



Immunology
Antibody Structure and Function
Lecture 6
2025-2026

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Our targets

Students should understand the followings

- The **meaning** of an antibody (Ab)
- The **structure** of Ab
- The **function** of each particular part of Ab
- The **different types** of Abs
- The **mechanism** of Ab production with **different antigen binding site**
- The mechanism of Ab **class switching**

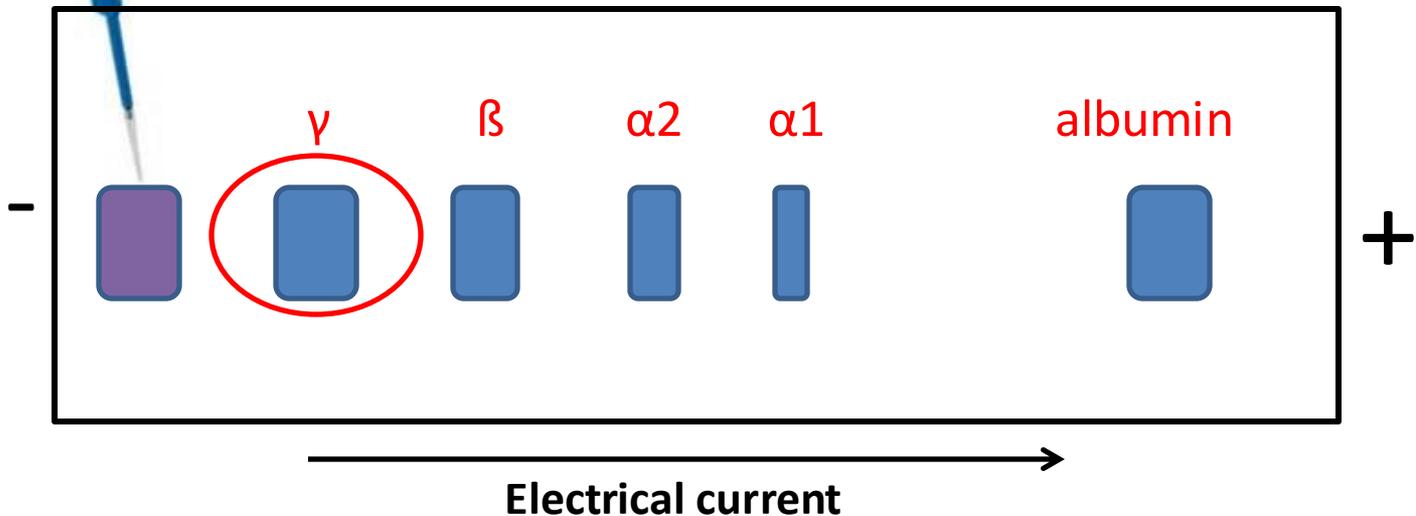
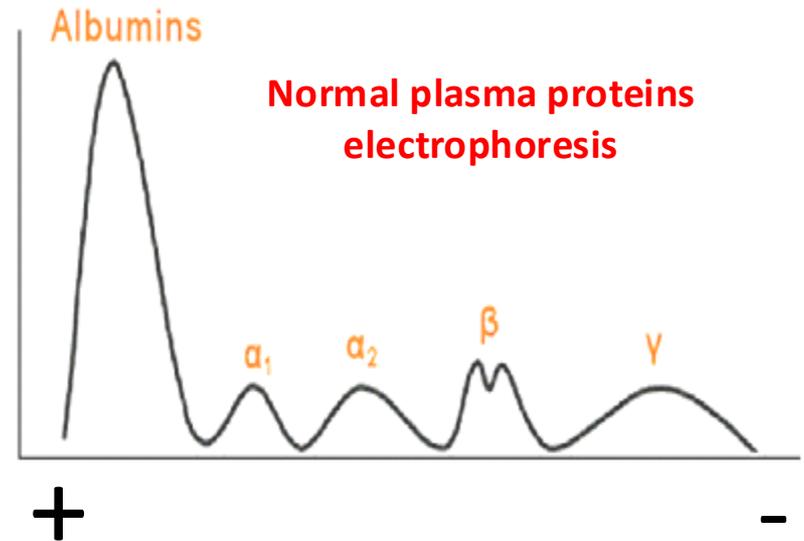
Introduction



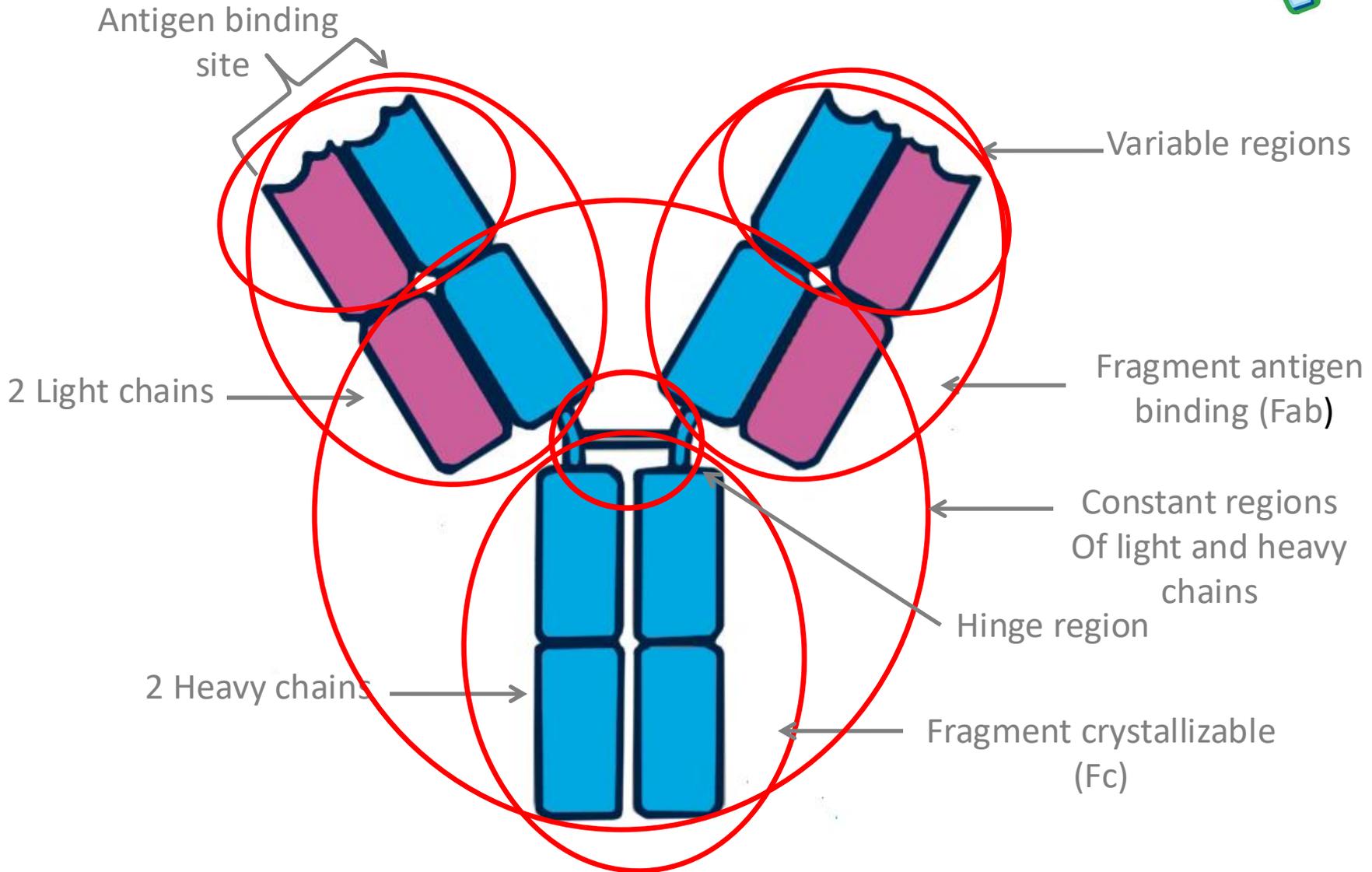
Isolation and Characterization

Antibodies

- Soluble proteins
- Belong to a class of proteins called globulins
- They are called gamma-globulins



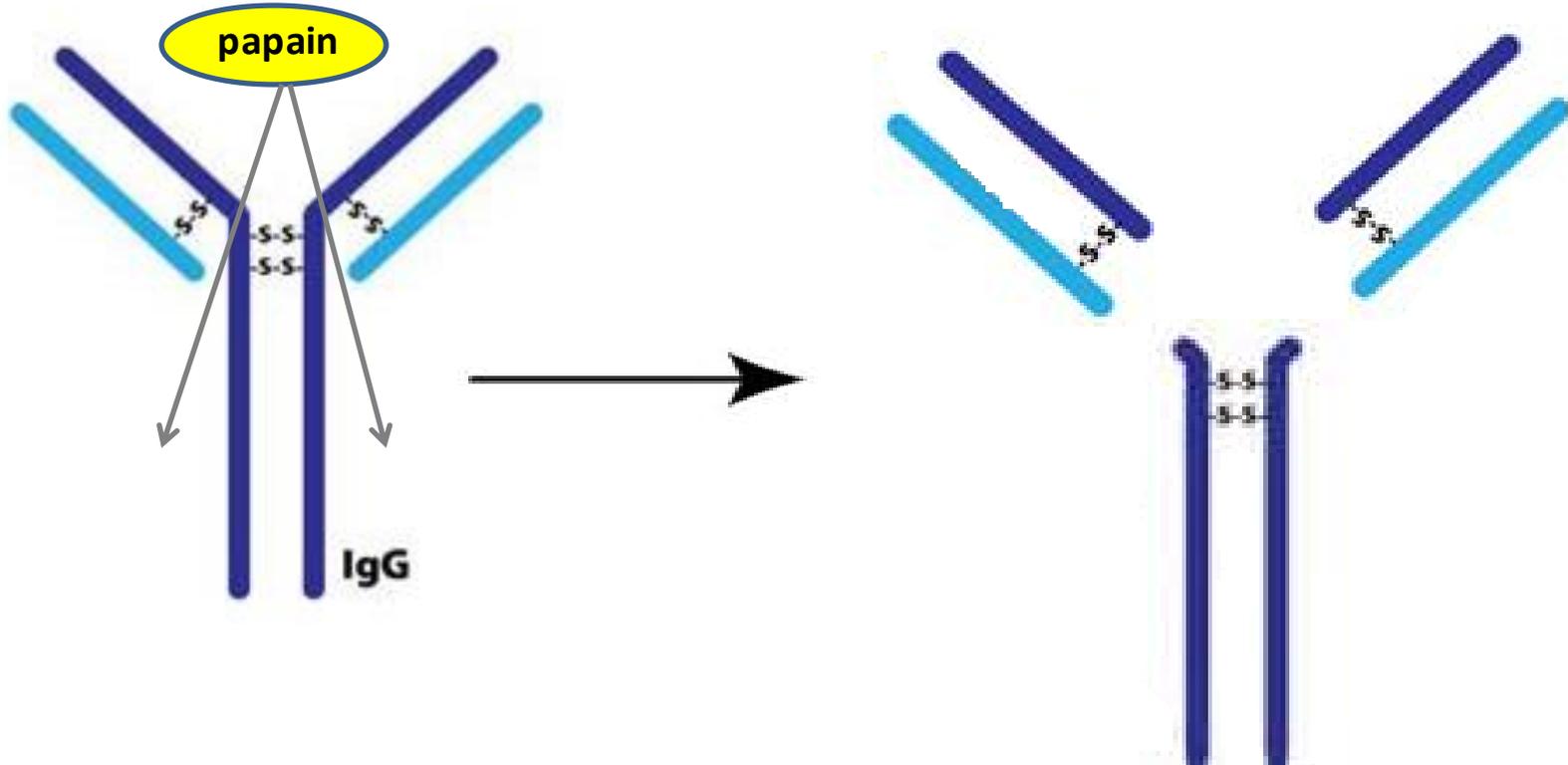
Antibody Structure



Antibody Structure



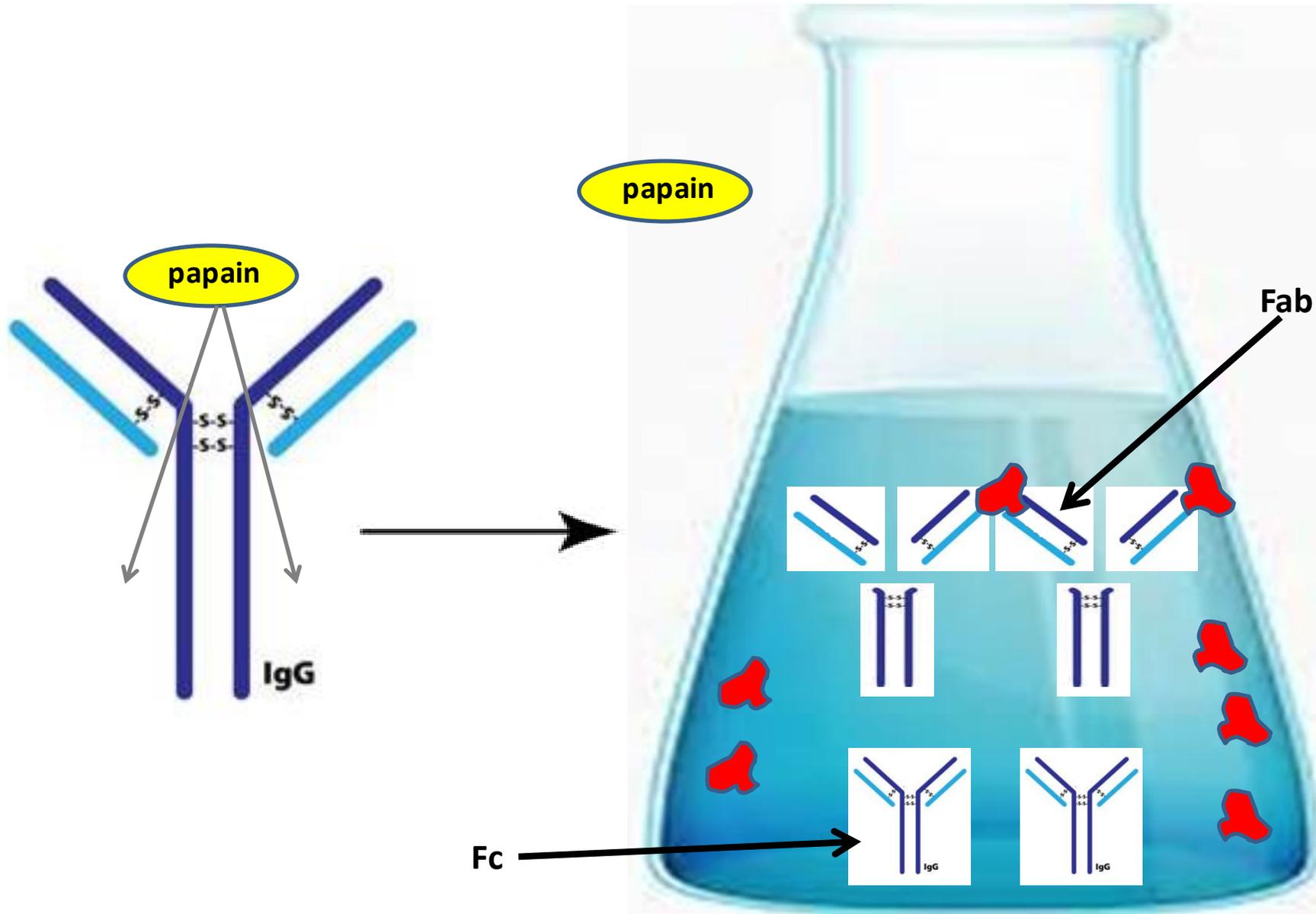
Discovery of the Fab and Fc regions



Antibody Structure



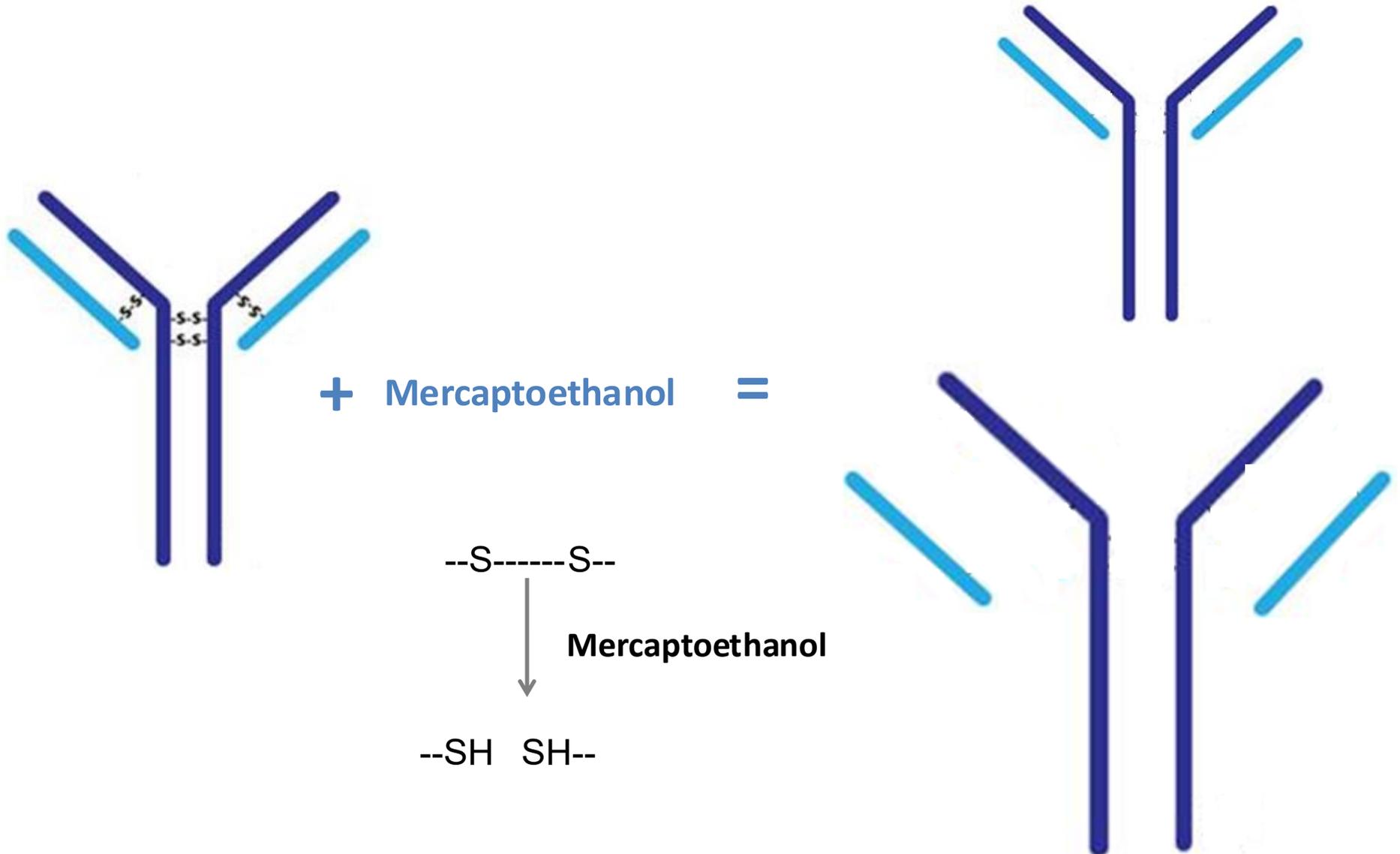
Discovery of the Fab and Fc regions



Antibody Structure



Discovery of the Ab tetrapeptide structure



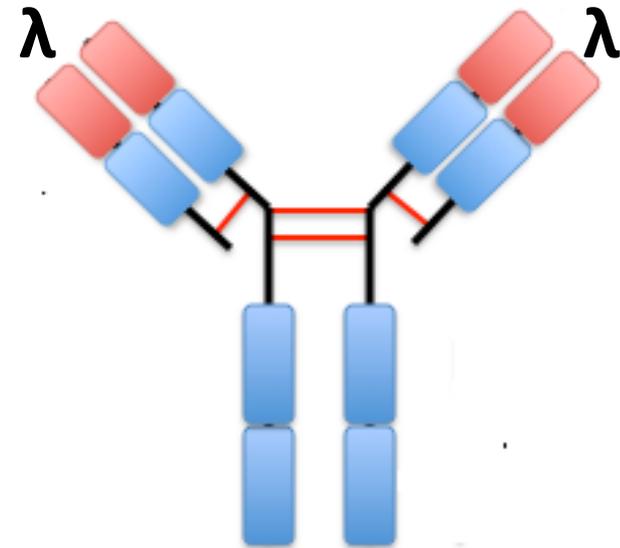
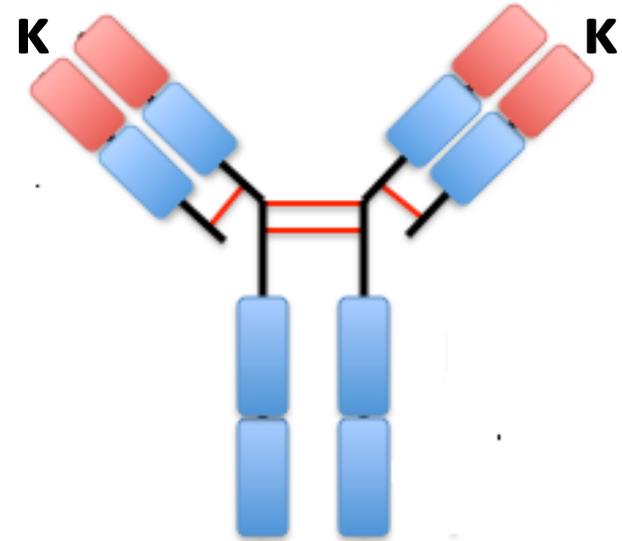
Antibody Structure



Structure of the light chain

Two classes of light chains :

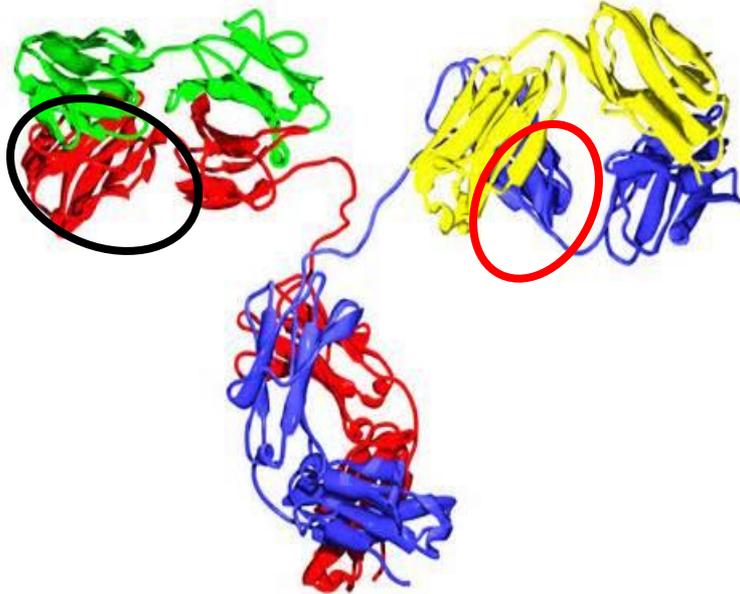
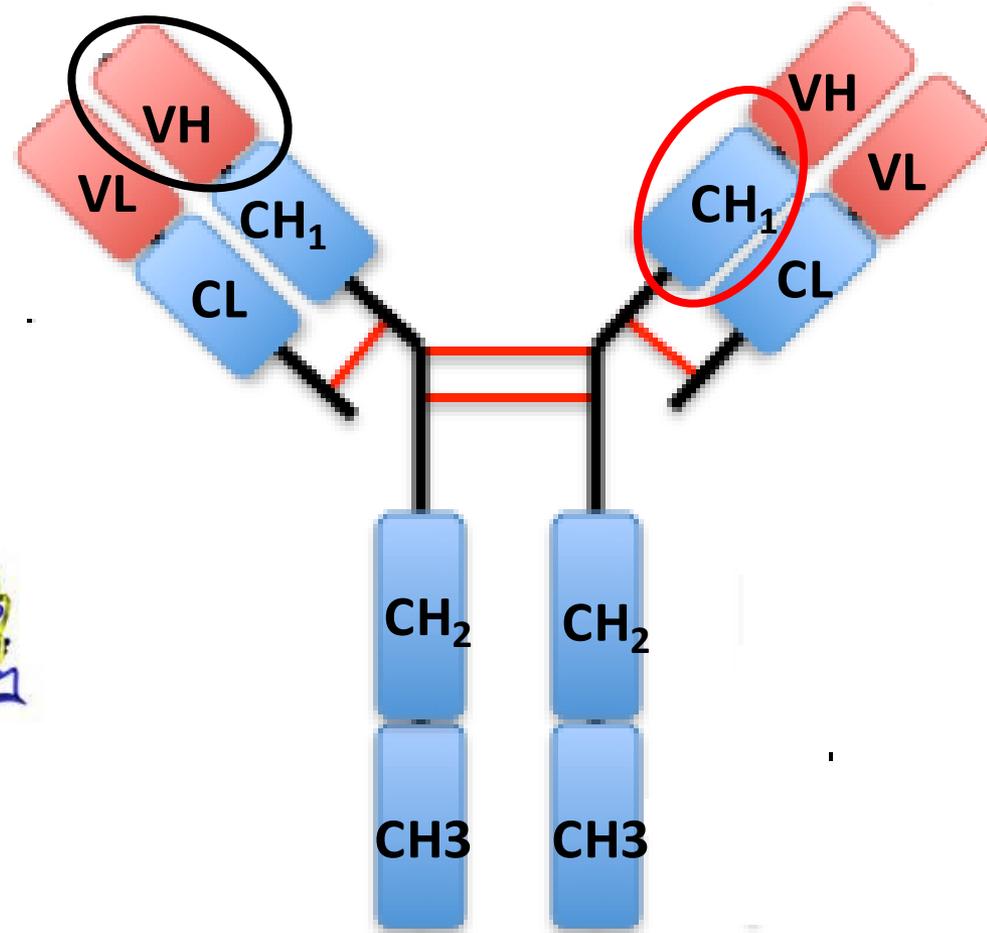
- ✓ Kappa (κ) chain
- ✓ Lambda (λ) chain



Antibody Structure



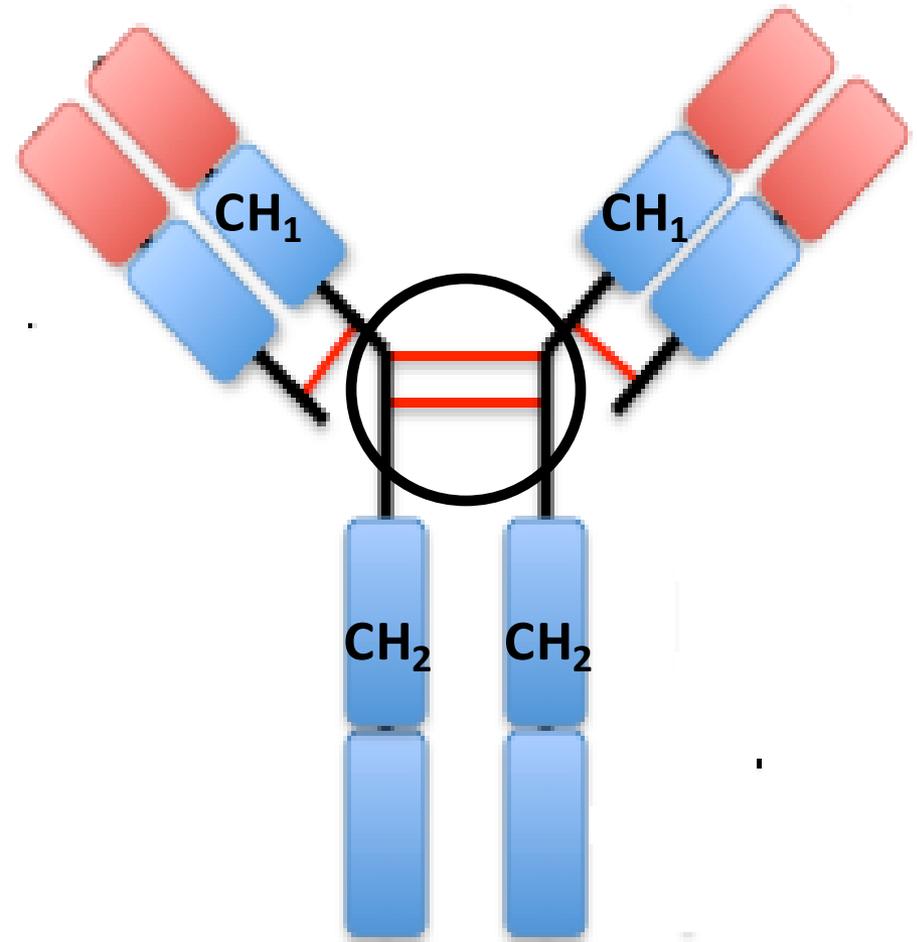
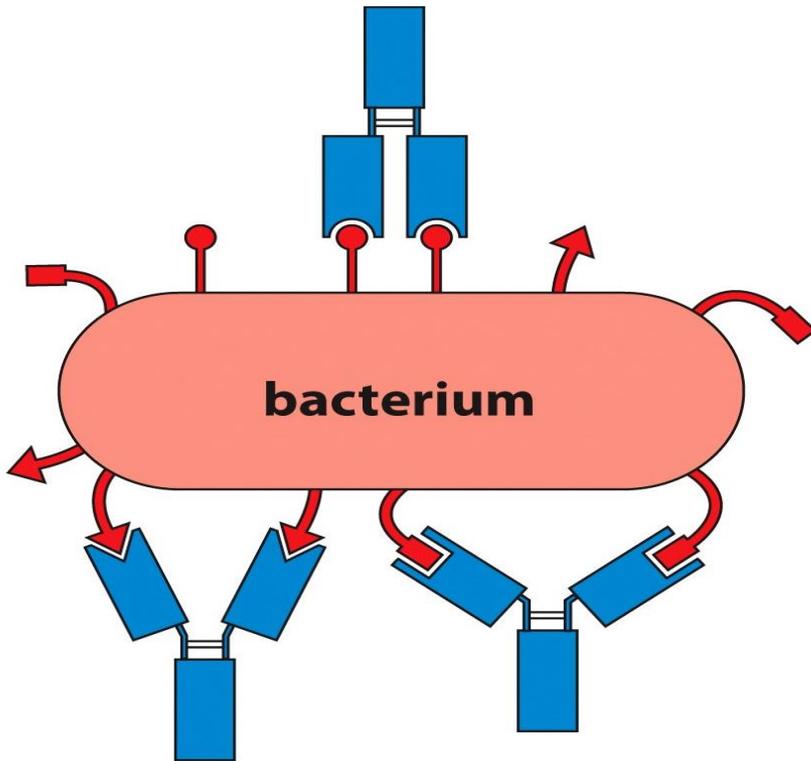
Domains



Antibody Structure



Hinge region

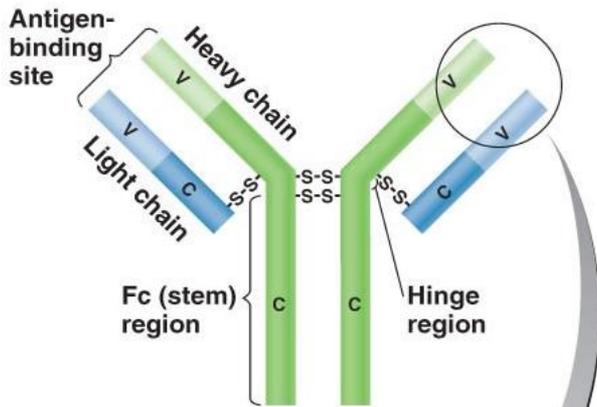


Antibody Structure

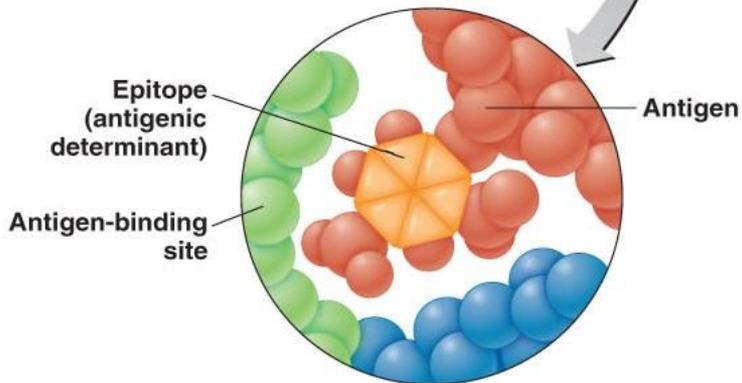
Antigen binding site

Antigen binding site

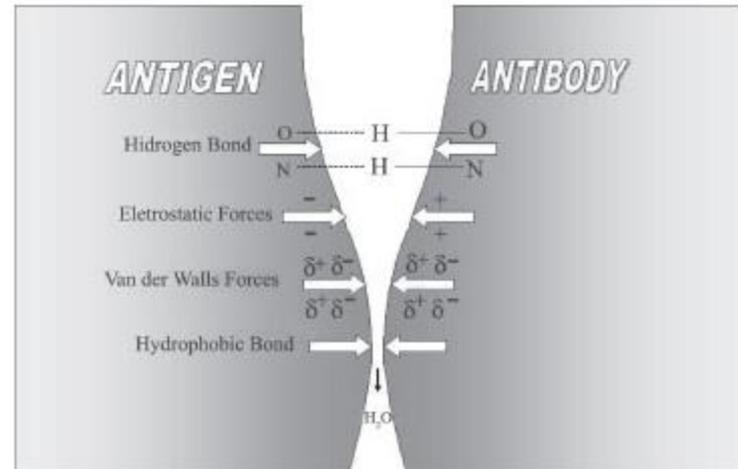
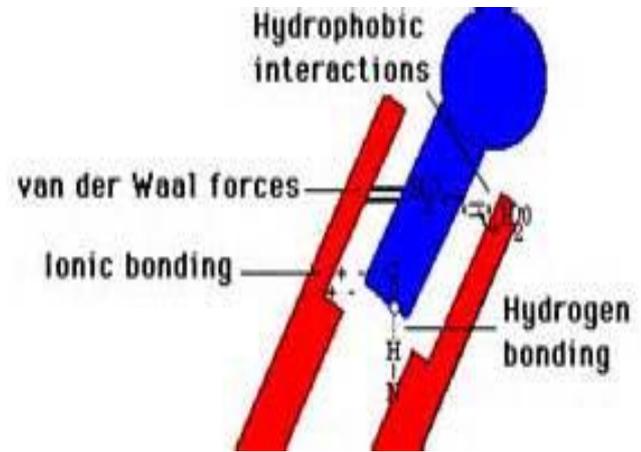
Bonds between antigen epitope and antibody binding site



(a) Antibody molecule



Enlarged antigen-binding site bound to an epitope

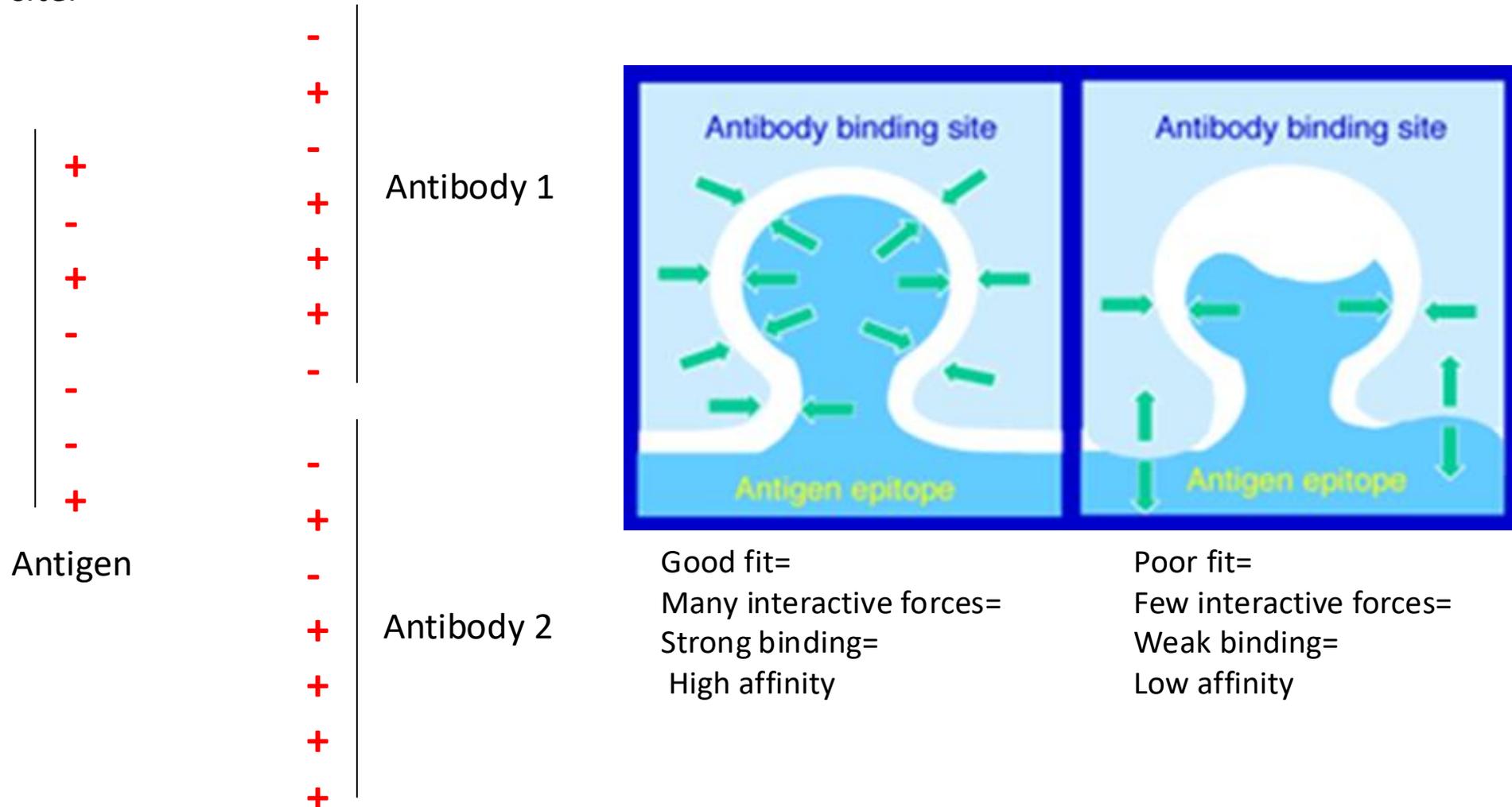


Antibody Structure

Antigen binding site

Affinity

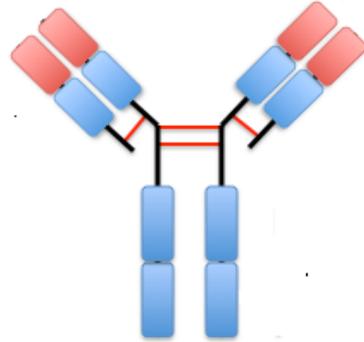
measures the strength of interaction between an epitope and an antibody's antigen binding site.



Antibody Classes (isotypes)



IgG



IgA

IgM

IgE

IgD

Monomeric antibody

Half life is about 23 days

The predominant Ab in blood, lymph fluid, CSF, and peritoneal fluid

Has four subclasses (IgG1 to IgG4)

Half life





IgG

Functions

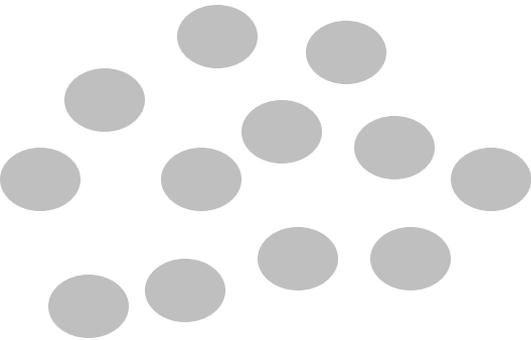
1. Precipitation reaction
2. Agglutination
3. Fetal and neonatal protection
4. Opsonization
5. Immobilization of bacteria
6. Neutralization of bacteria
7. Neutralization of toxins



IgG

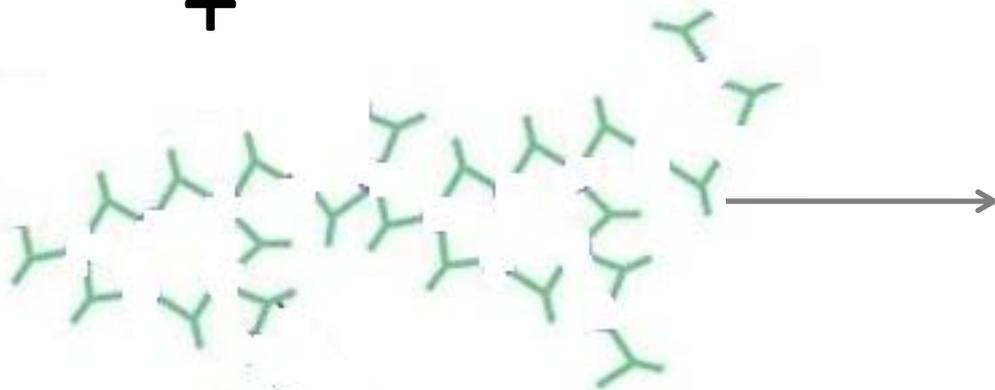
Functions

1. Precipitation reaction

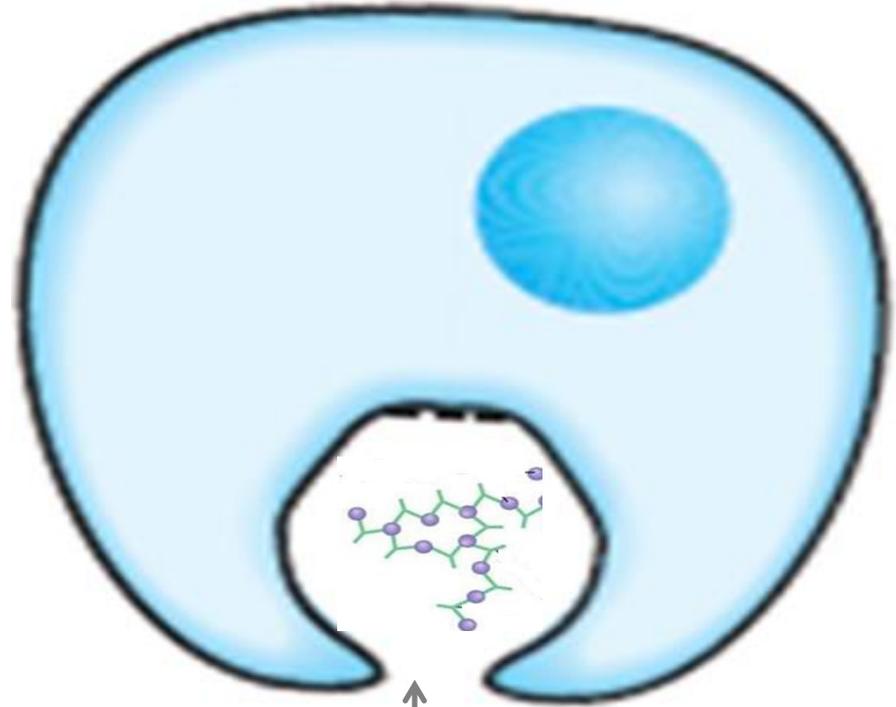


Soluble antigens

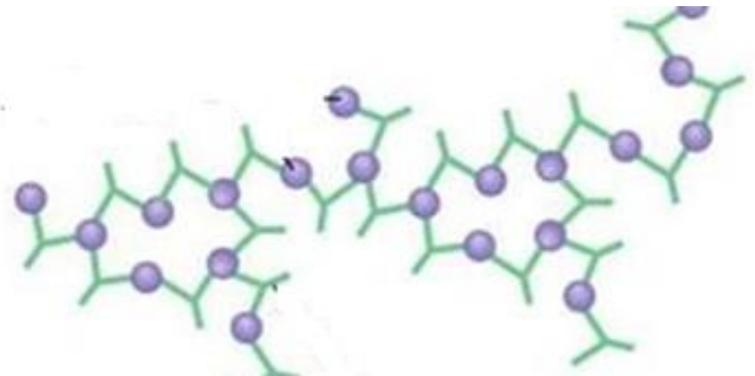
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Specific antibodies



Facilitate phagocytosis

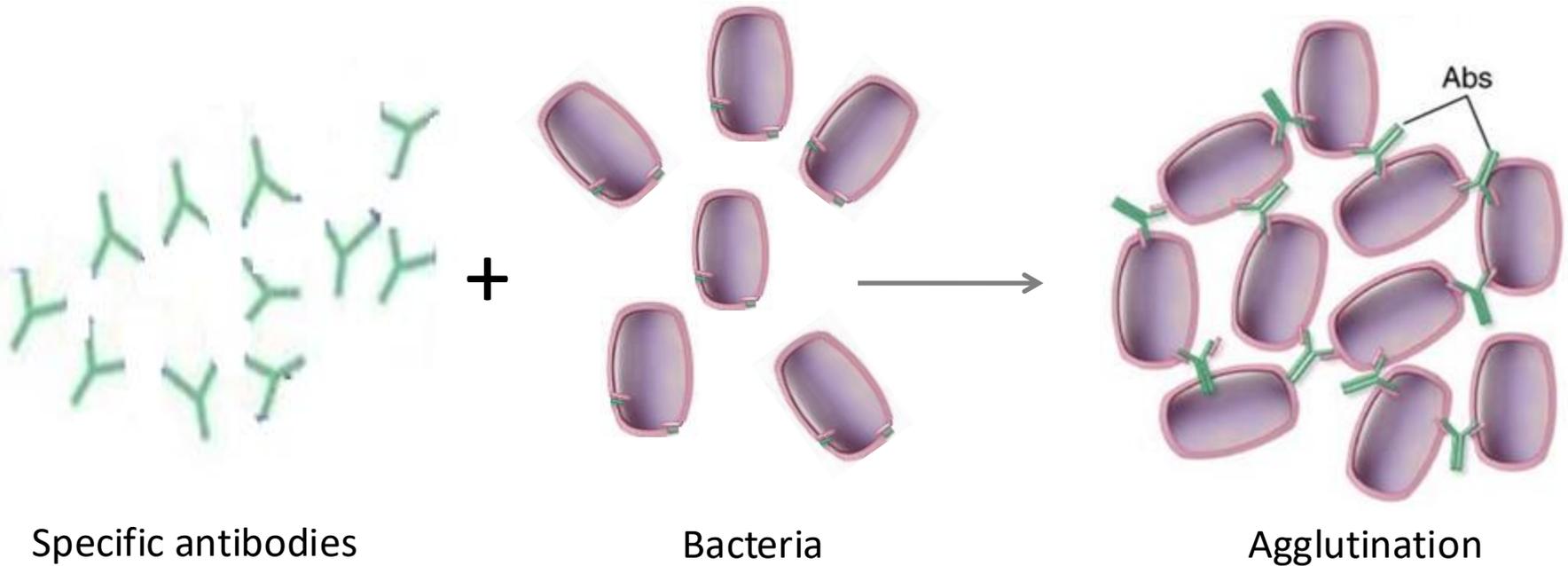




Functions

2. Agglutination:

Is the clumping of large particles



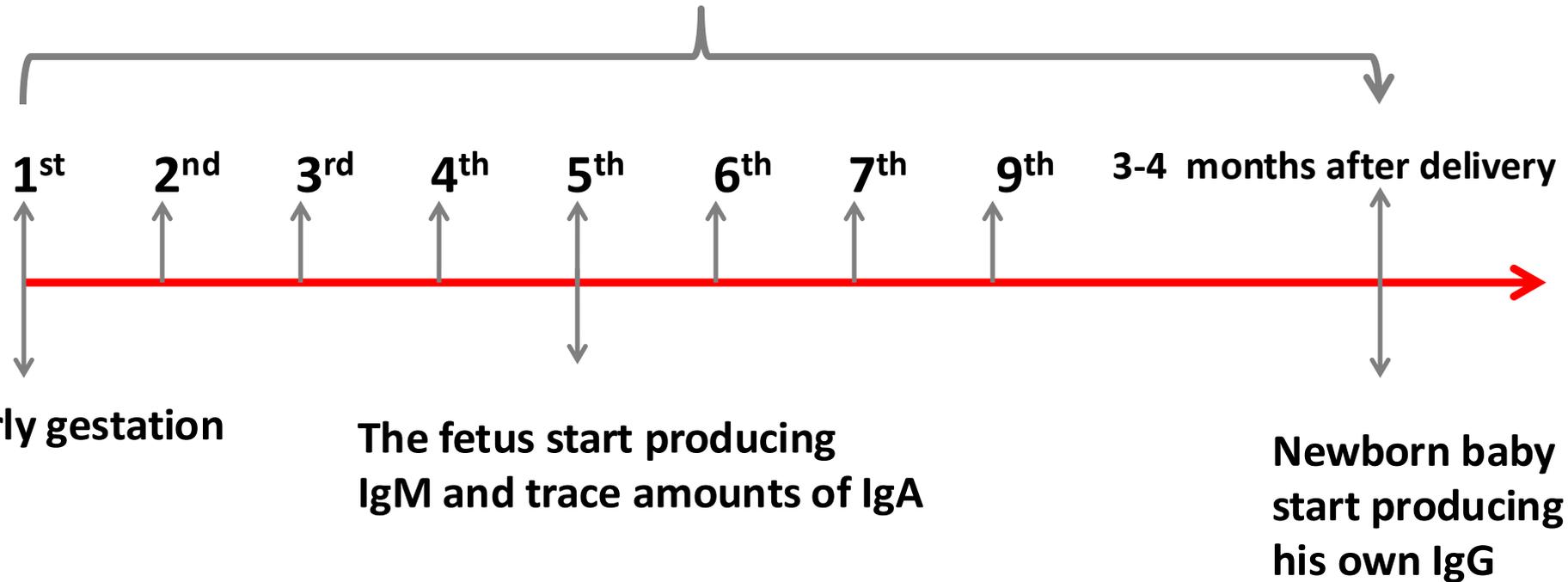


IgG

Functions

3. Fetal and neonatal protection (can pass placenta)

Protection by Maternal IgG



Antibody Classes (isotypes)

Functions

4. Opsonization: from Greek to prepare for eating

IgG



Antibody

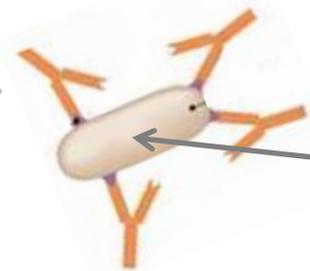
Complement

Macrophage

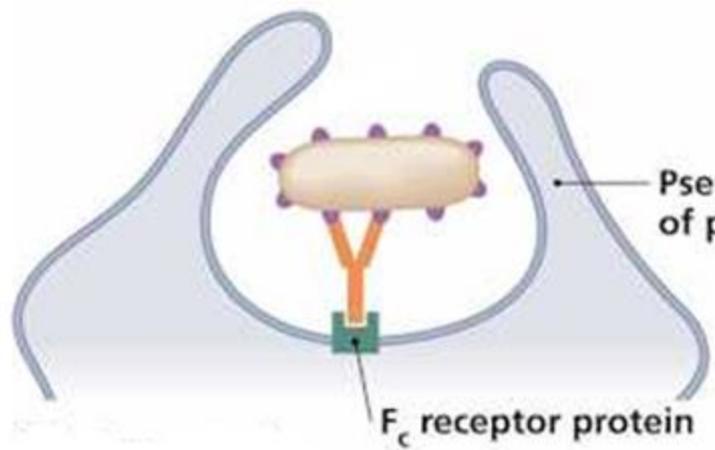
Bacteria



+

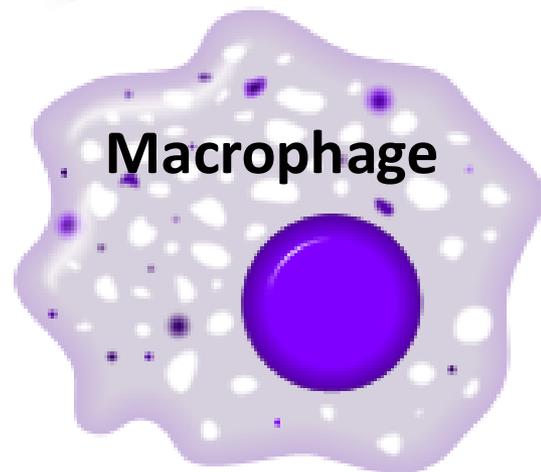


Bacterium



Pseudopod of phagocyte

F_c receptor protein



Macrophage

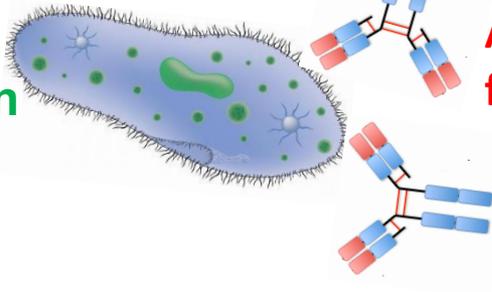


IgG

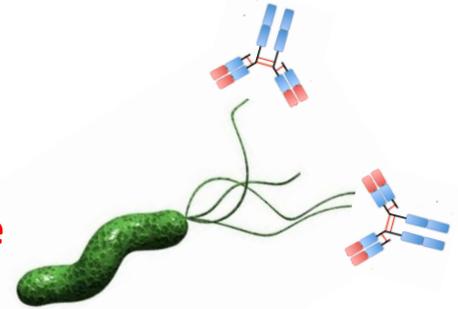
Functions

5. Immobilization and neutralization of bacteria

paramecium

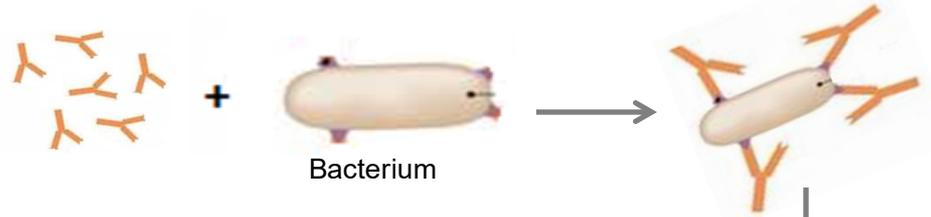


Antibodies against cilia and flagella leave them immotile

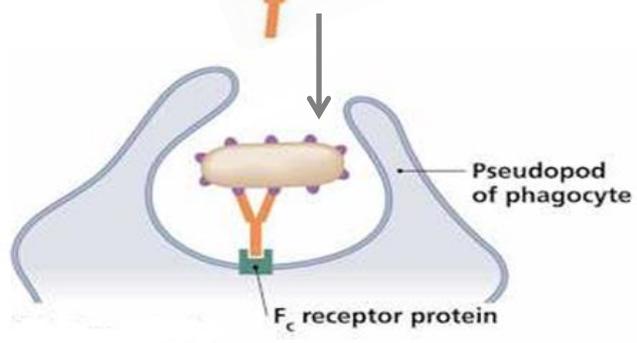


Helicobacter pylori

Immobilization



neutralization

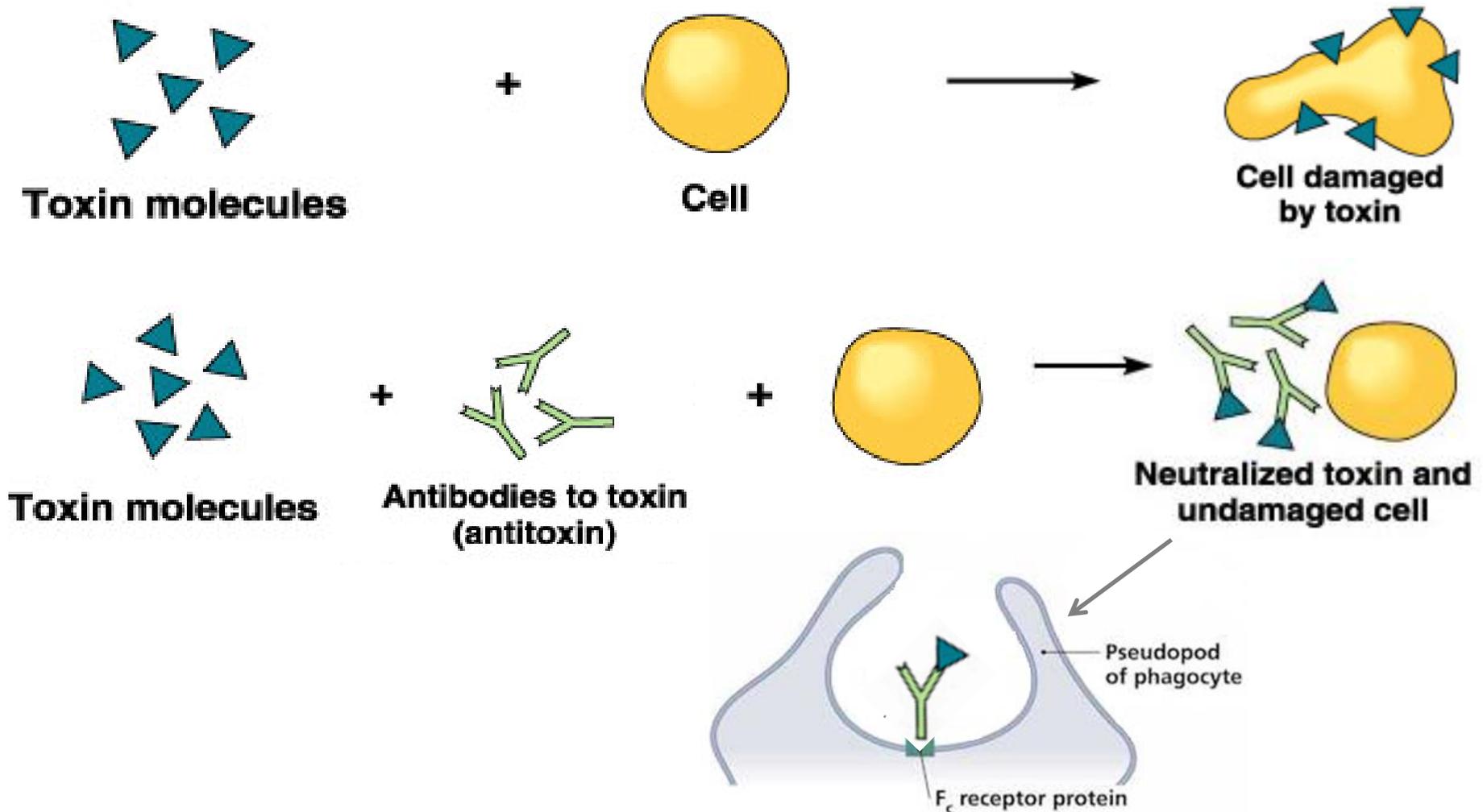




IgG

Functions

7. Neutralization toxins

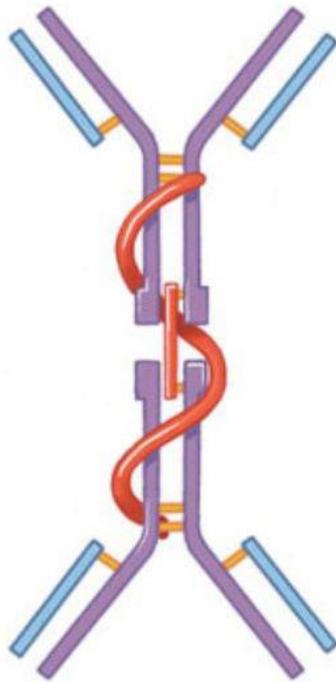




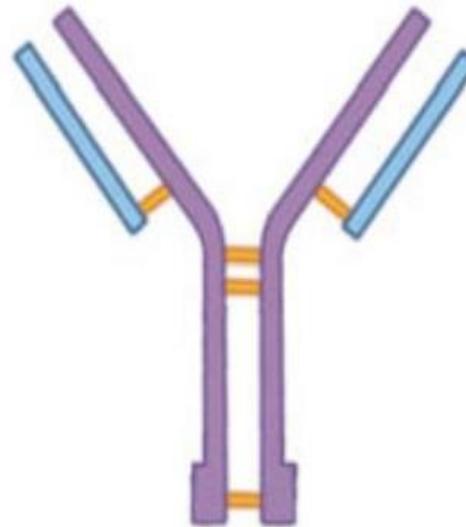
IgA

Forms

Plasma cells produced and released two forms of IgA



Dimeric IgA

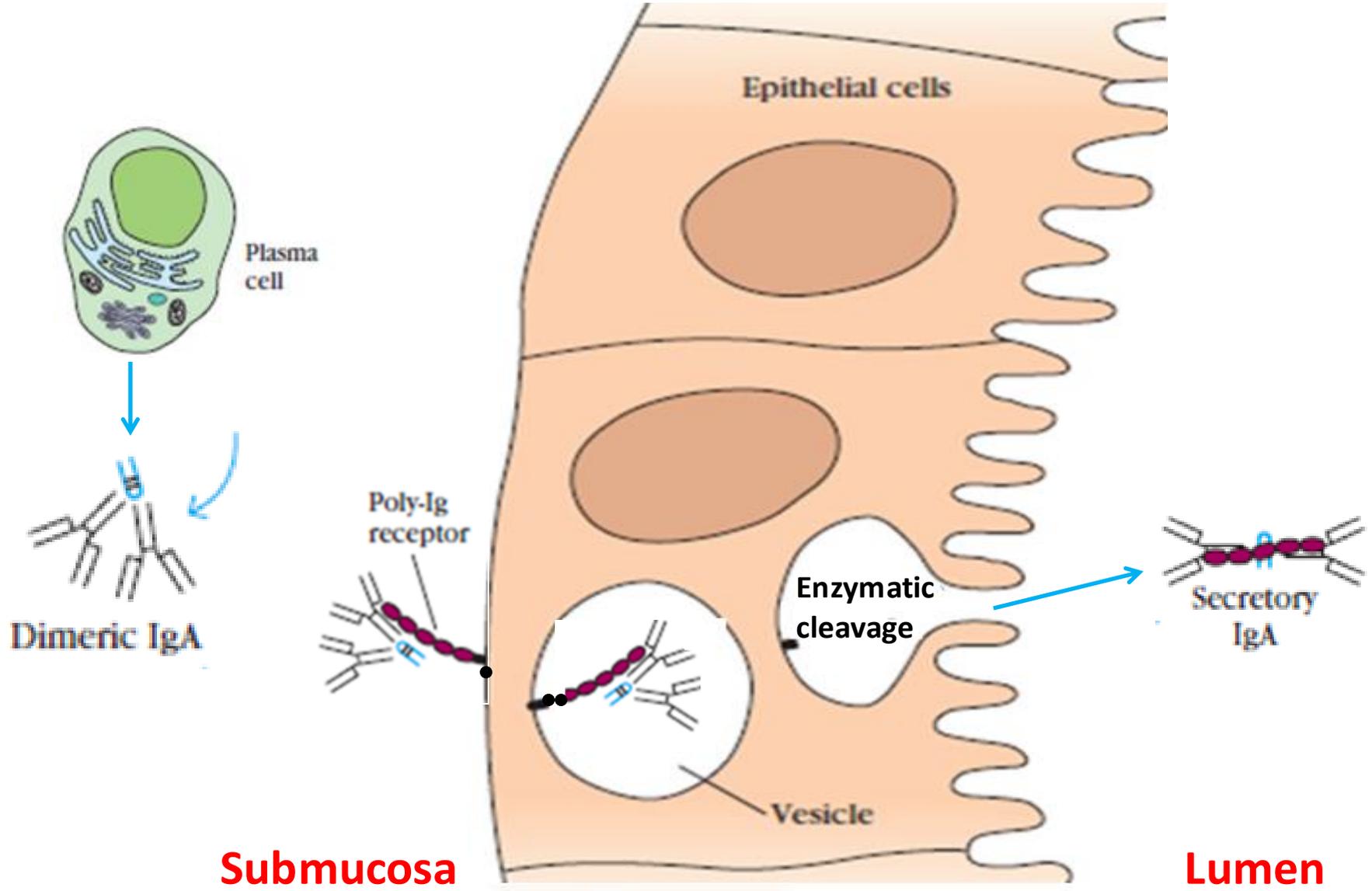


Serum IgA: has a monomeric form with unknown function

Antibody Classes (isotypes)

IgA

Formation of secretory IgA



IgA

Functions:

- Provides neonates a protection against respiratory and GIT infections
- Efficient antiviral and agglutinating Ab
- Cannot fix complement
- Half-life 6 days

Antibody Classes (isotypes)

Out with stool

IgA

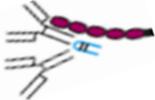
Salmonella



Lumen

Intestinal epithelium

M cells



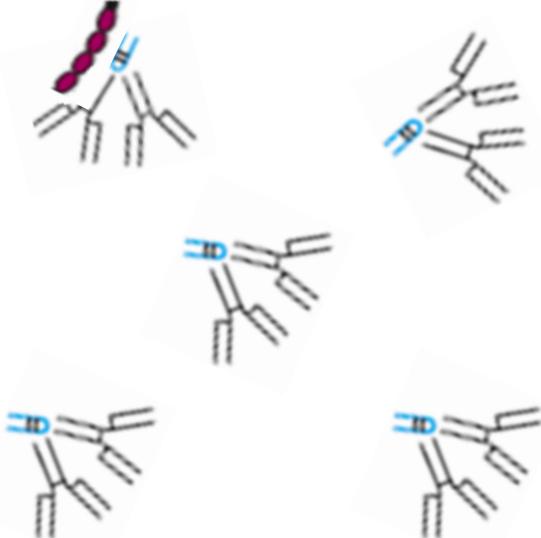
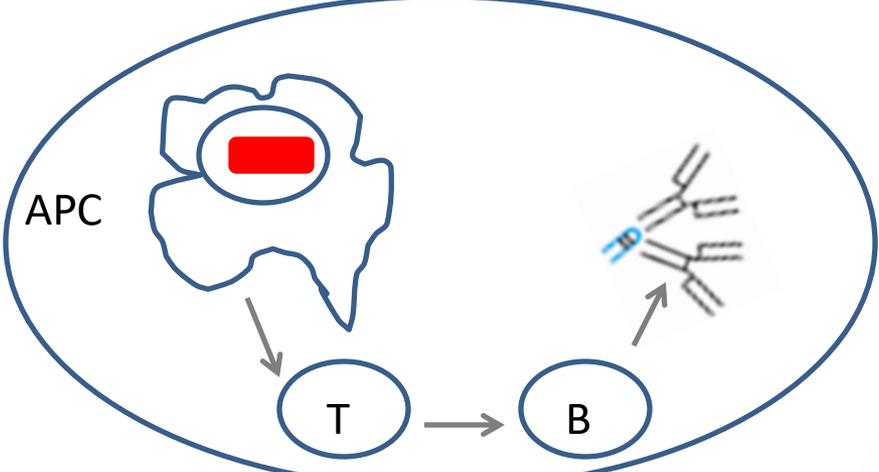
Submucosa

APC

T

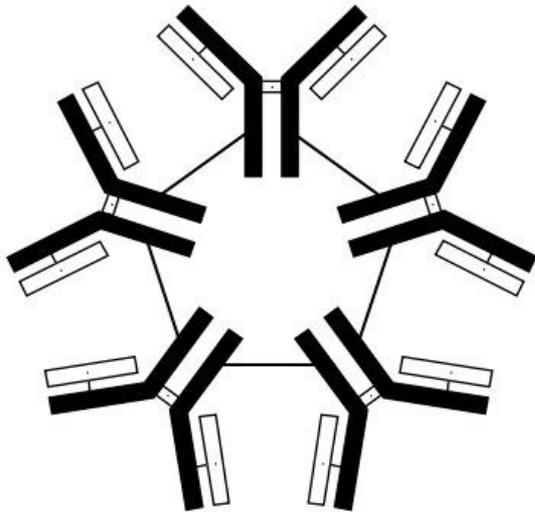
B

Peyer's patches



Antibody Classes (isotypes)

IgM



The first Ab produced in response to an antigenic stimulation

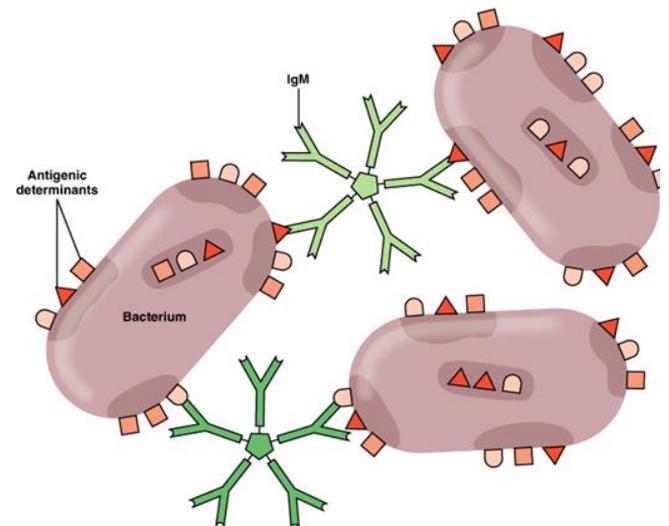
The half life is 10 days

First Ab produced after 5 months of gestation

Efficient agglutinating and complement fixing Ab



Cannot pass placenta



Antibody Classes (isotypes)

IgD

Have unknown protection function

Ab concentration

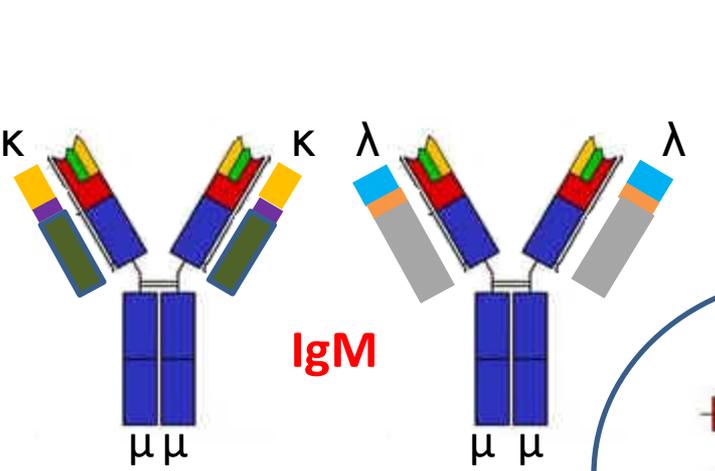
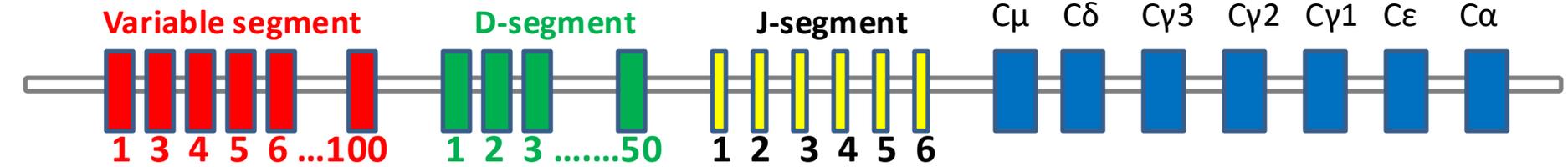
G A M E D


IgE

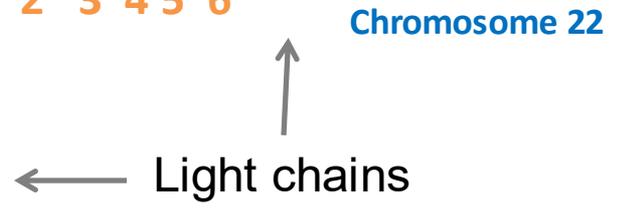
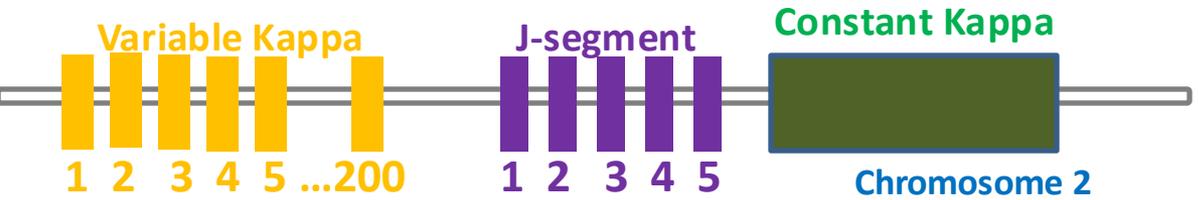
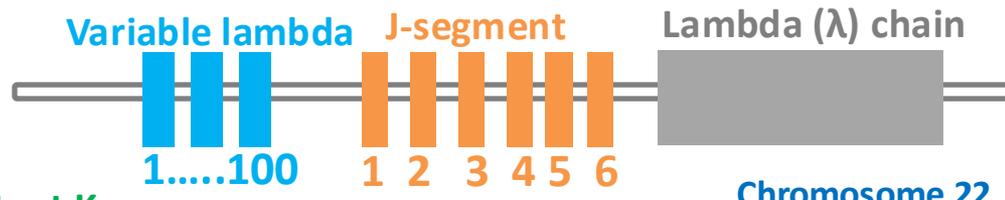
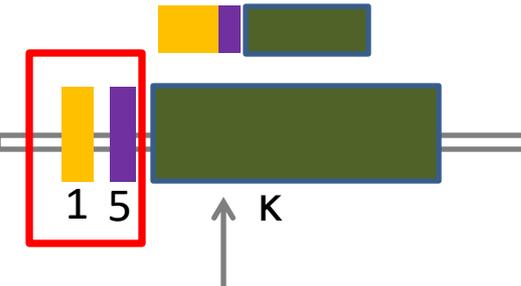
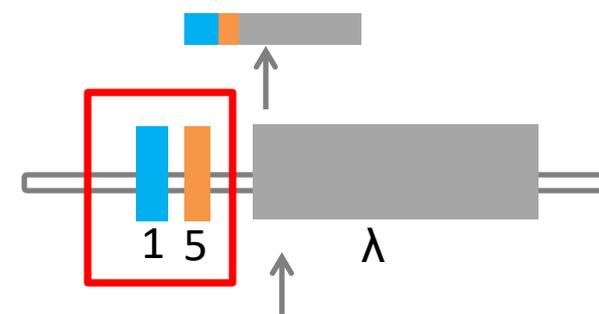
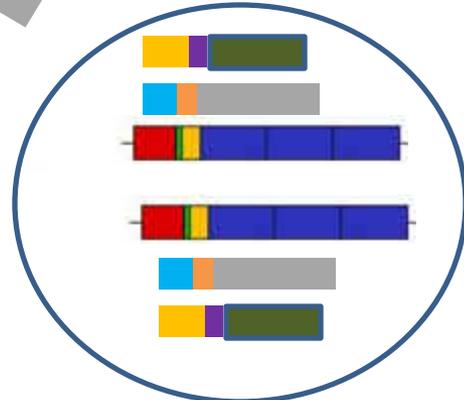
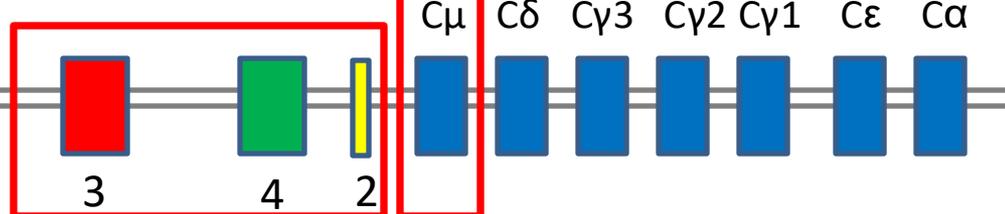
- Not agglutinating and complement fixing Ab
- Increasing levels of IgE in serum have been shown to occur during infections with certain parasites
- Has a high affinity receptor on the surface of eosinophils
- Associated with hypersensitivity or allergy reactions
- Half life is 2 days

Why do we have millions of different versions of Fab?

Chromosome 14



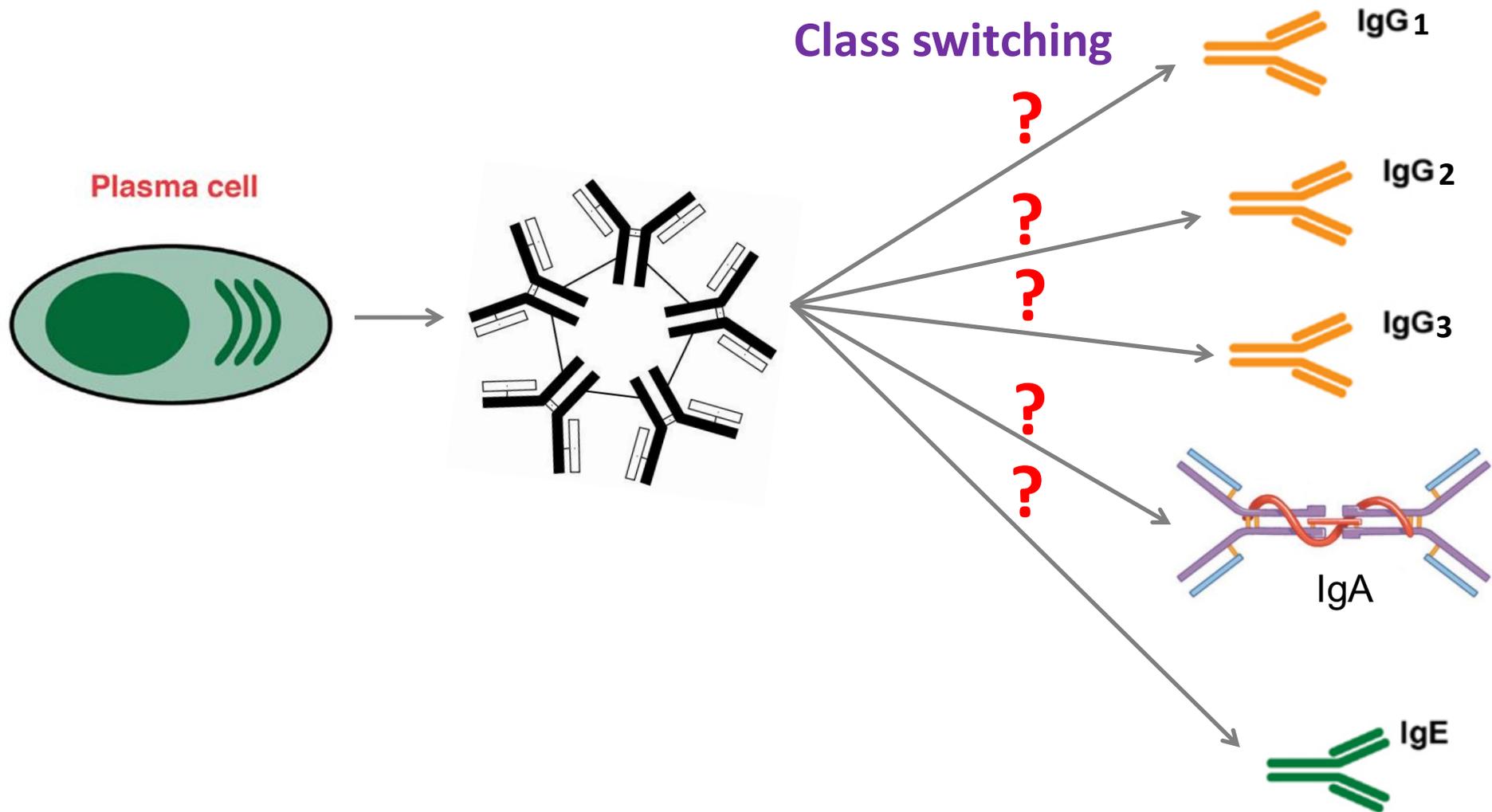
Recombinases



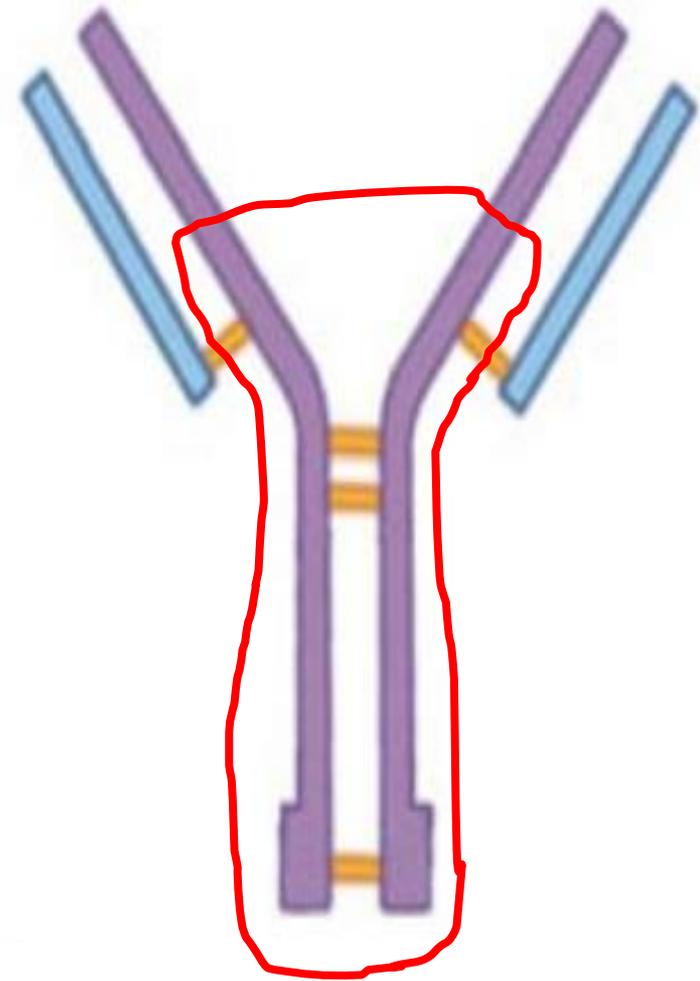
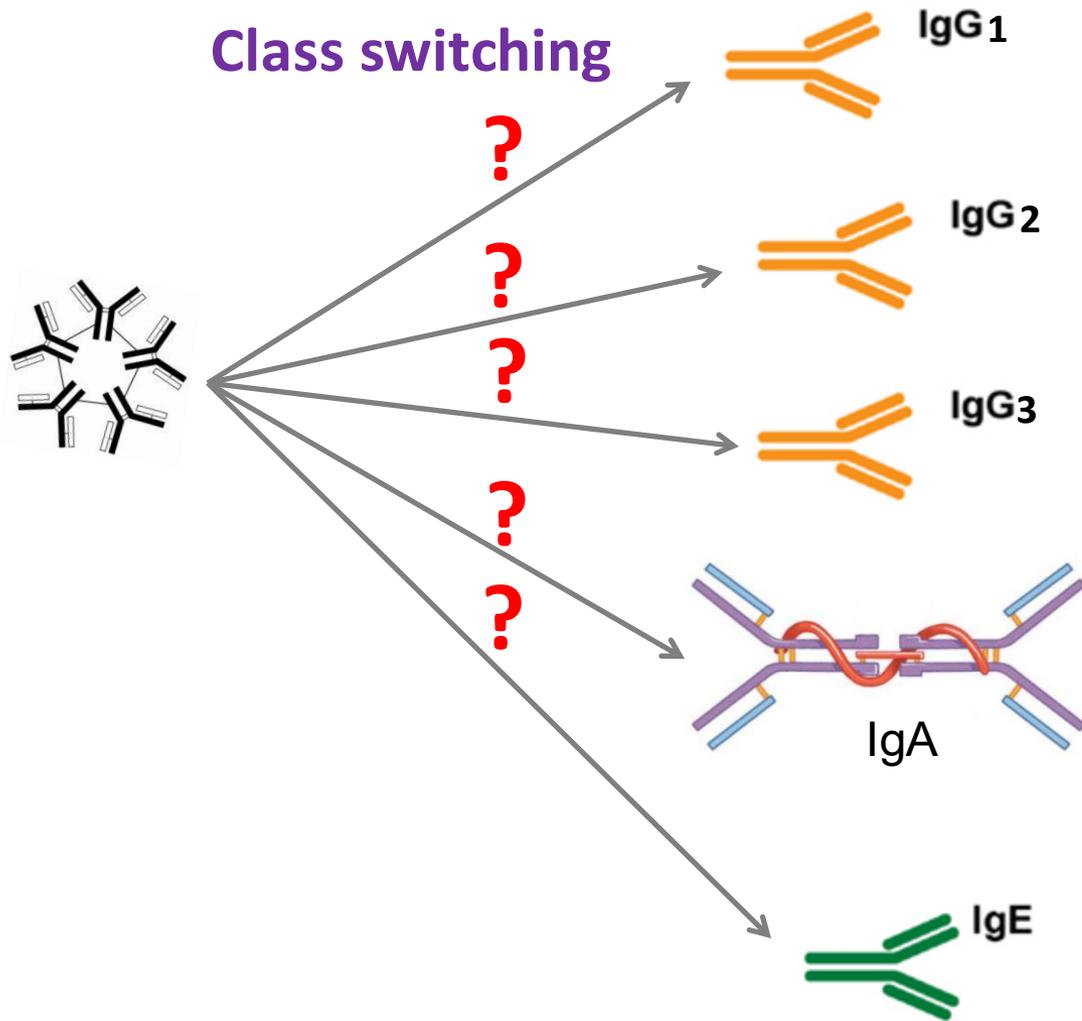
Light chains

The process of class switching

How to produce more than type of antibodies from one response?

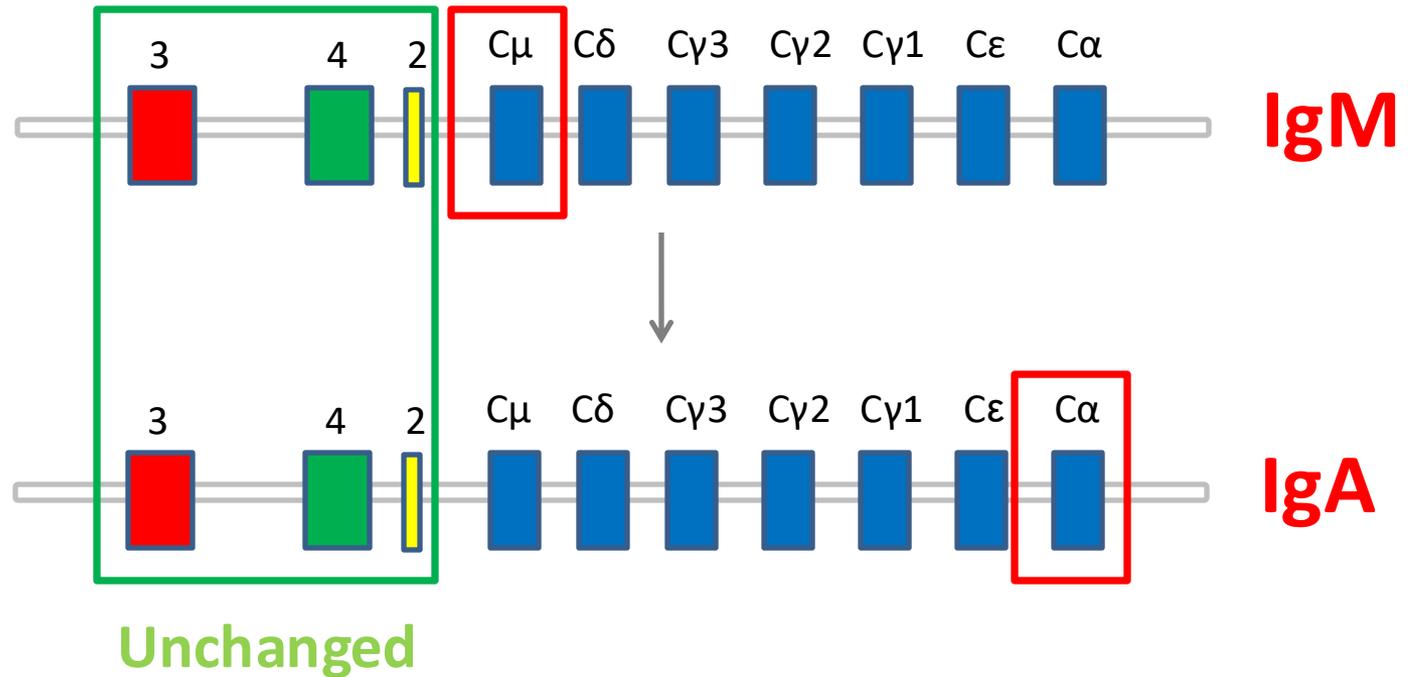
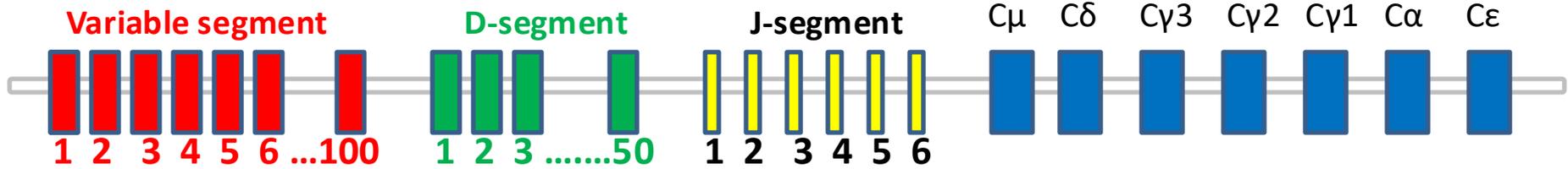


The process of class switching



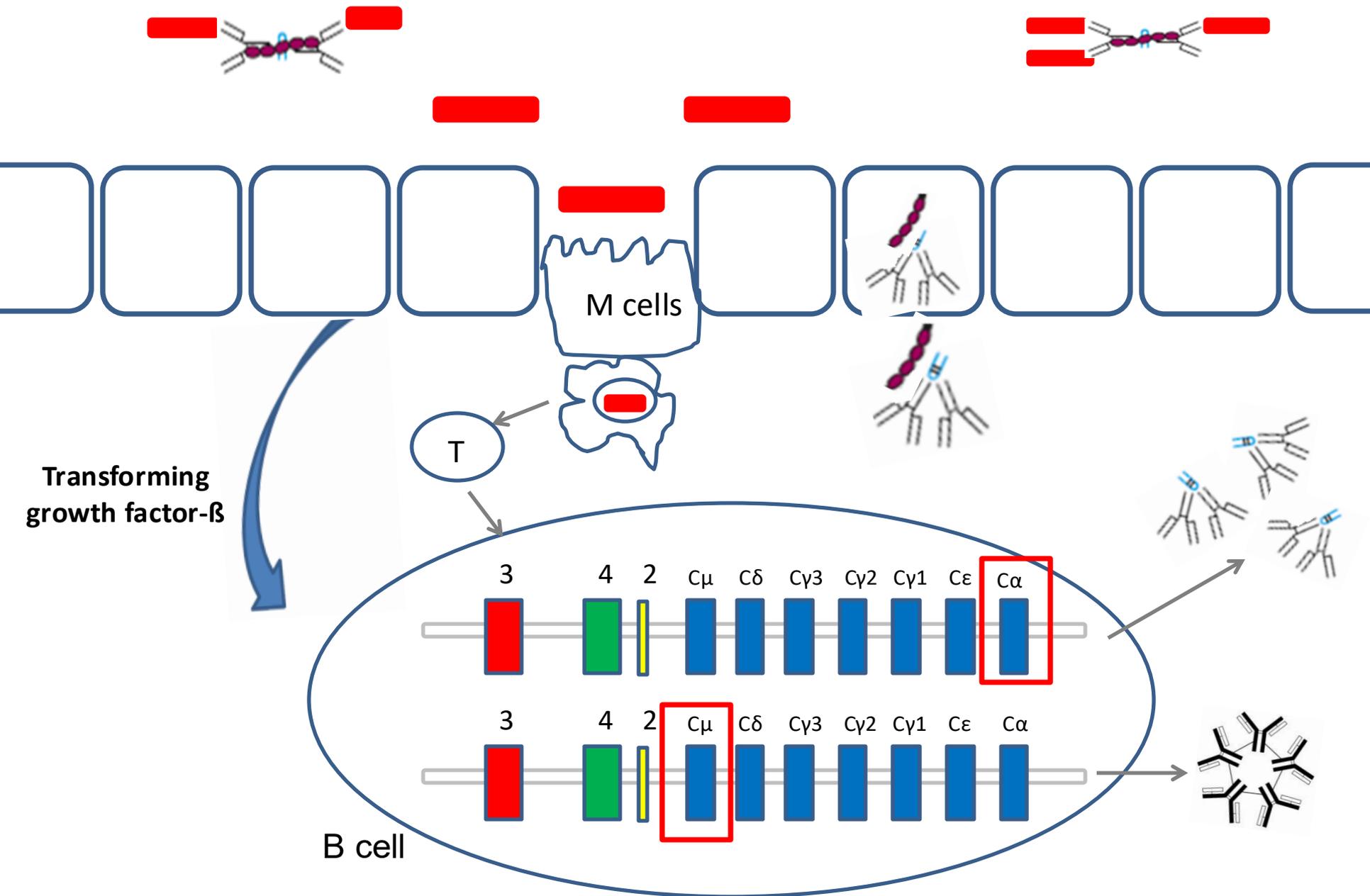
Class switching is determined only by change in the type of the constant region

The process of class switching

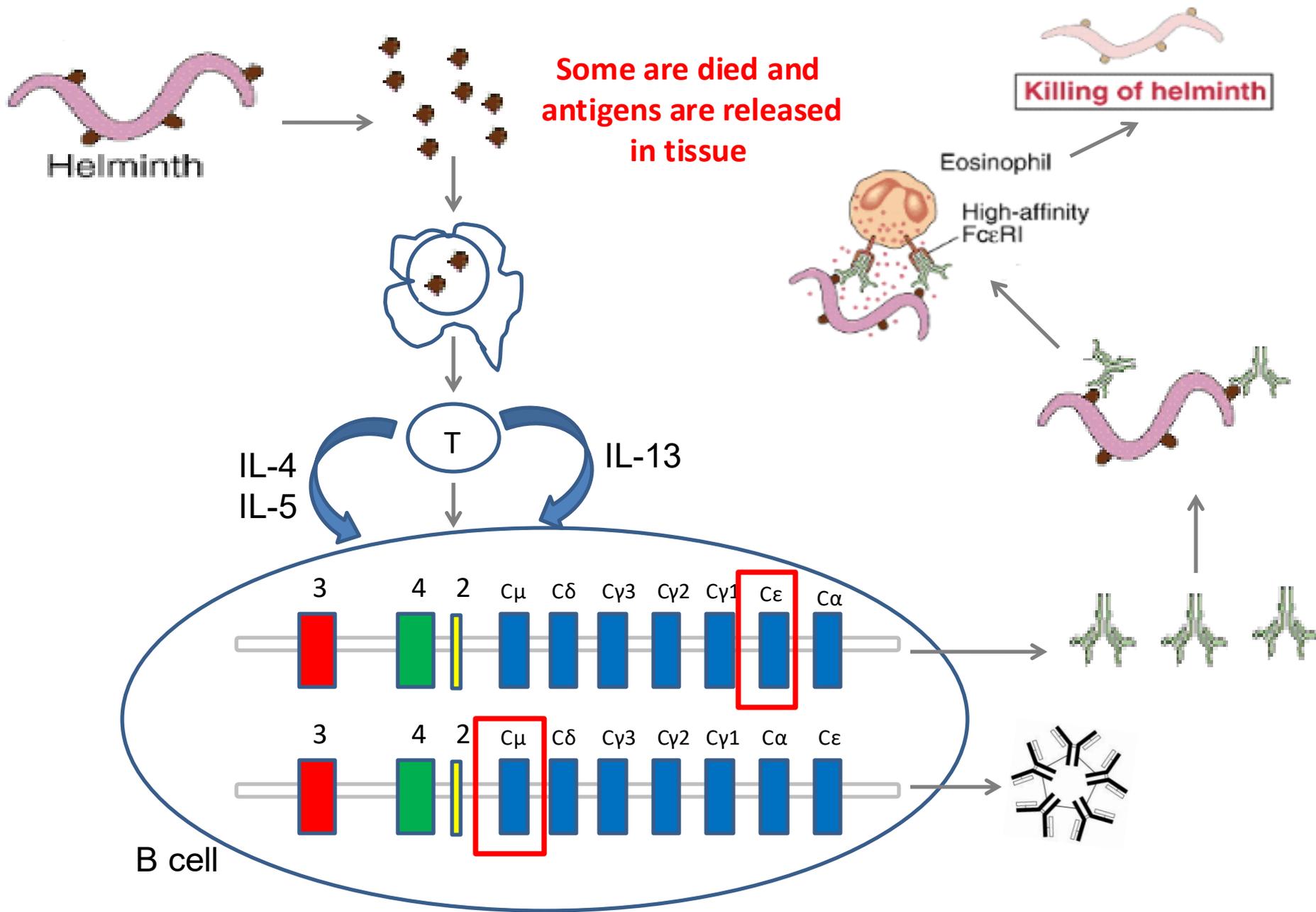


More than one type of antibodies from one response

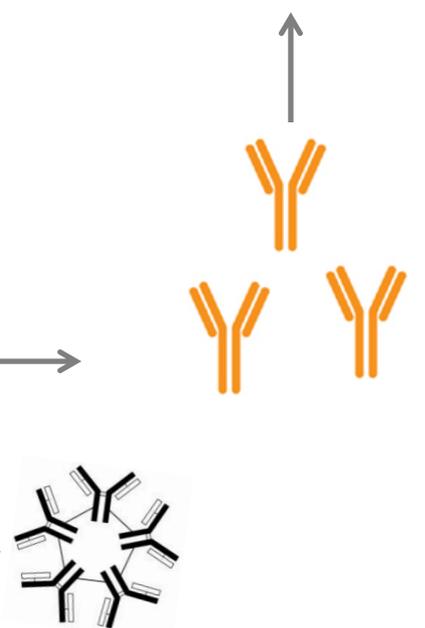
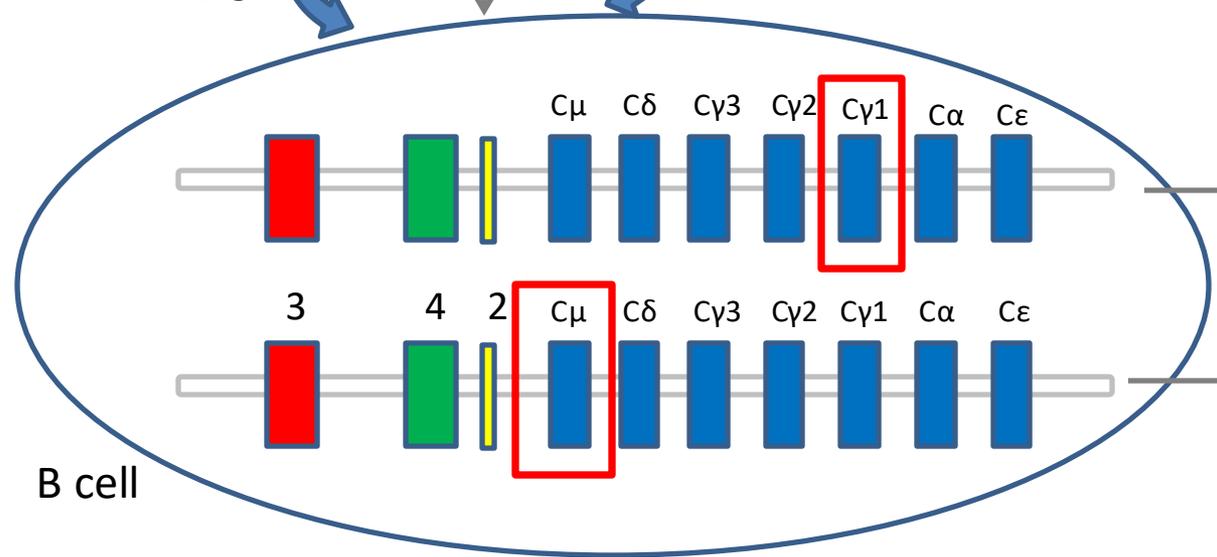
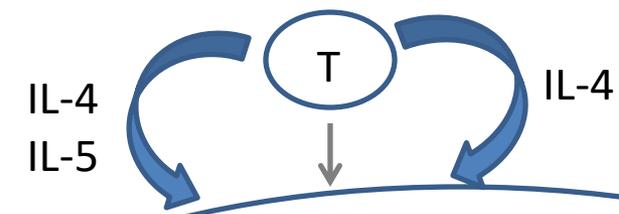
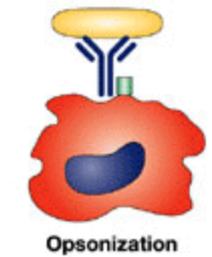
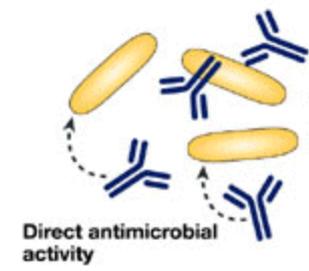
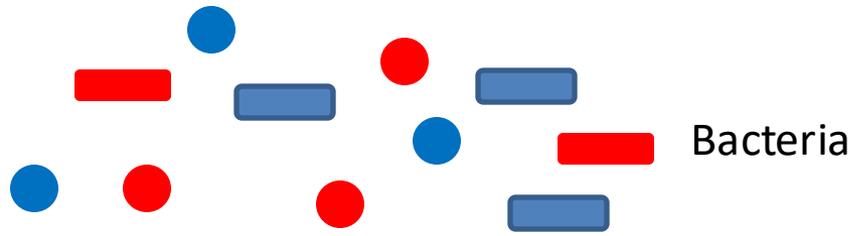
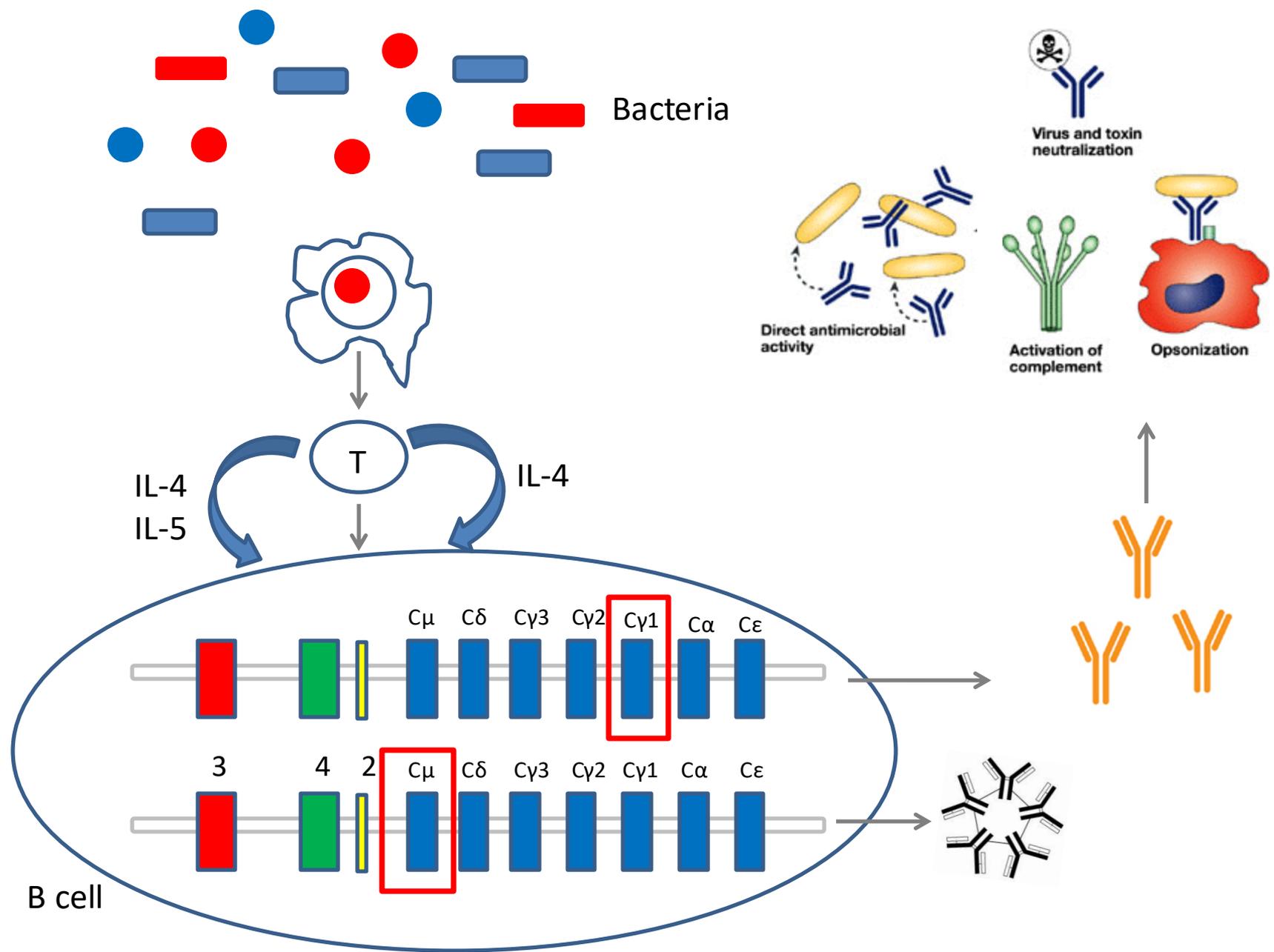
IgM to IgA



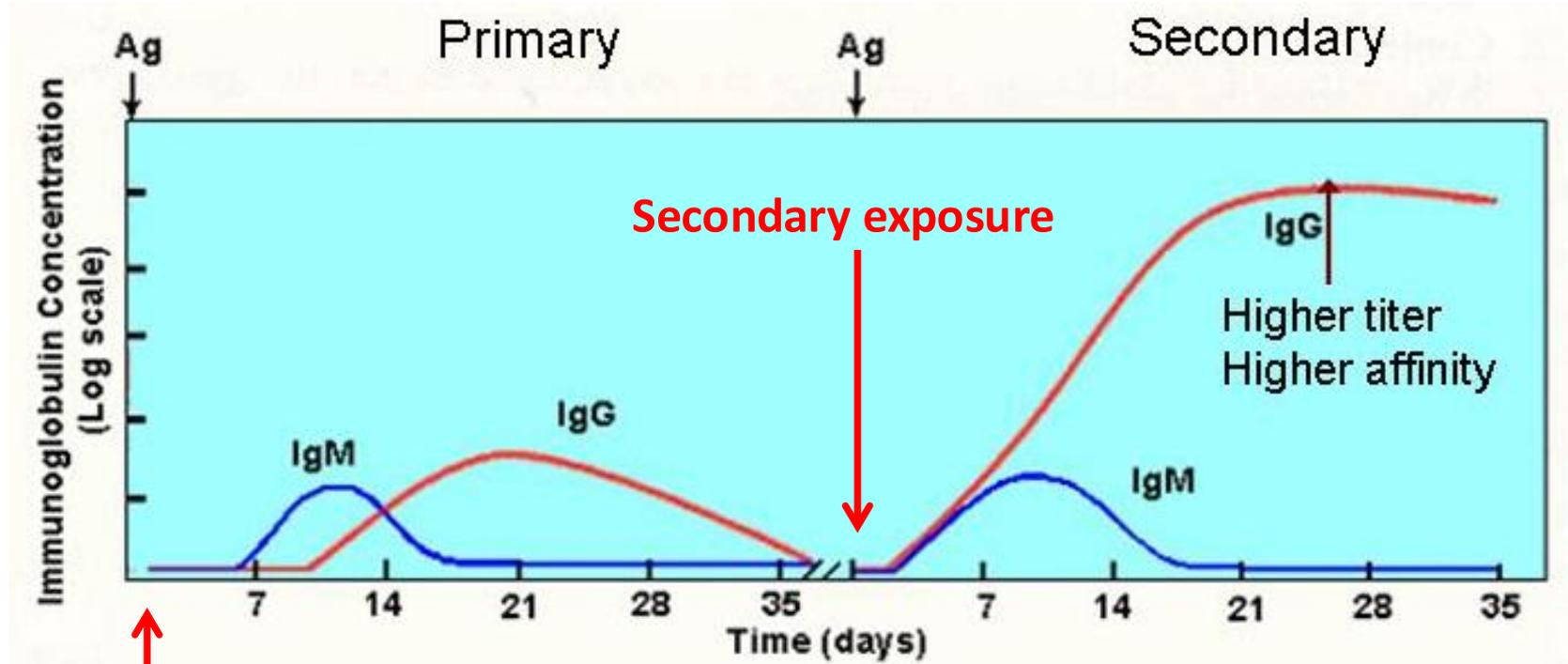
IgM to IgE



IgM to IgG1



Kinetics of antibody response following immunization



Primary exposure