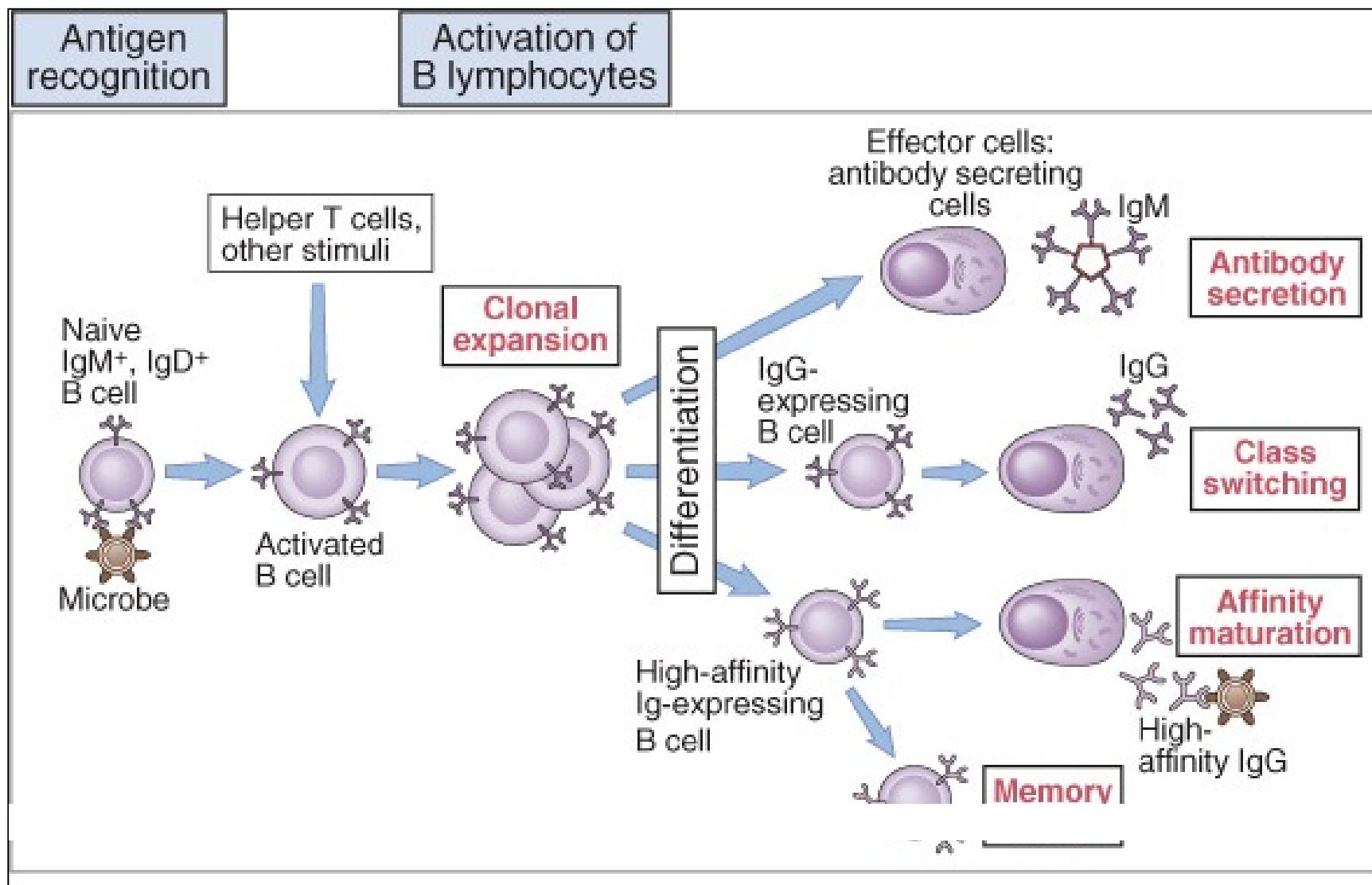
Figure 2.26



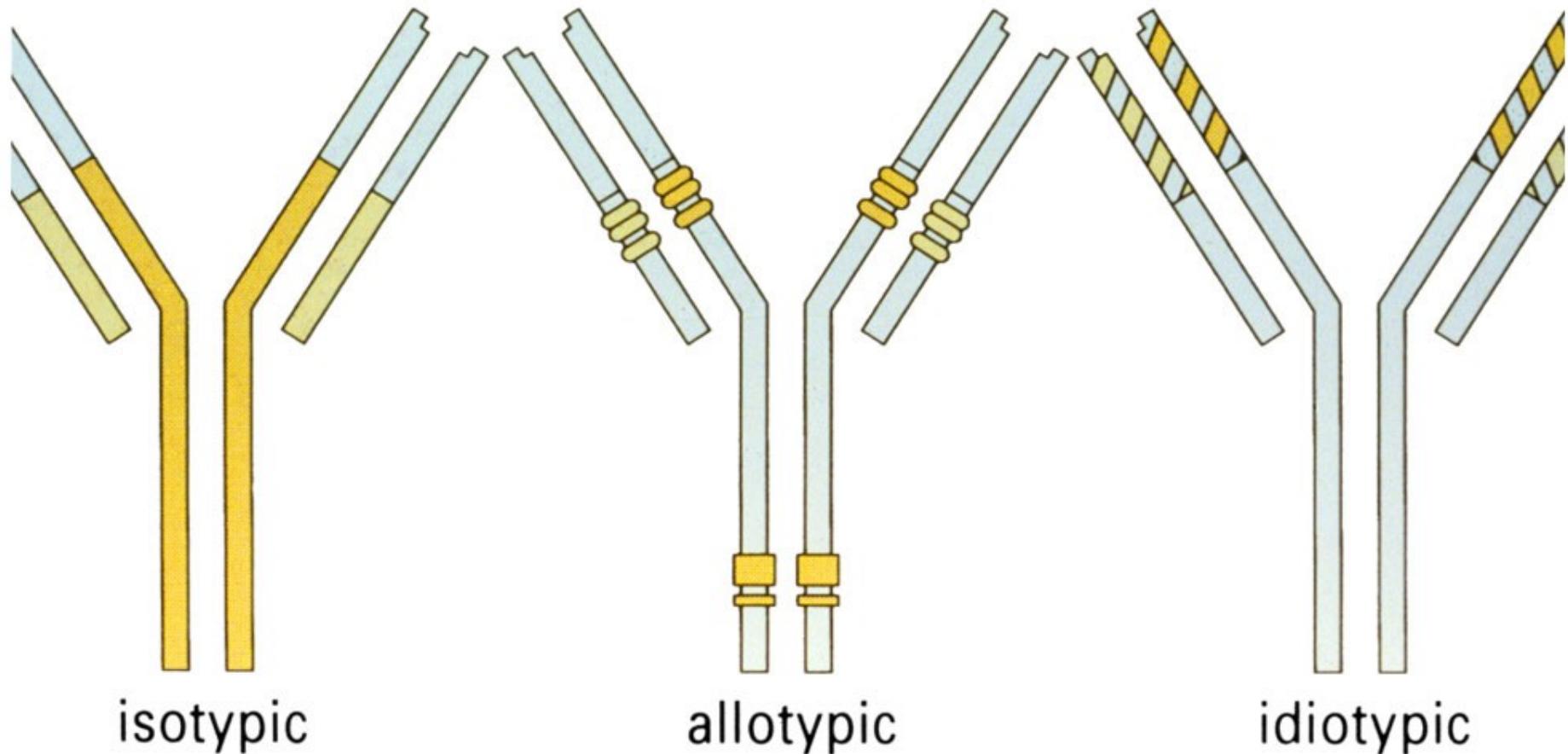
Clonal selection theory



Activation and differentiation of B-lymphocytes



Antibody variants



isotypic

allotypic

idiotypic

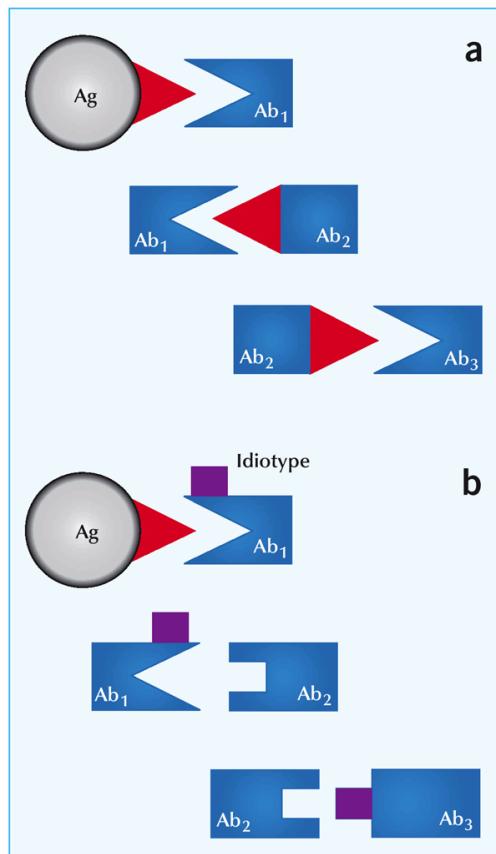
Isotype

- The class or subclass of an immunoglobulin.
- Antigenic determinants are on constant part of immunoglobulin molecule.

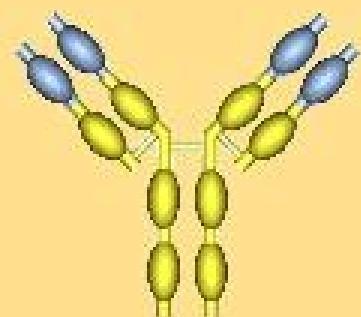
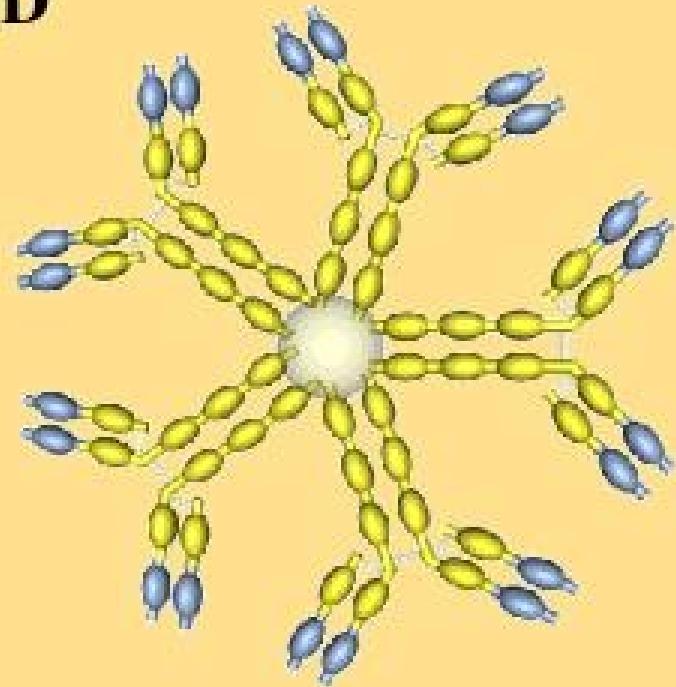
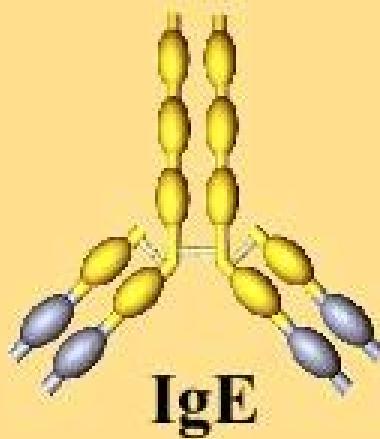
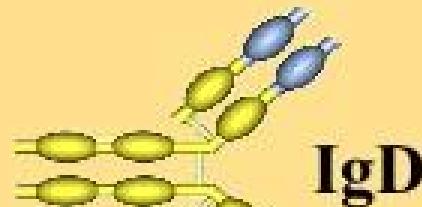
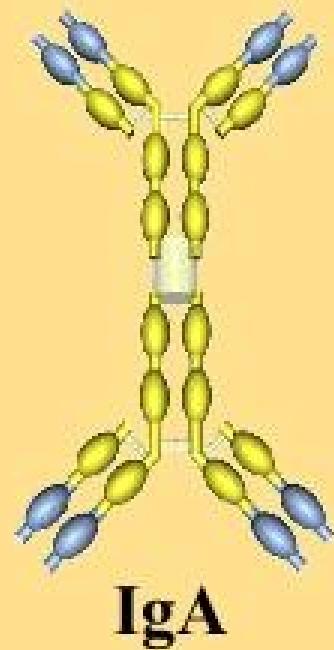
Idiotype

- An antigenic determinant on the variable region of a specific antibody.

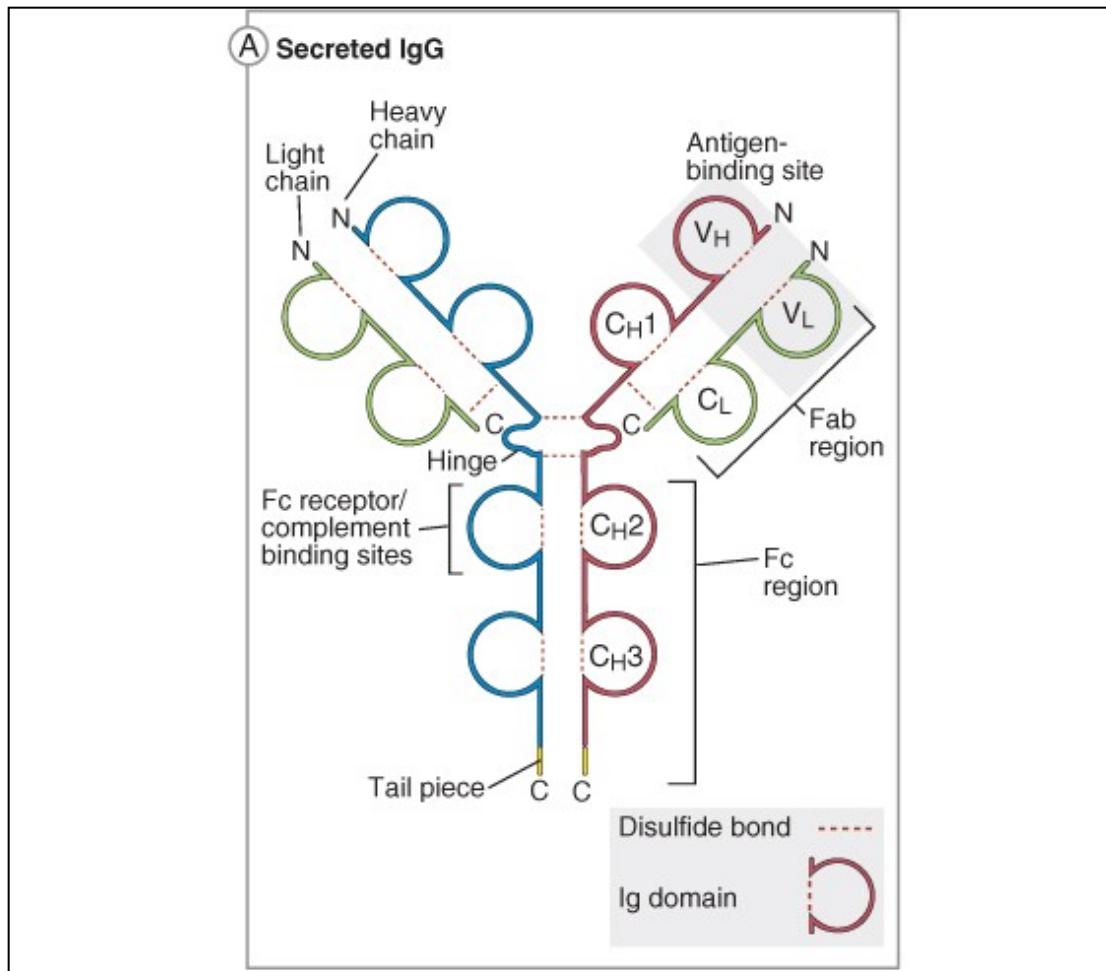
Interaction Idiotype-antiidiotype



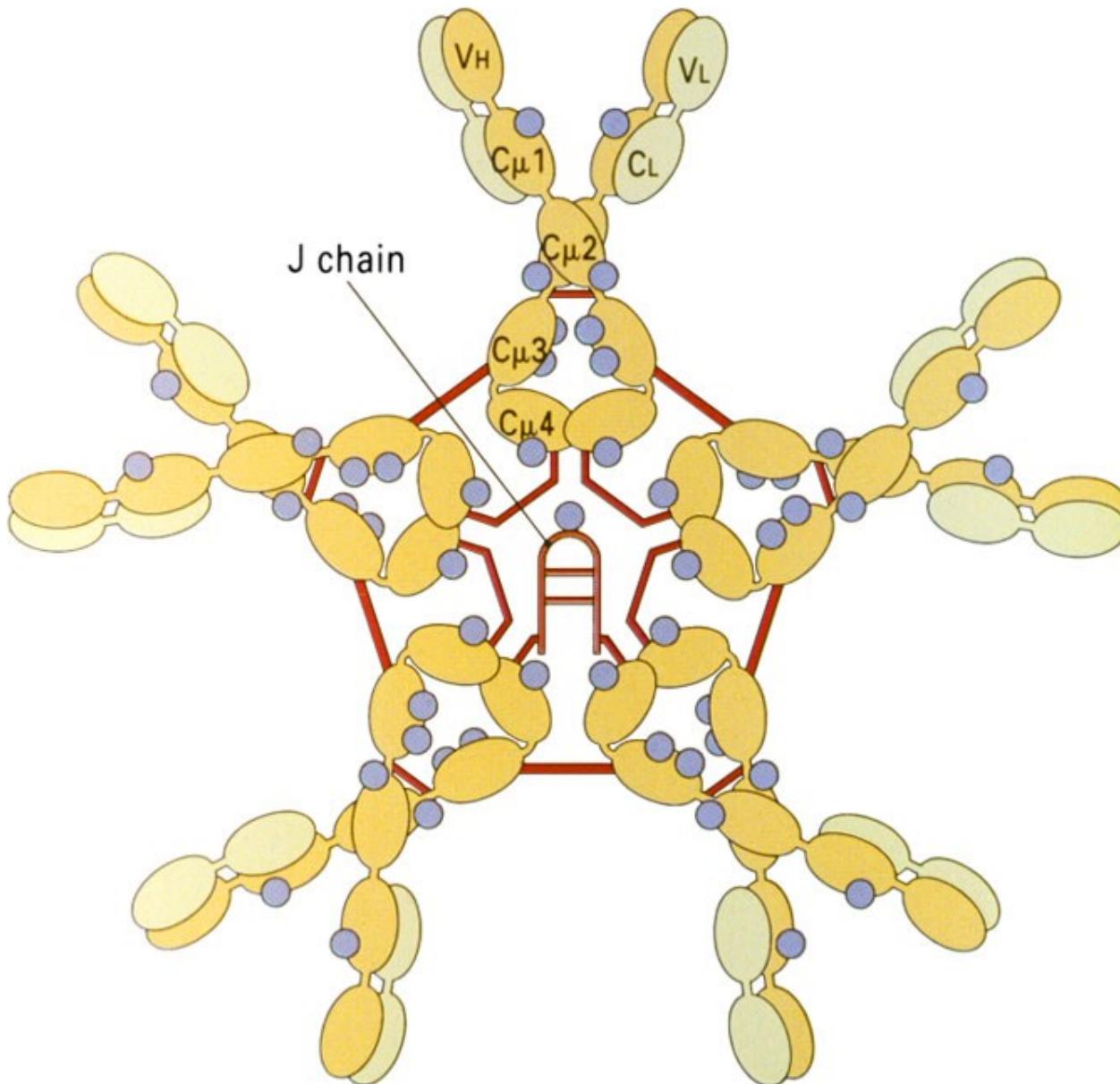
Shoenfeld Y: *Nature Medicine* **10**, 17 - 18 (2004)



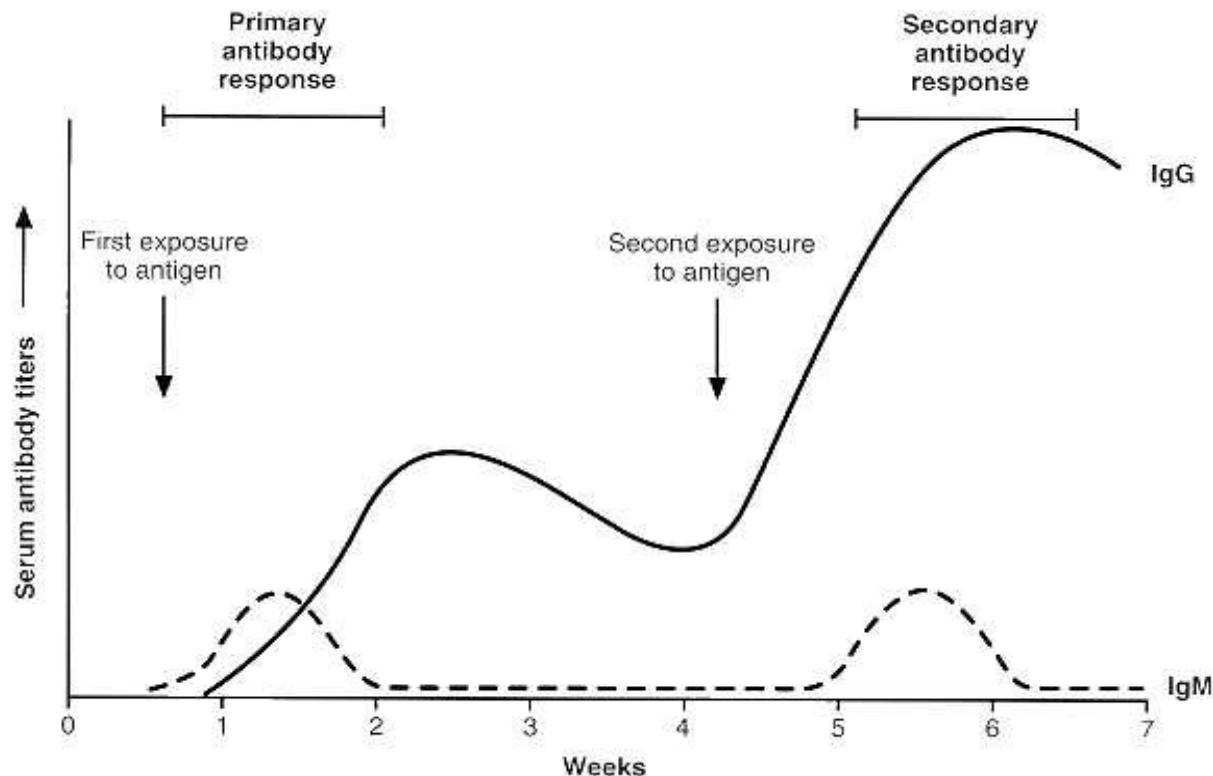
IgG

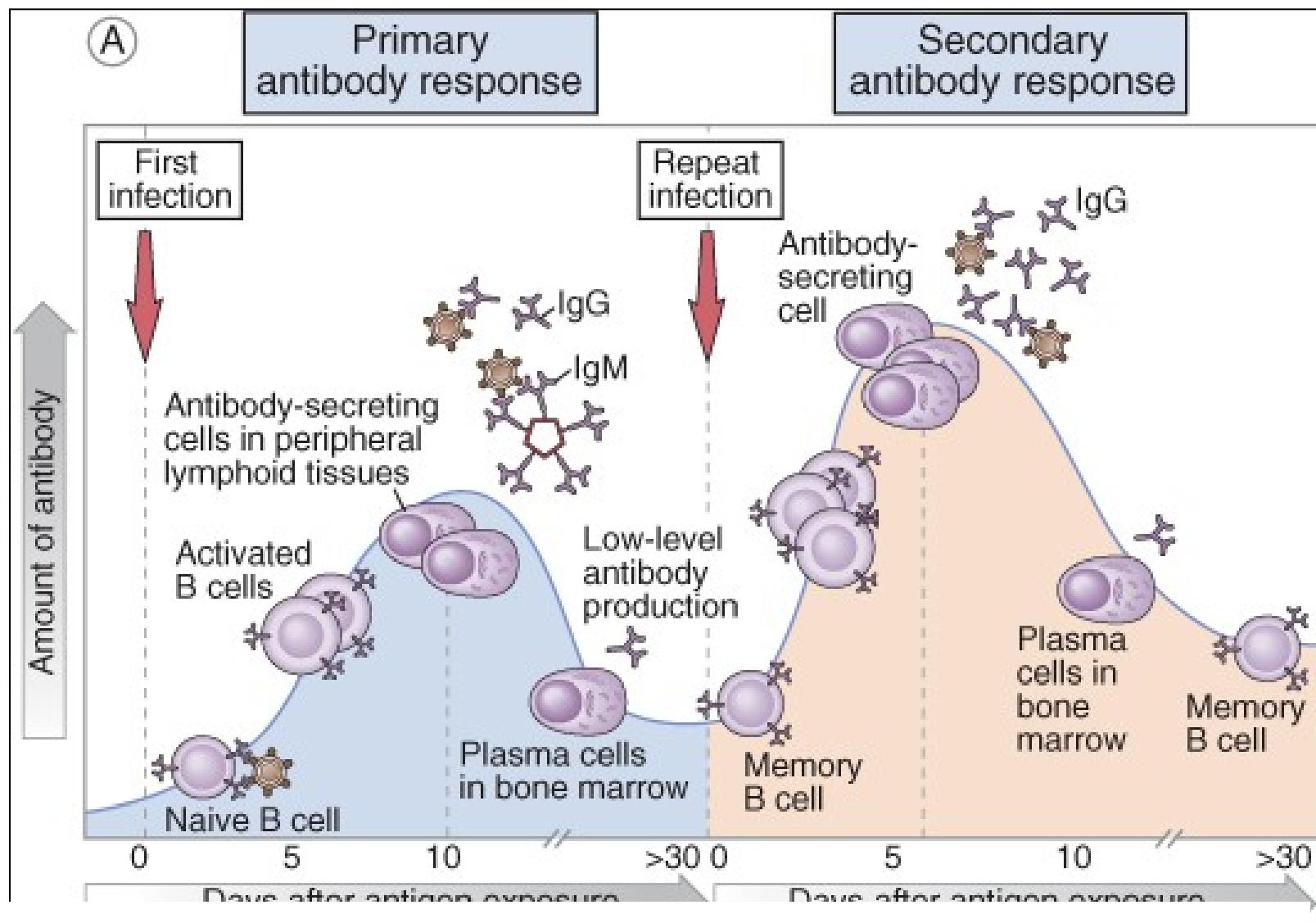


Structure of human IgM

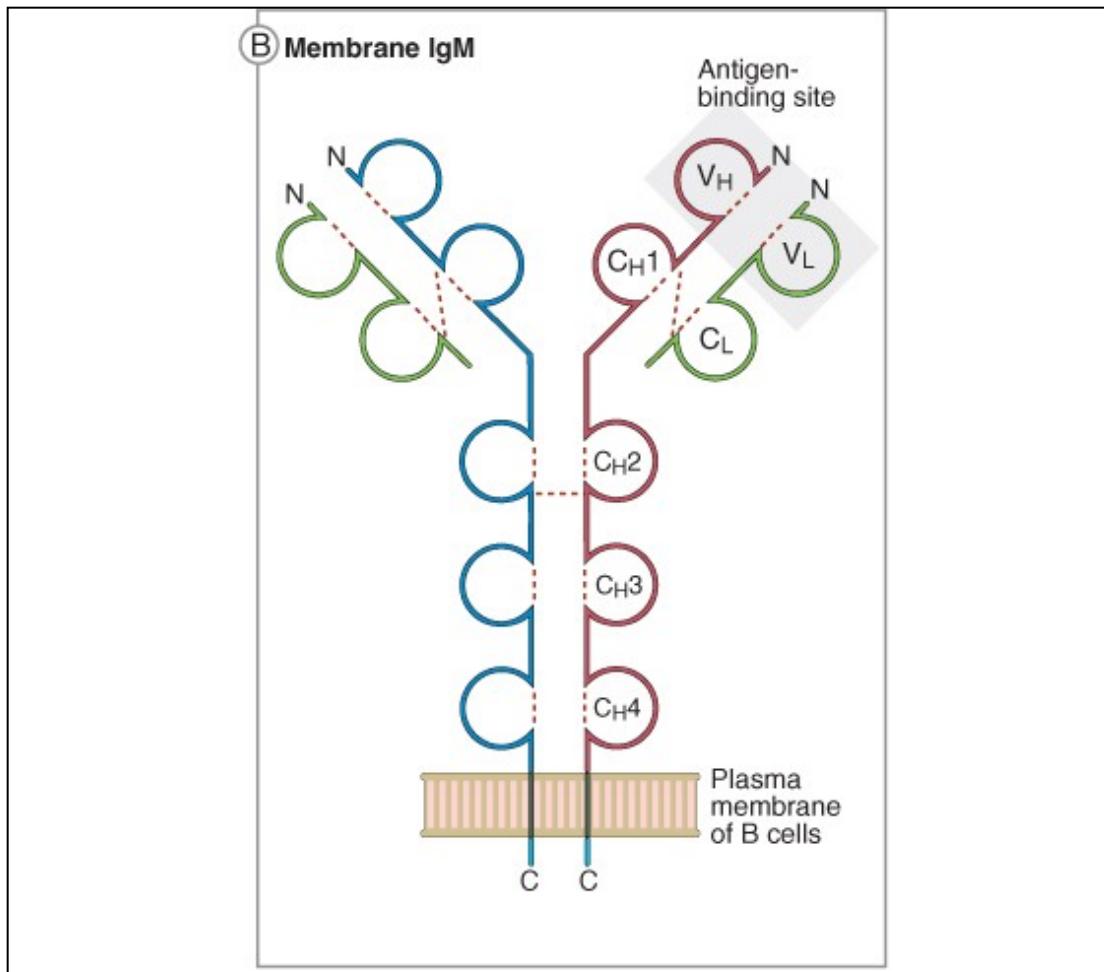


Primary and secondary immune response





IgM on B-cell membrane



Expression of surface immunoglobulins on B-cells

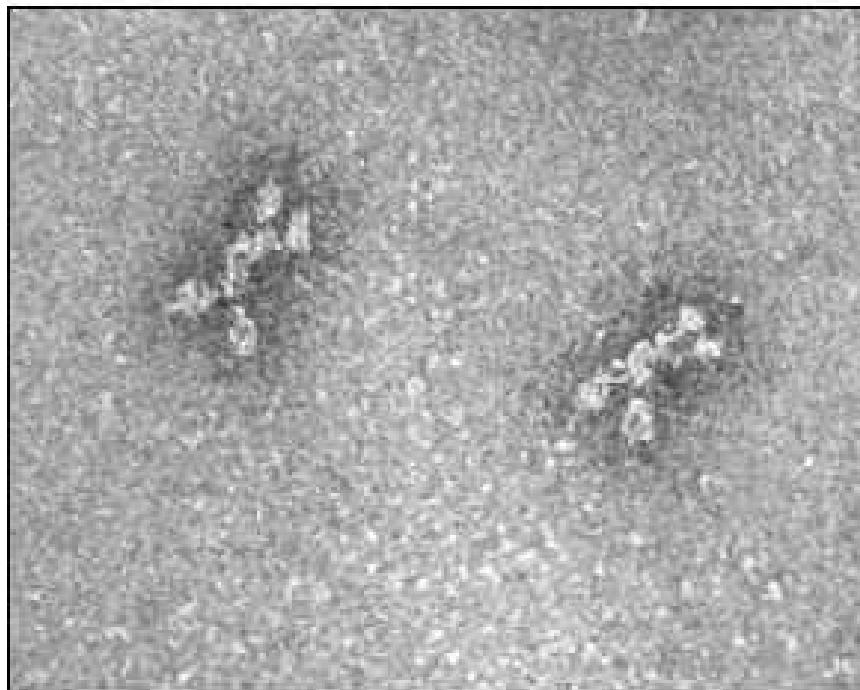
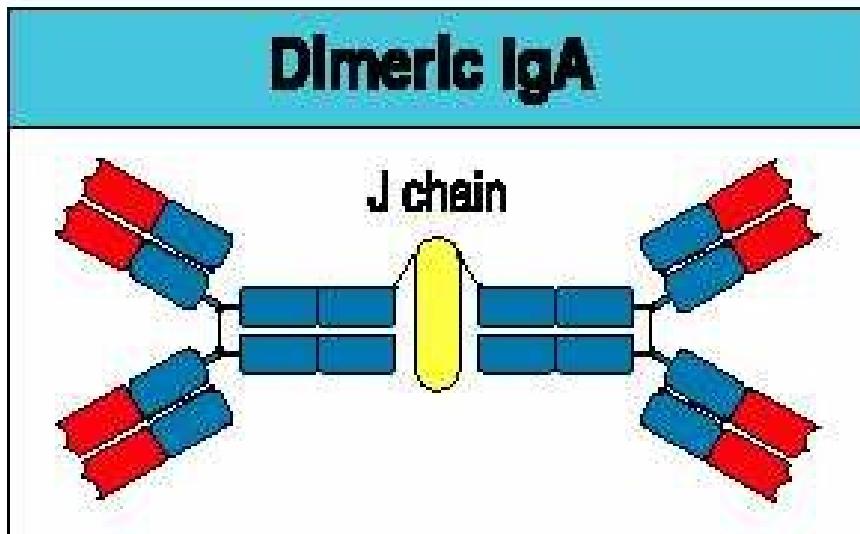
The diagram illustrates the sequential stages of B-cell maturation:

- Stem cell:** Undifferentiated cell.
- Pre-B cell:** Expresses a single chain of the heavy IgM chain.
- Immature B cell:** Expresses membrane IgM and IgD.
- Mature B cell:** Expresses membrane IgM, IgD, and IgG.
- Activated B cell:** Expresses membrane IgG and IgA, and undergoes low-rate Ig secretion, heavy chain isotype switching, and affinity maturation.
- Antibody-secreting cell:** Expresses membrane IgG and IgA, and undergoes high-rate Ig secretion, reduced membrane Ig.

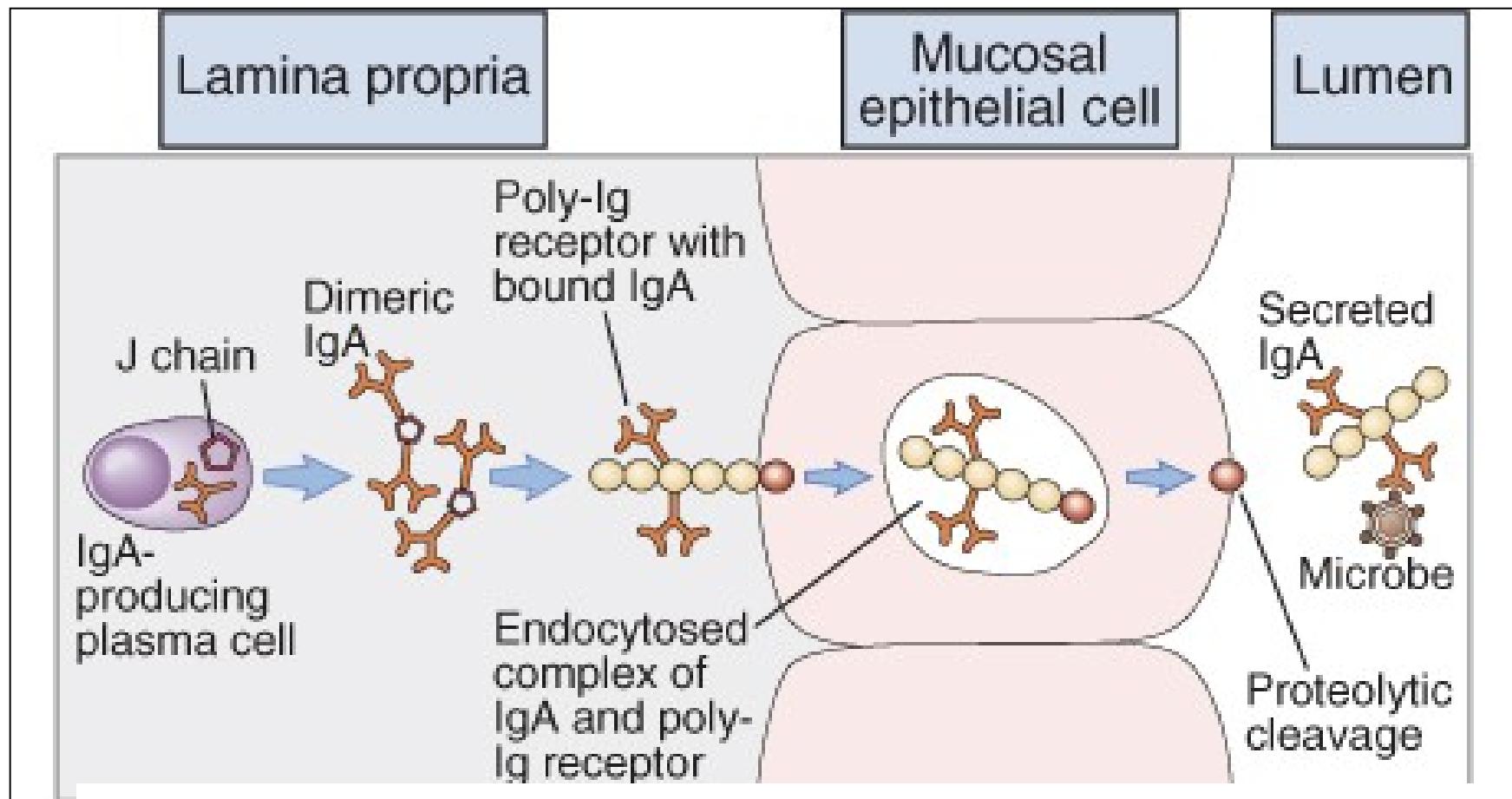
Stage of maturation	Stem cell	Pre-B cell	Immature B cell	Mature B cell	Activated B cell	Antibody-secreting cell
Pattern of immunoglobulin production	None	Cytoplasmic μ heavy chain	Membrane IgM	Membrane IgM, IgD	Low-rate Ig secretion; heavy chain isotype switching; affinity maturation	High-rate Ig secretion; reduced membrane Ig

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Figure 2.29



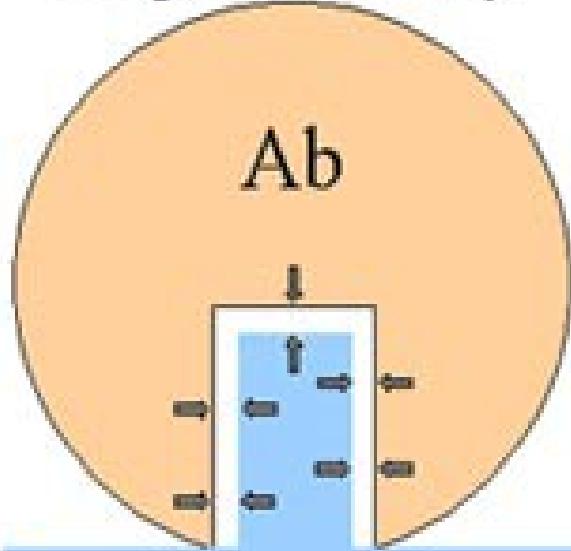
Formation of Secretory IgA



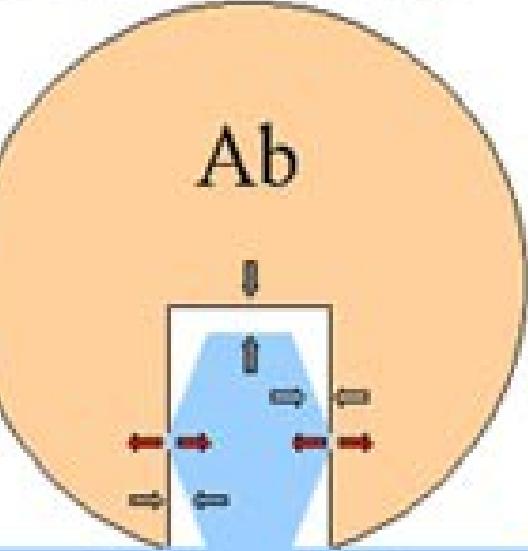
- **Affinity:** The strength of the binding between a single site of an antibody (one variable region) and an epitope.
- **Avidity:** The overall strength of interaction between antibody and antigen. The avidity depends on affinity and the valency of interactions.

Antibody affinity

High Affinity



Low Affinity



Antibody affinity



High Affinity

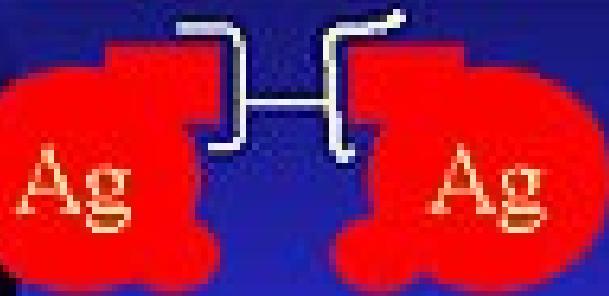


Moderate
Affinity



Low Affinity

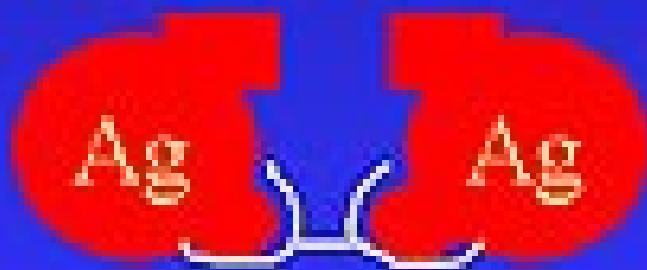
Antibody Avidity



Moderate
Avidity



High
Avidity



Moderate
Avidity

Biological functions of immunoglobulin molecules

- Activation of complement system (IgG, IgM)
- Opsonization (particularly IgG)
- Neutralization of antigens (IgG, IgA, IgM)
- Adherence interference (IgA, IgG)
- Antibody dependent cellular cytotoxicity (ADCC)
- Agglutination, precipitation (IgG, IgM)
- Mast cells degranulation (IgE)
- Transport through placenta (IgG)
- Immunoregulation (mainly IgG)

Antibody dependent cellular cytotoxicity (ADCC)

