



Preview: host defense



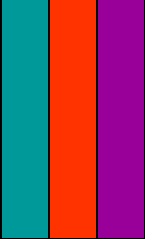
Q1: What's innate immunity?

Q2: What's the relationship between antigen and antibody?

Q3: What's humoral immunity?



Host Defenses



■ Adaptive

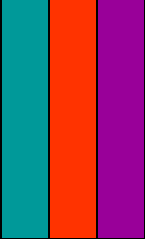
The **adaptive immune system** is composed of highly **specialized**, systemic cells and processes that eliminate or prevent pathogenic challenges.

■ Innate

the cells and mechanisms that defend the host from infection by other organisms, in a manner of lower **specificity**



Defense Barriers



- **Physical**

- **Inflammation**

- **Chemical**

- **Fever**

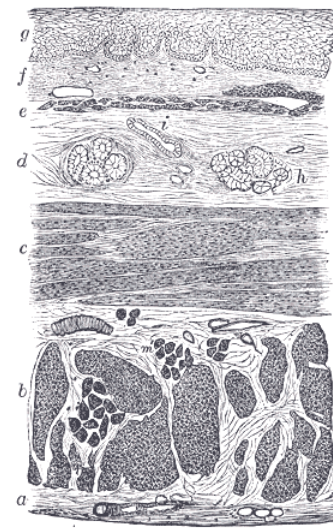
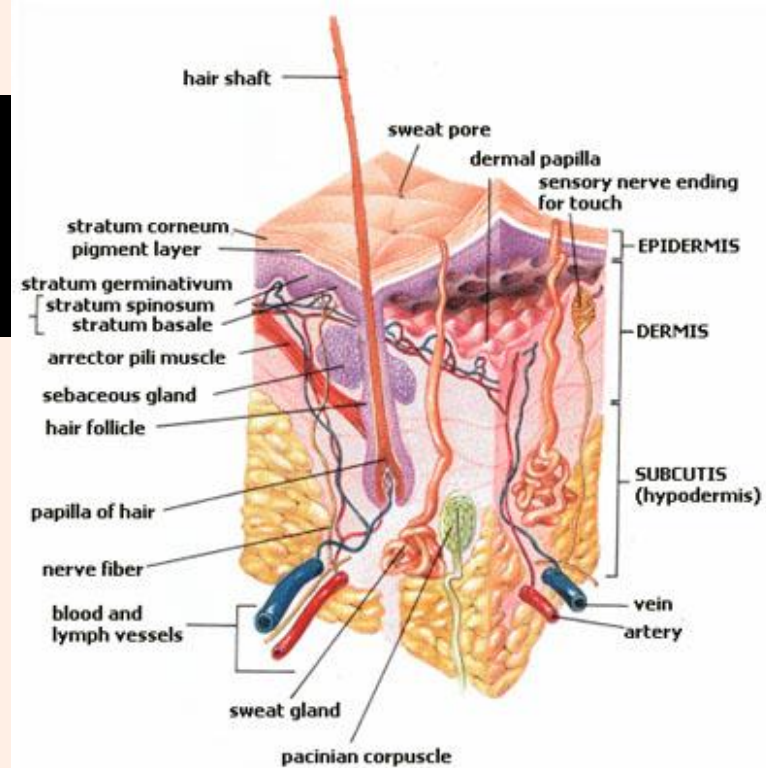
- **Cellular defenses**

- **Molecular defenses**

Physical Barriers

■ Skin

■ Mucous membranes



Serosa
Longitudinal Muscle
Myenteric Plexus
Circular Muscle
Submucosal Plexus
Submucosal
Mucosal

Chemical Barriers

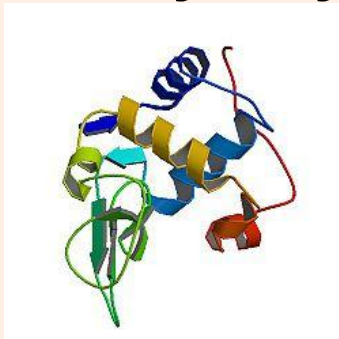
■ Salt

Limited water availability to inhibit microbe growth

■ pH

Mostly decrease pH value to inhibit microbe growth

■ Lysozyme

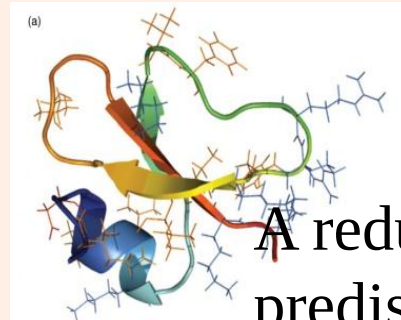


■ Transferin



■ Lactoferrin

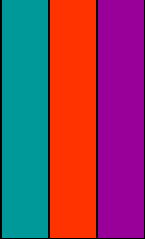
■ Defensins (18-45 aa)



A reduction of ileal defensins may predispose to Crohn's disease.

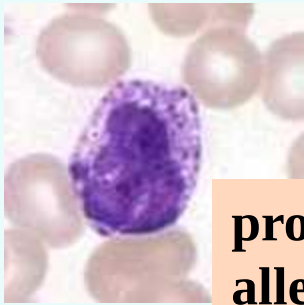


Lysozyme is in:

- 
- A. Virus**
 - B. Bacteria**
 - C. saliva**
 - D. Saliva and tear**

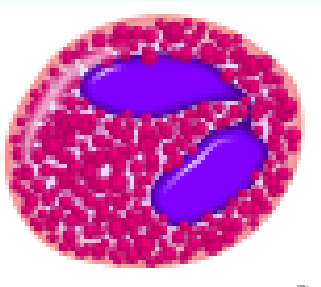
Cellular Defenses - Granulocytes

■ Basophils/Mast cells



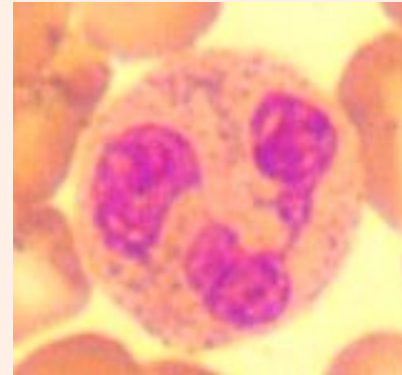
promotes blood flow to tissues,
allergic response

■ Eosinophils



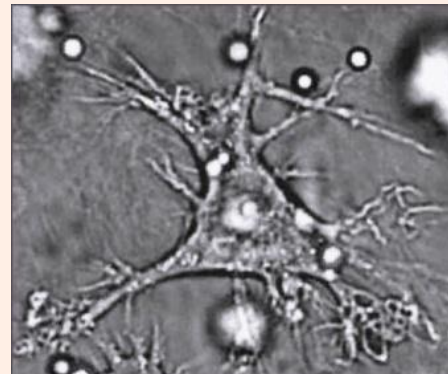
Against parasites

■ Neutrophils



Phagocytosis

■ Dendritic cells



process antigen material

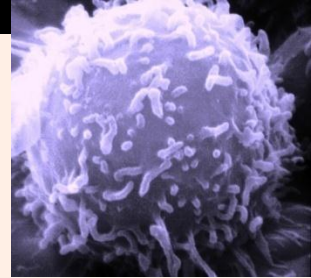
Cellular Defenses — Agranulocytes

■ Monocytes



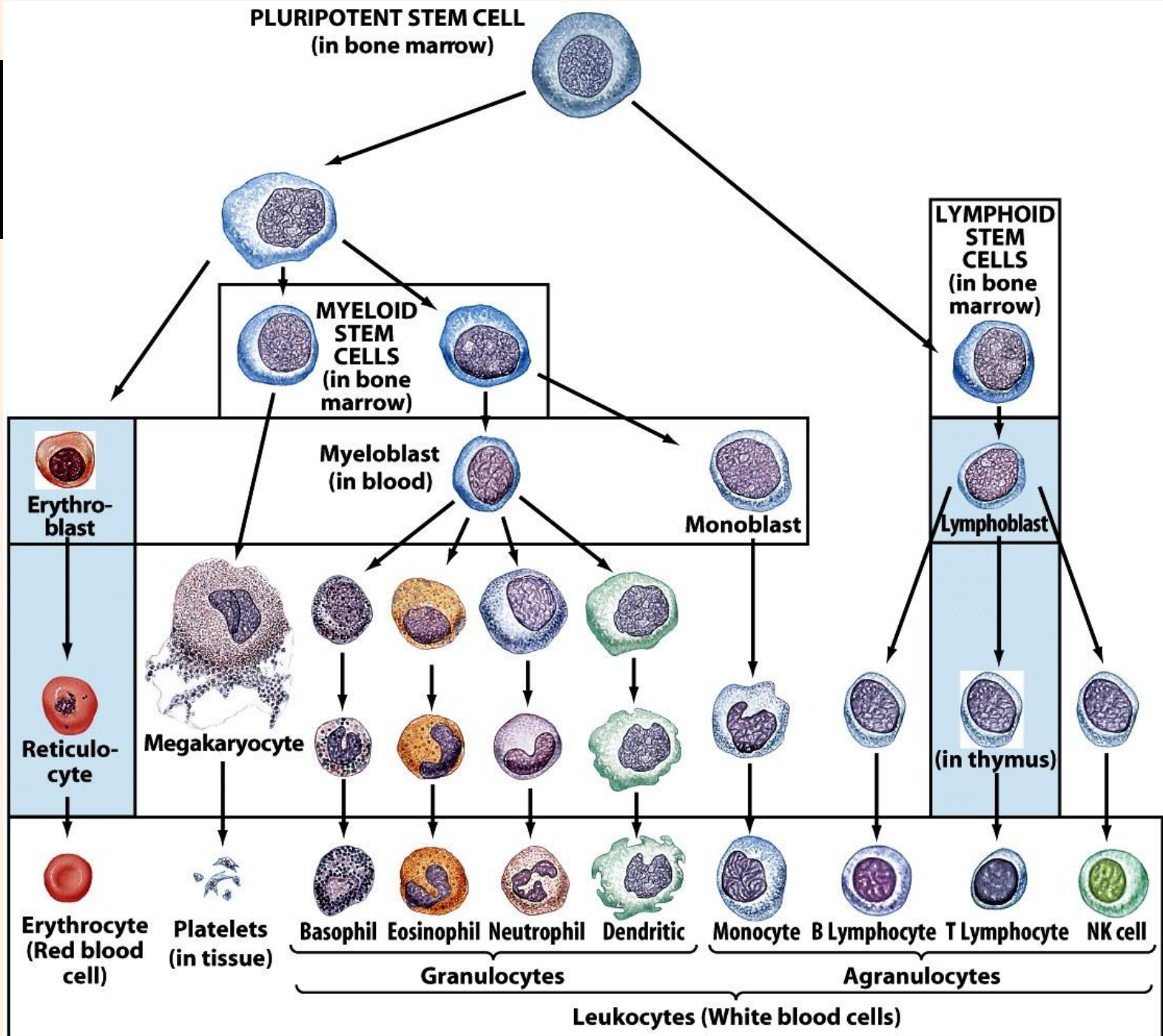
1) replenish resident macrophages and dendritic cells under normal states, and (2) in response to inflammation signals, monocytes can move quickly (approx. 8-12 hours) to sites of infection in the tissues and divide/differentiate into macrophages and dendritic cells to elicit an immune response.

■ Lymphocytes



the natural killer cells (NK cells). The small lymphocytes are the T cells and B cells.

Blood Cells

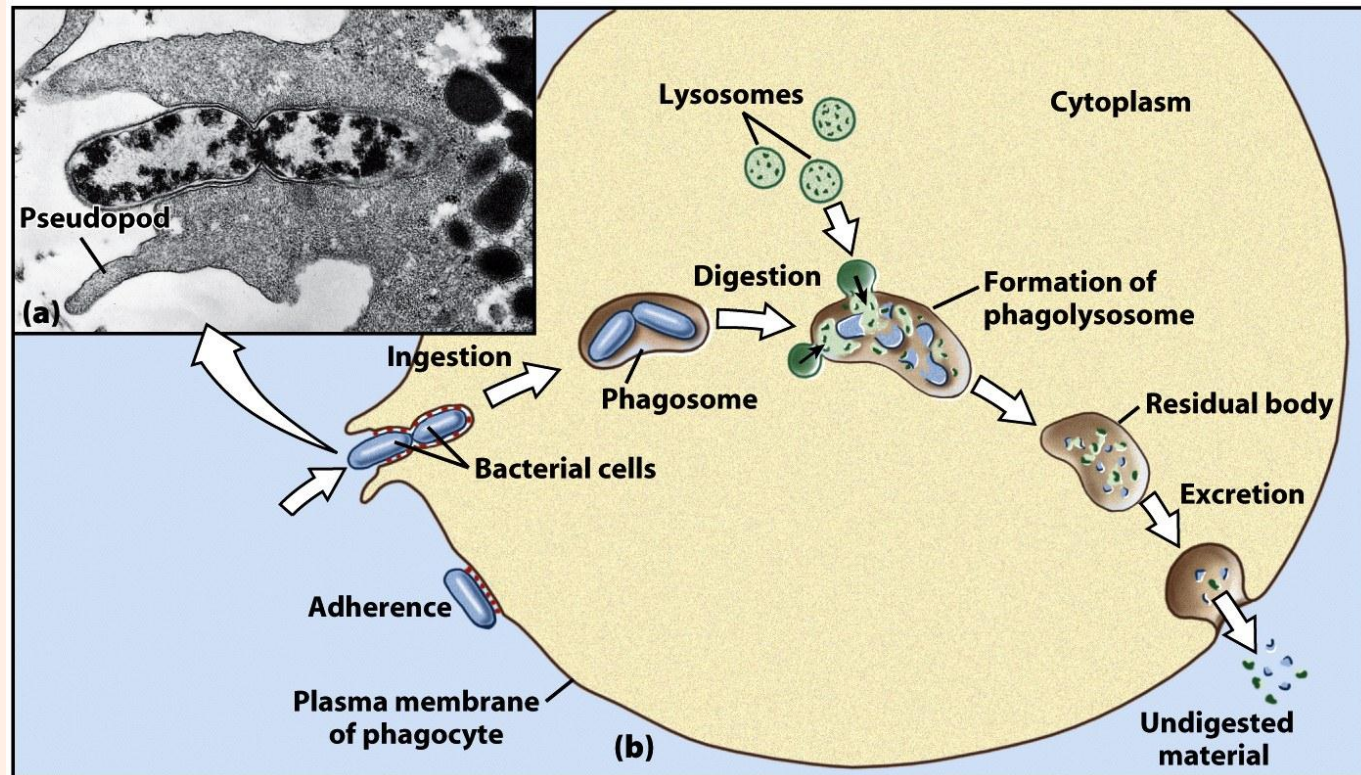


Phagocytosis

Cells Involved: **neutrophils, monocytes**

Process

- Chemotaxis
- Adherence
- Ingestion
- Digestion

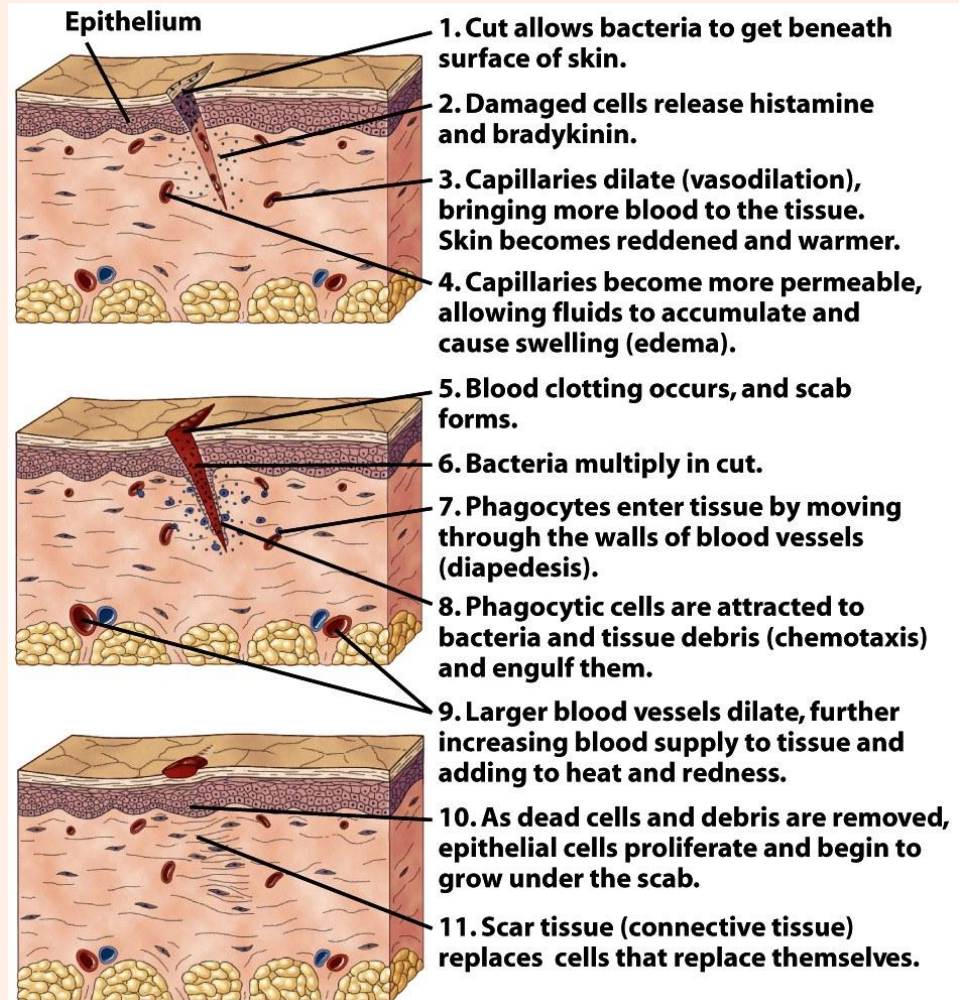


Characteristics of Inflammation

■ Acute Inflammation

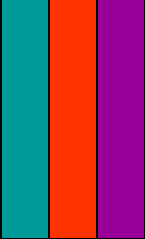
■ Repair/Regeneration

■ Chronic Inflammation



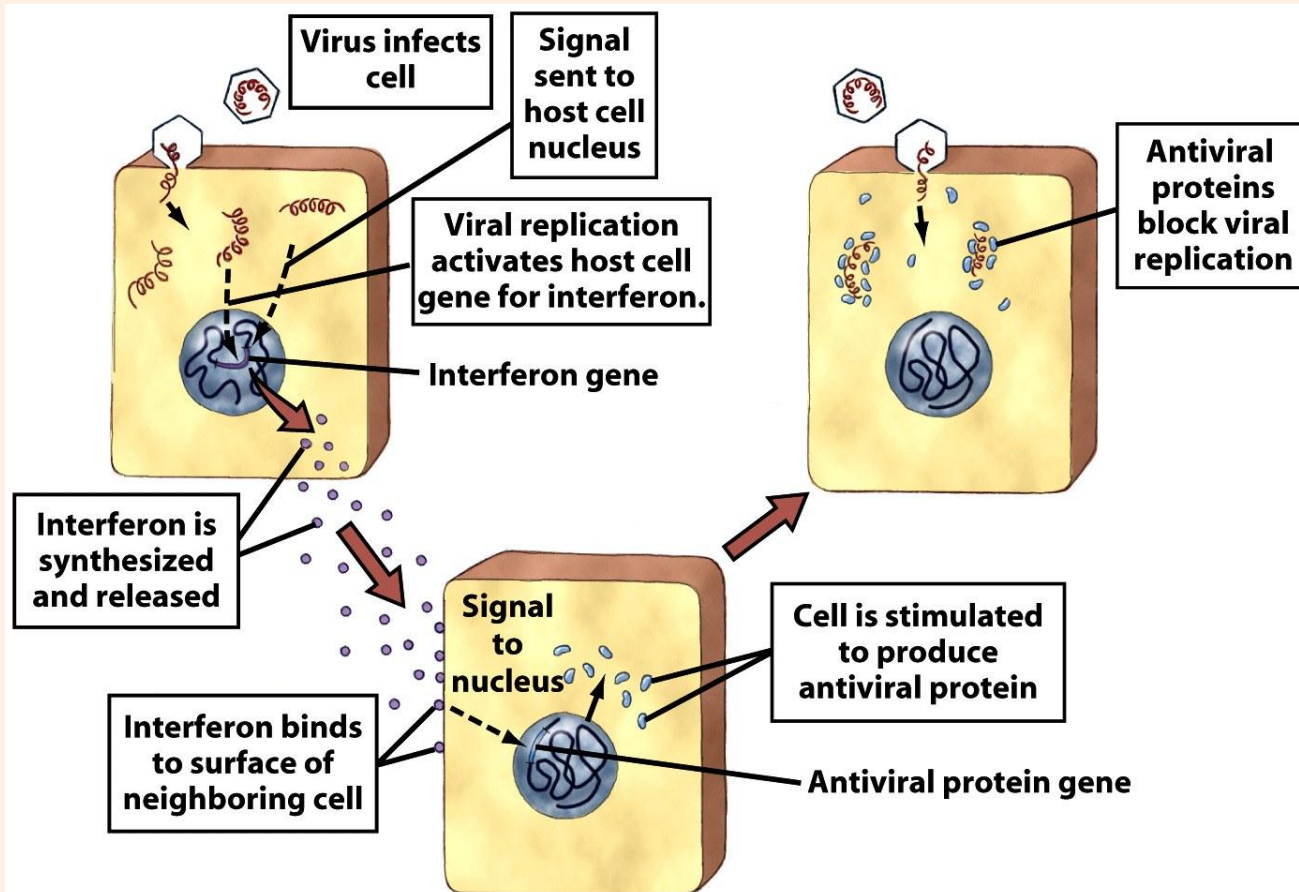


Fever

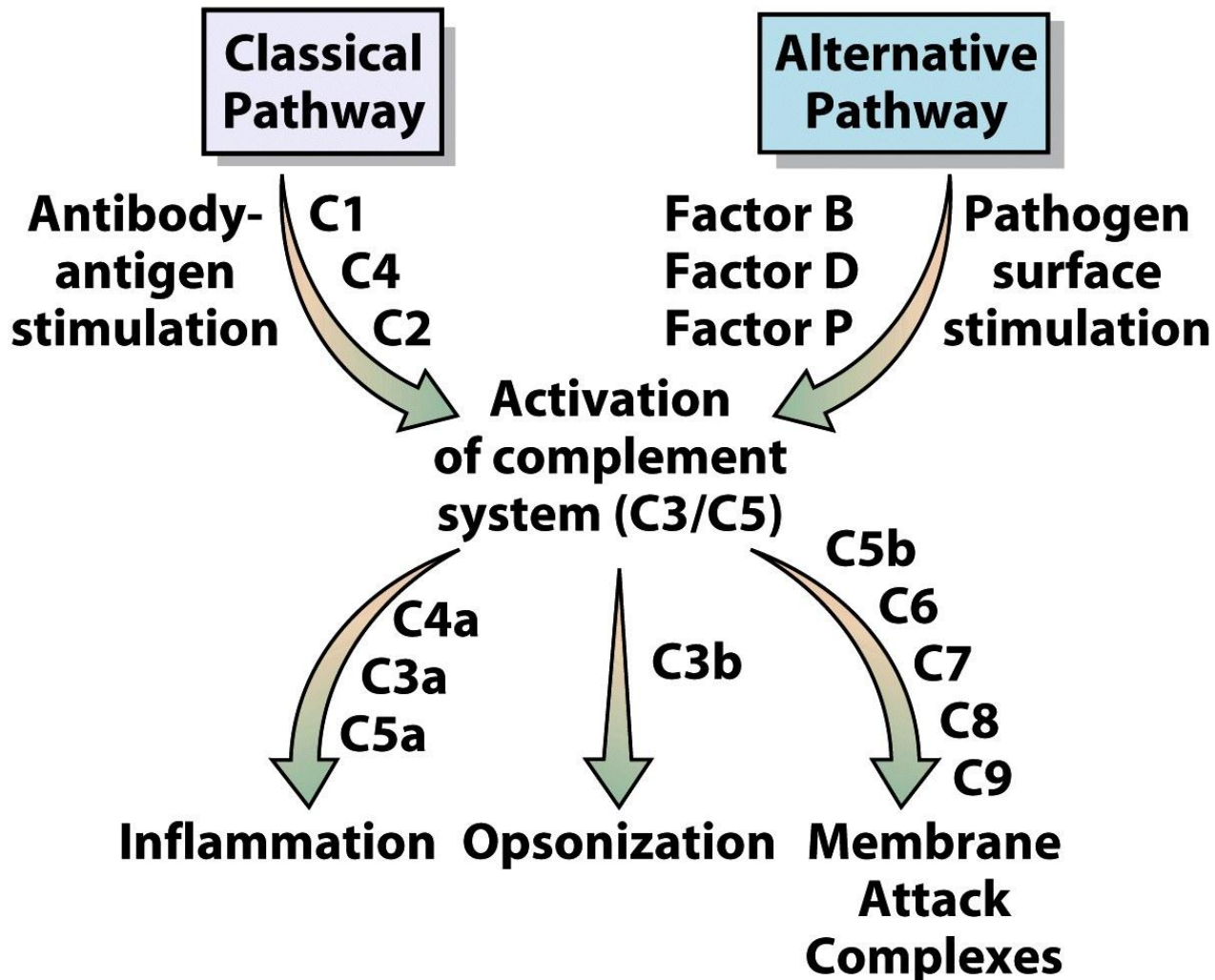
- 
- **Exogenous/Endogenous Pyrogens**
 - **Benefits/Risks**
 - **Leukocyte Endogenous Mediator**

Interferon

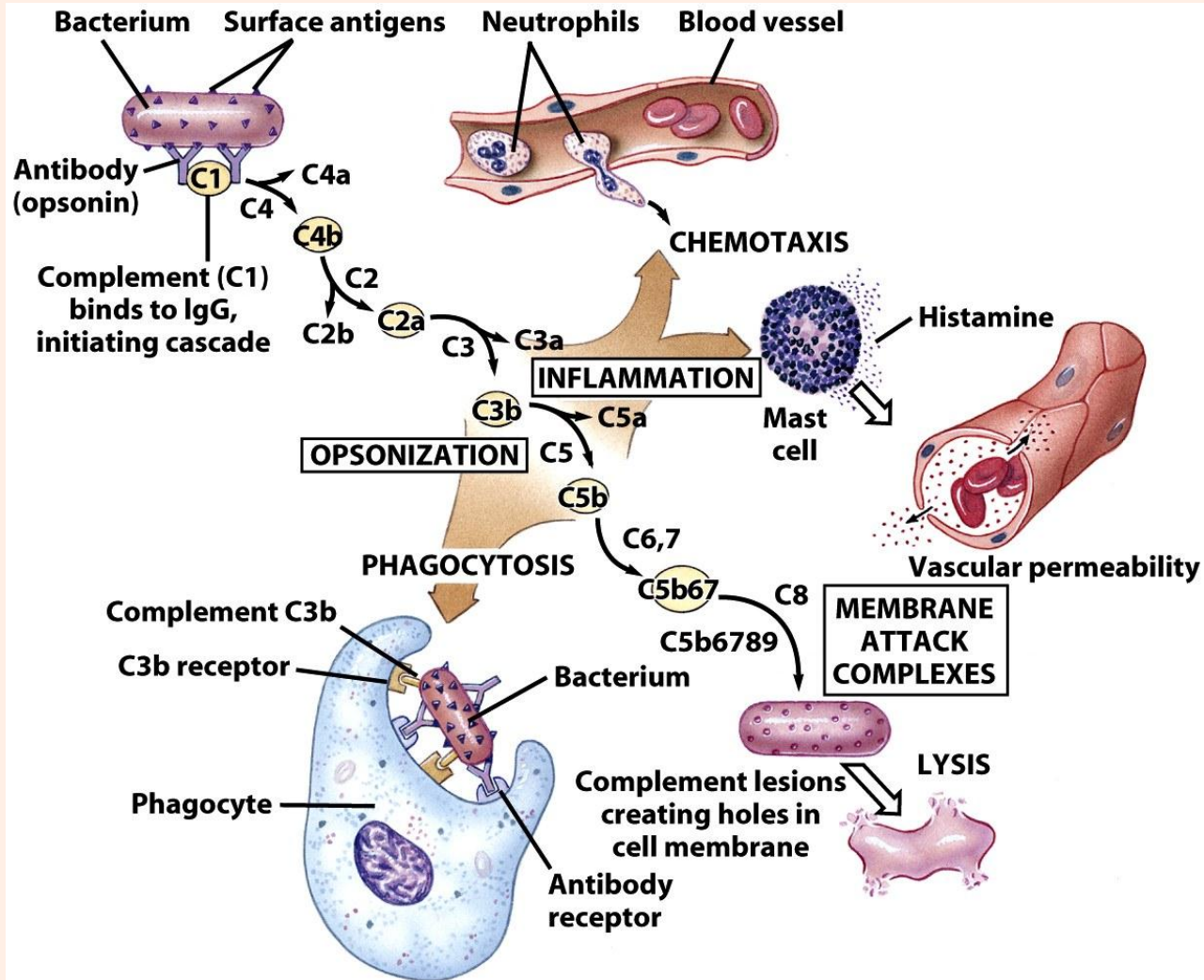
■ Interferon protein



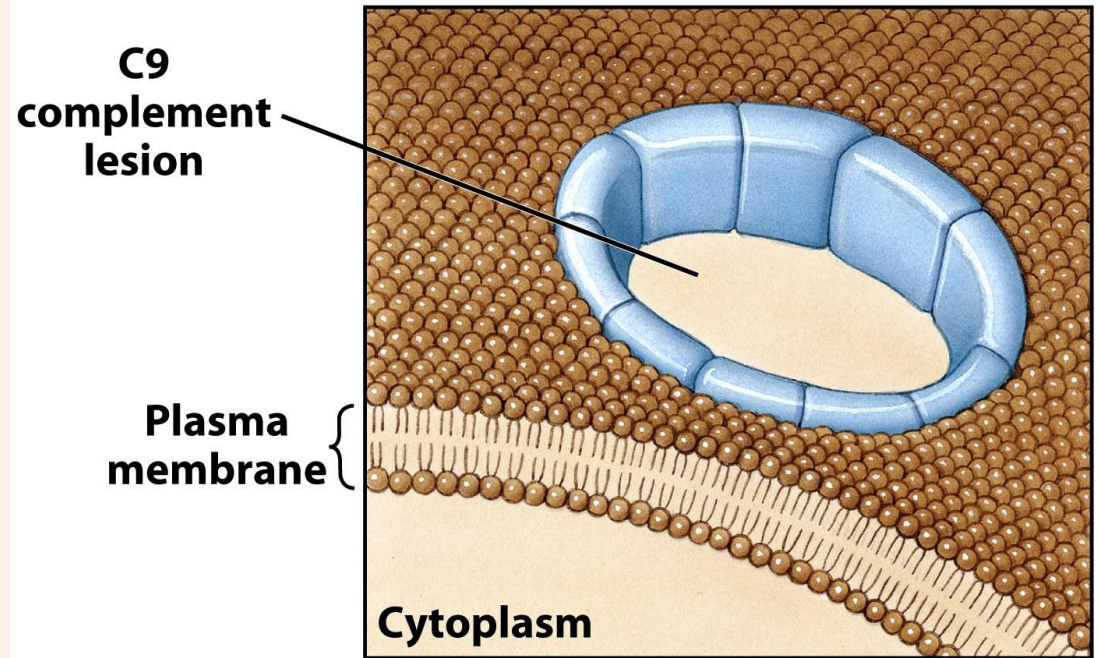
Complement System



Complement System



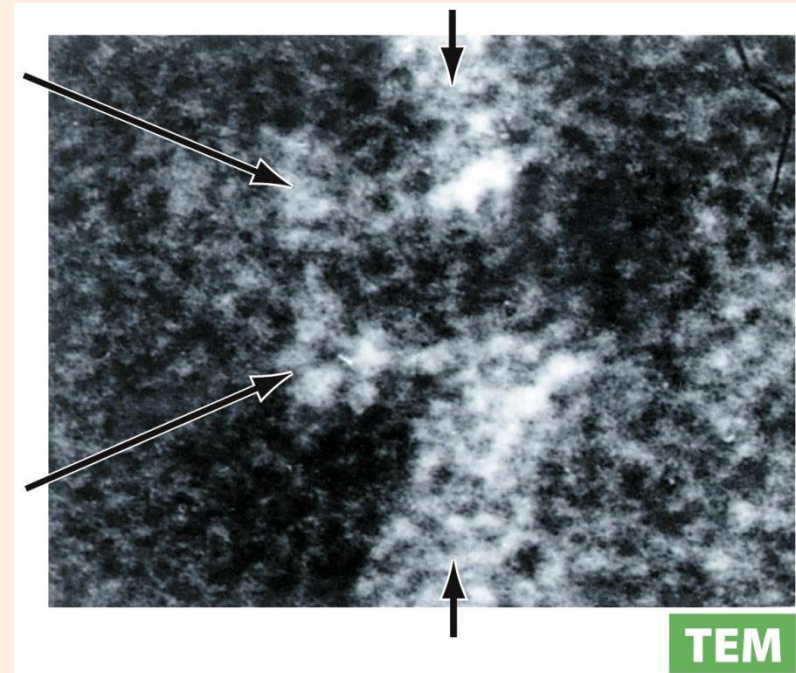
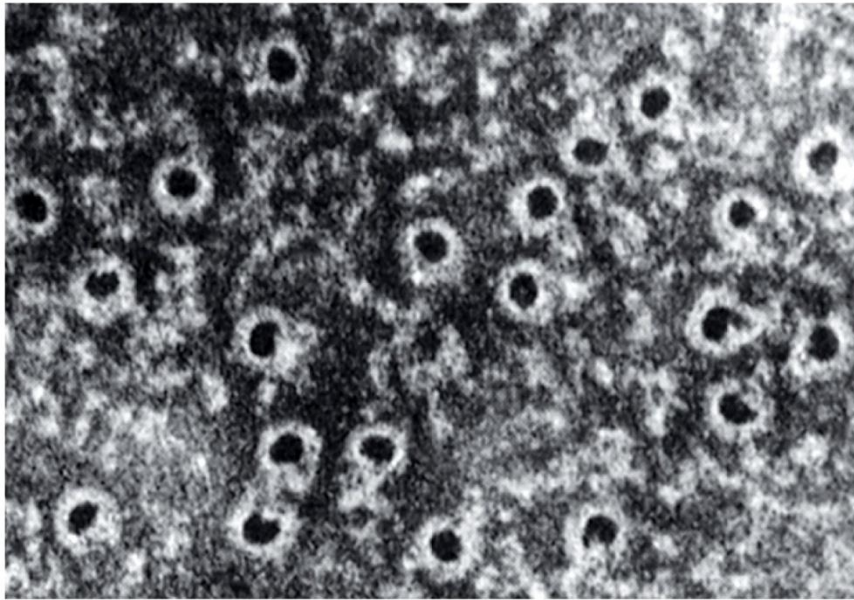
Complement — Cytolysis



Classic:

<http://www.youtube.com/watch?v=vbWYz9XDtLw&feature=related>

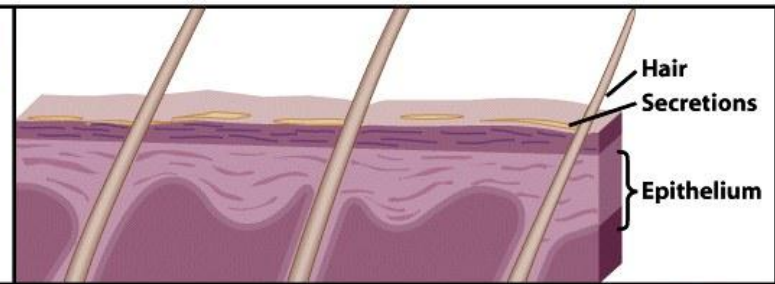
Complement — Cytolysis



Non-specific Defenses

PHYSICAL BARRIERS

Prevent approach and deny access to pathogens



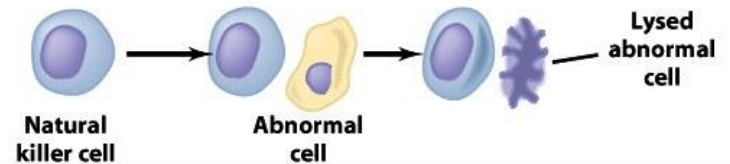
PHAGOCYTES

Remove debris and pathogens



EXTRACELLULAR KILLING

Destroys abnormal cells



INFLAMMATORY RESPONSE

Multiple effects



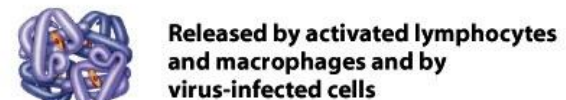
FEVER

Mobilizes defenses, accelerates repairs, inhibits pathogens



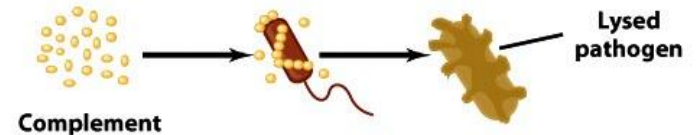
INTERFERONS

Increase resistance of cells to infection, slow the spread of disease



COMPLEMENT SYSTEM

Attacks and breaks down cell walls, attracts phagocytes, stimulates inflammation

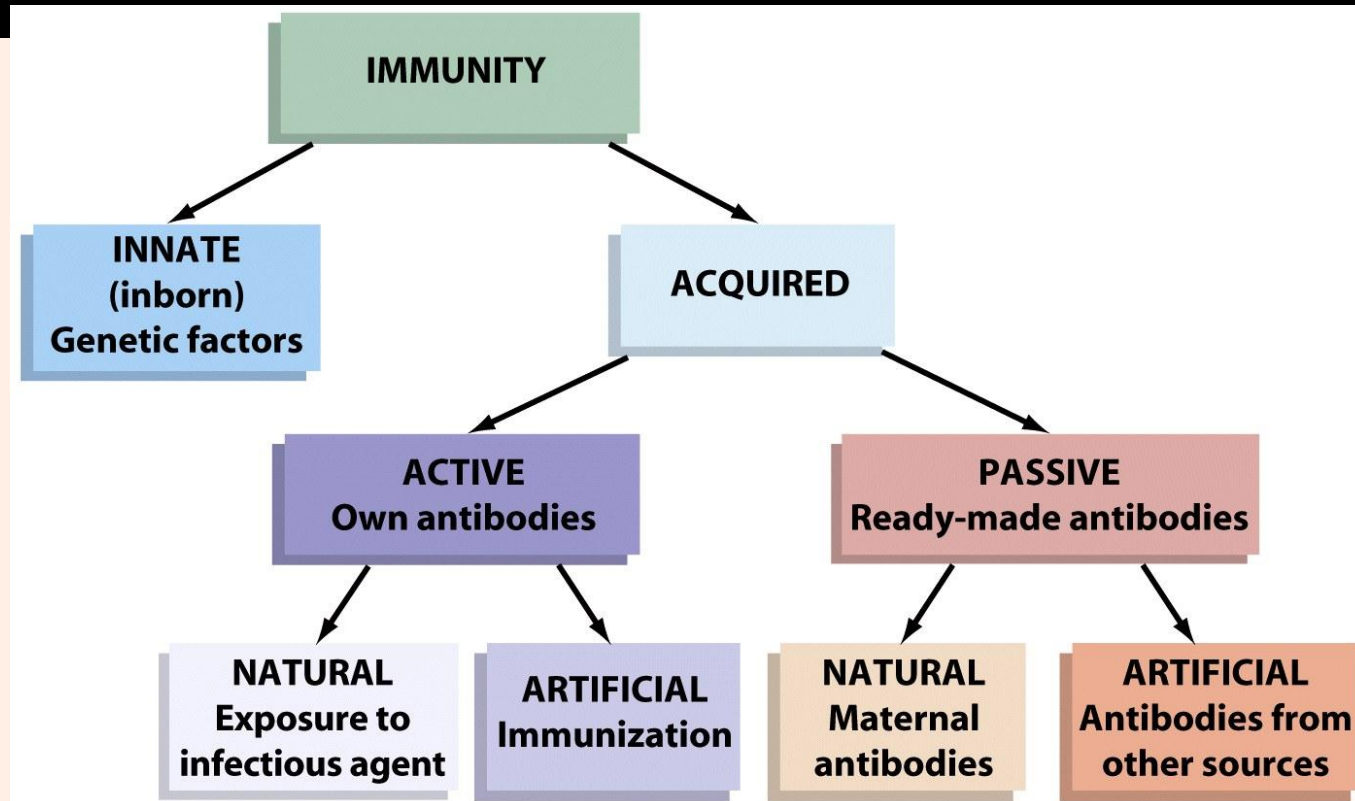


Types of Immunity

■ Innate vs. Acquired

■ Active vs. Passive

■ Natural vs. Artificial

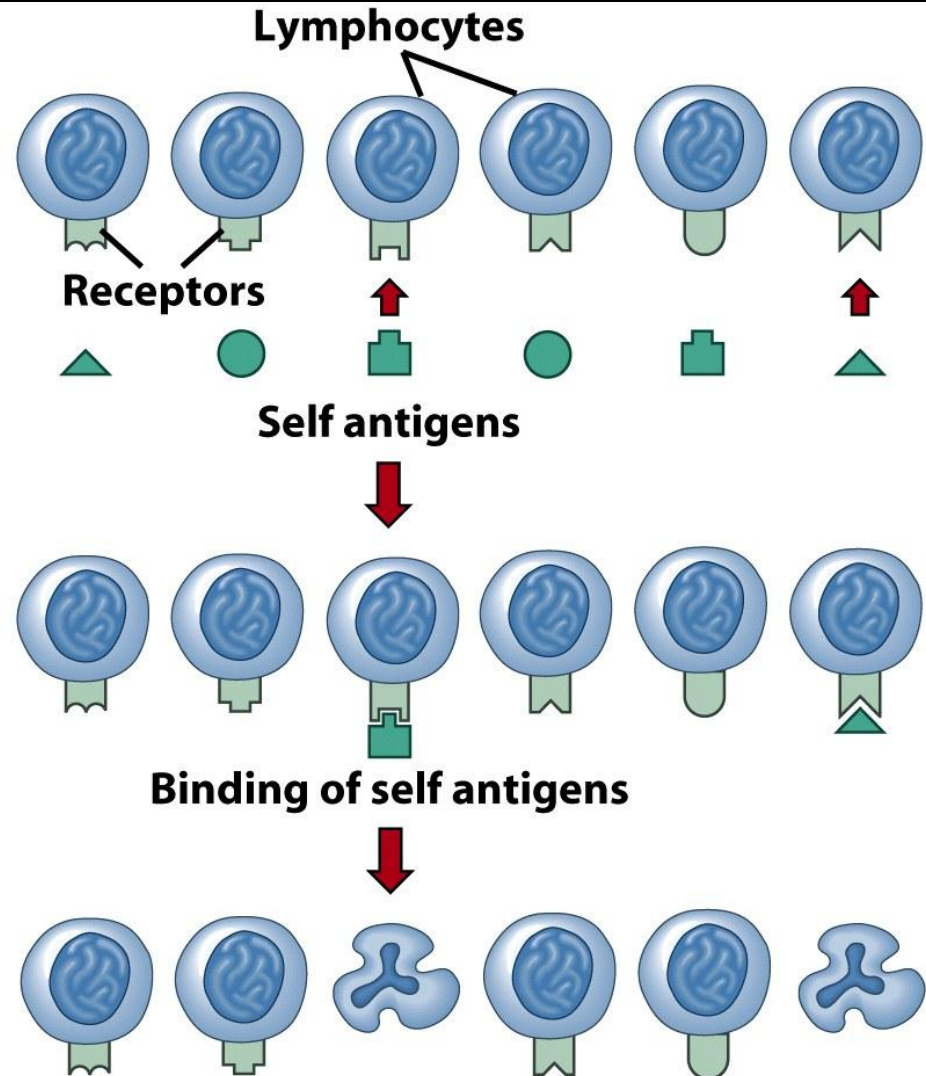


Passive immunity is the transfer of *active humoral immunity* in the form of readymade antibodies, from one individual to another.

General Immune System Properties

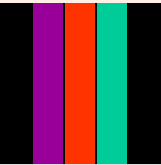
Self versus Non-self Recognition

- Specificity
- Diversity
- memory

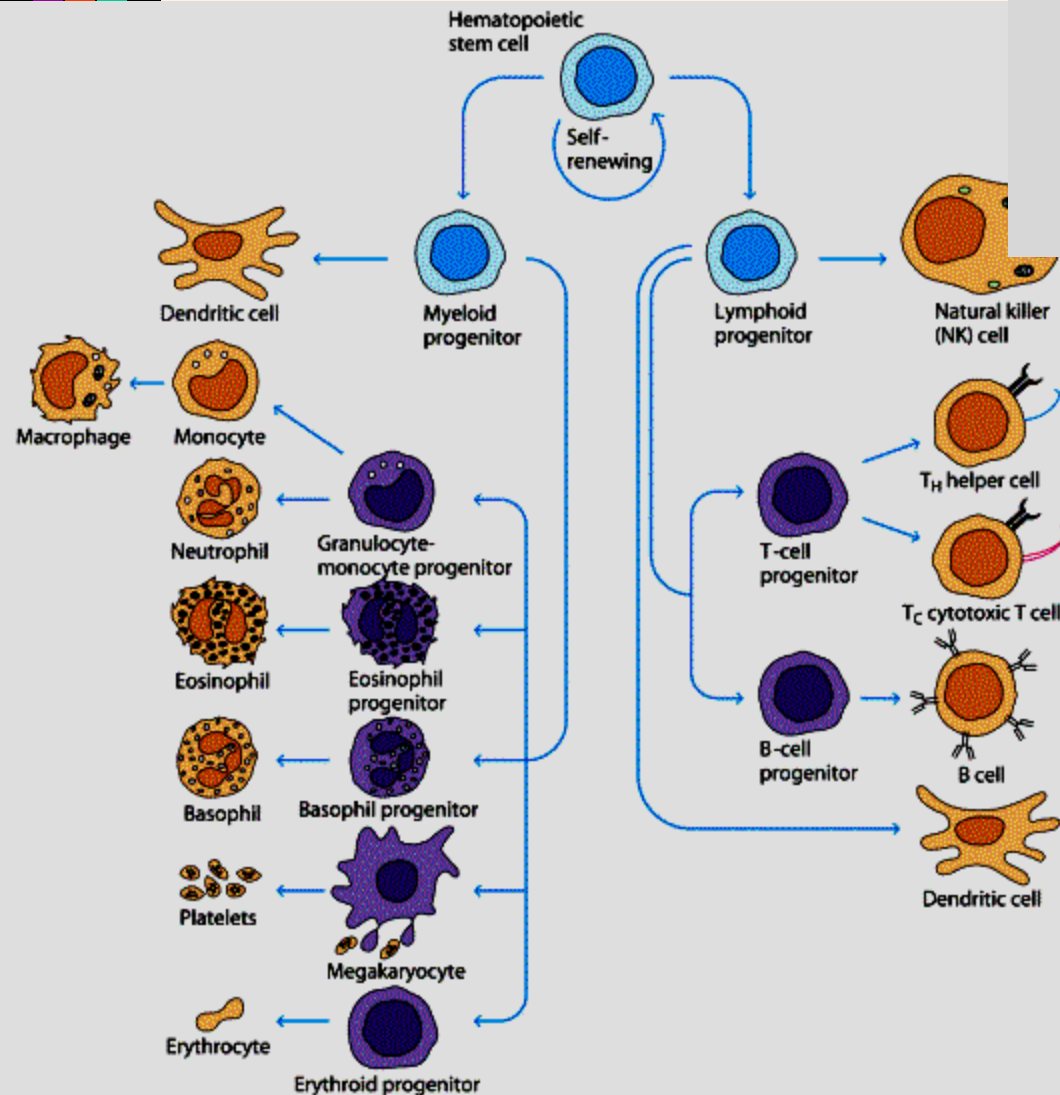


Clonal deletion of lymphocytes that have receptors for self

IMMUNOLOGY



Cell type	Cells/mm ³	%
Red blood cells	5.0×10^6	
Platelets	2.5×10^5	
Leukocytes	7.3×10^3	
Neutrophil		50–70
Lymphocyte		20–40
Monocyte		1–6
Eosinophil		1–3
Basophil		<1



hemopoiesis is the formation of blood cellular components.

Antigens

Antigens

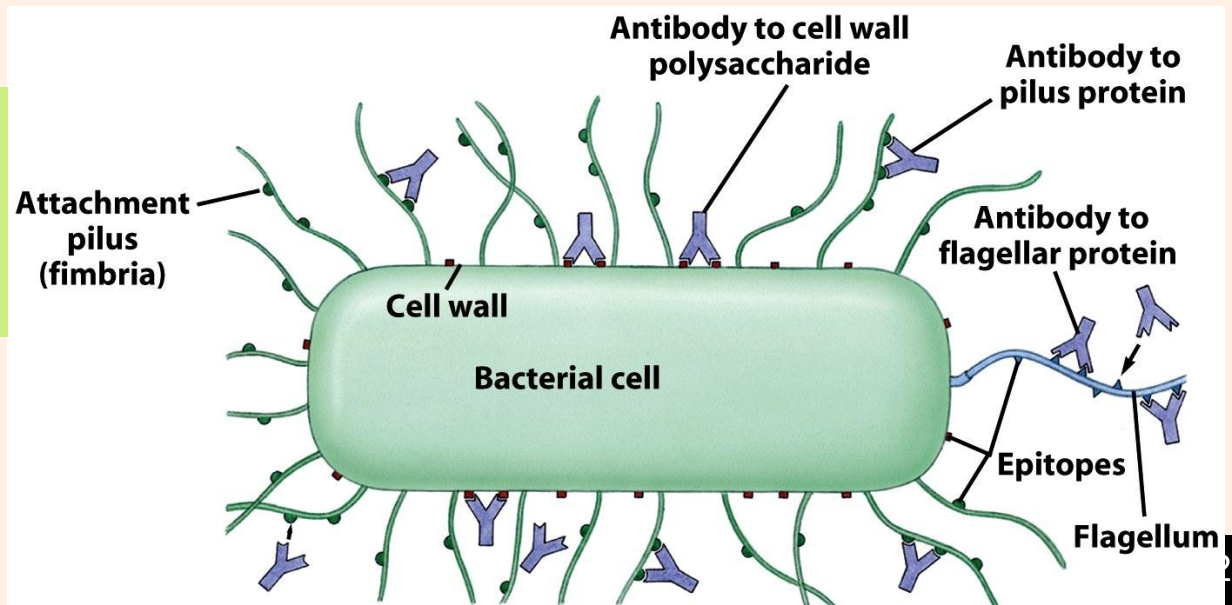
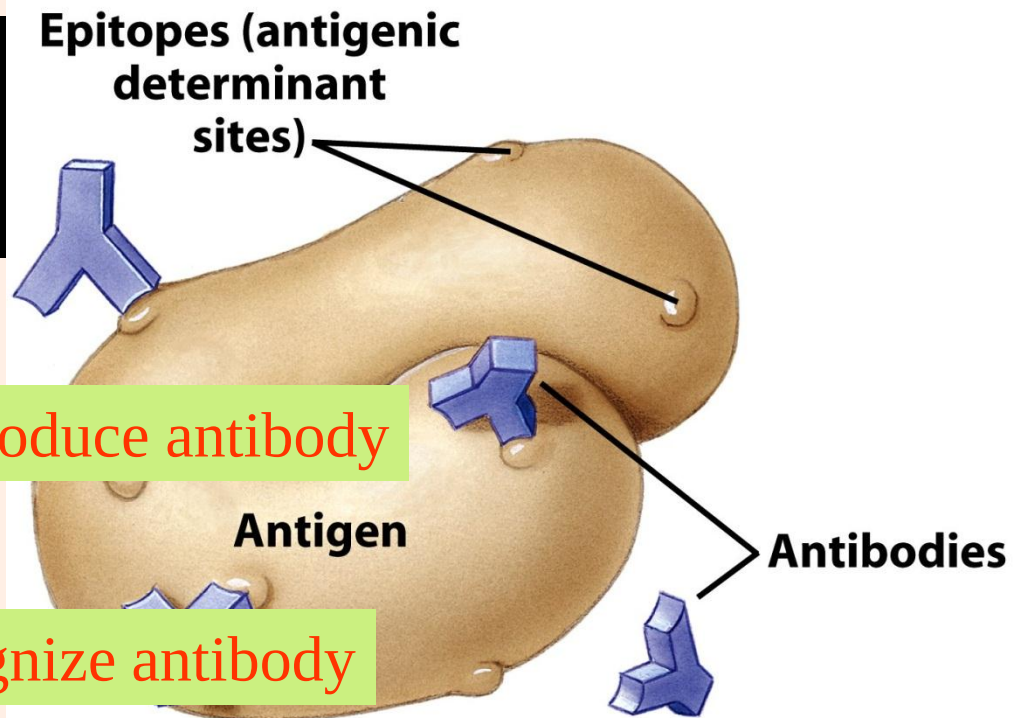
Molecules that can stimulate to produce antibody

Epitopes

Domain/region in antigen to recognize antibody

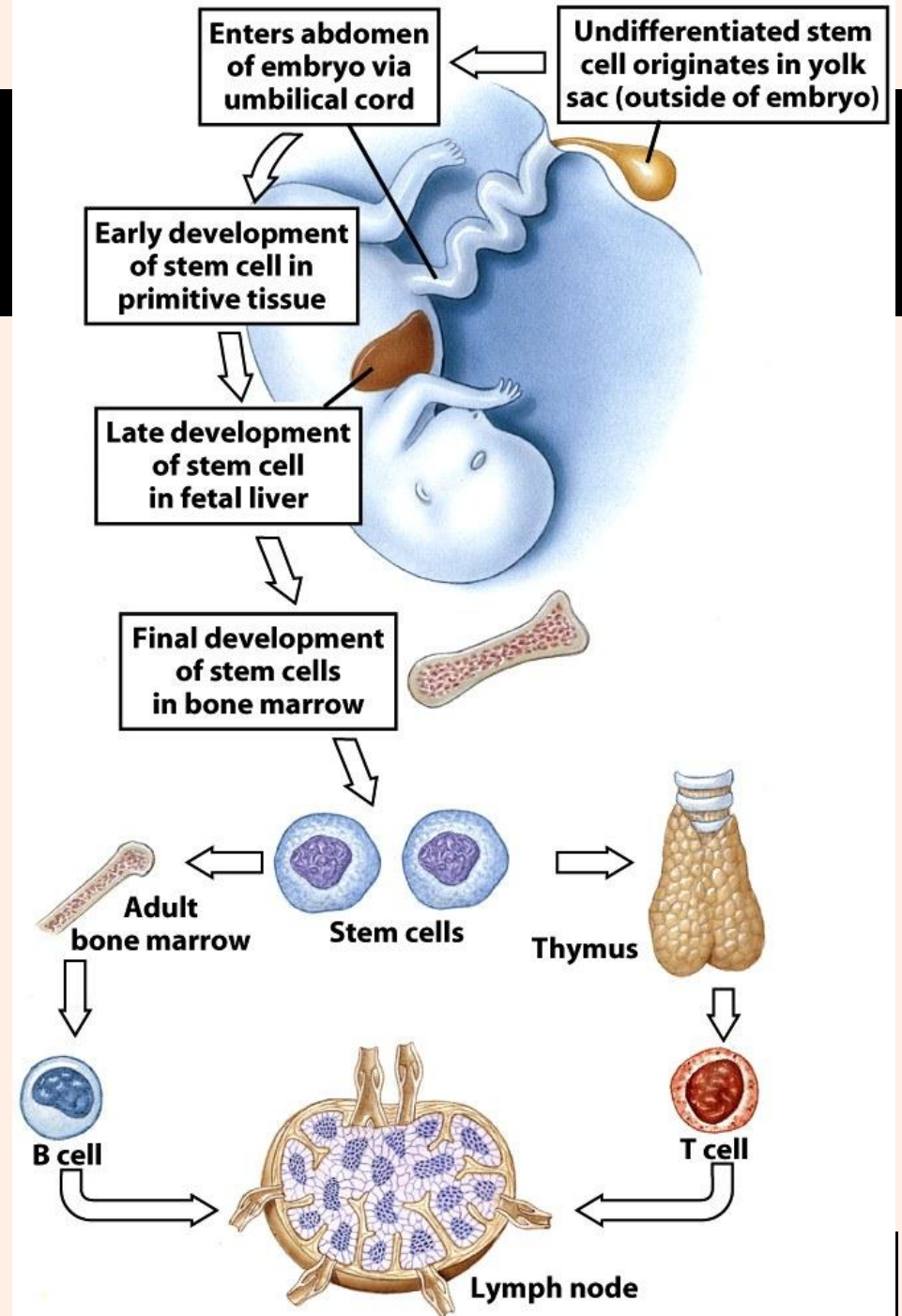
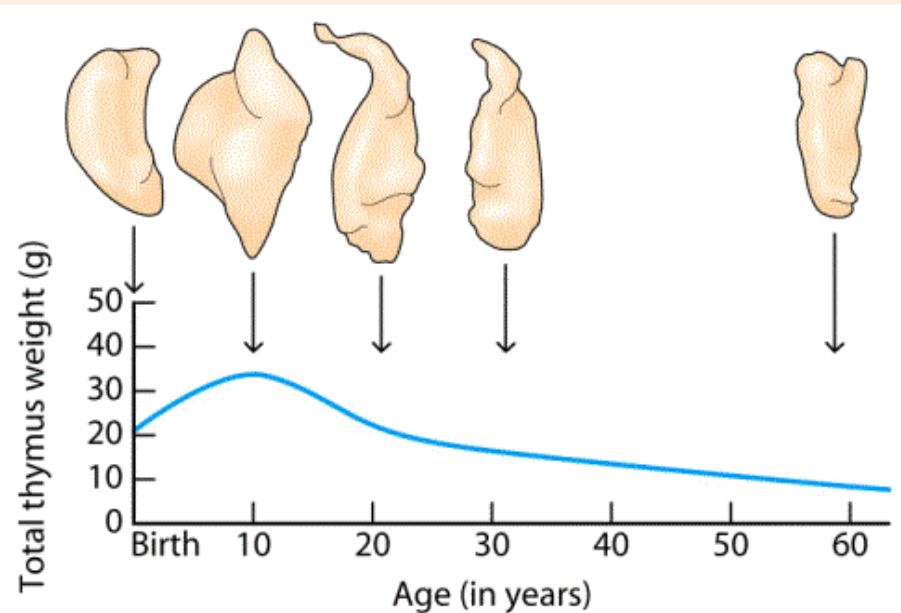
Haptens

carrier molecule that can enhance epitopes to produce antibody

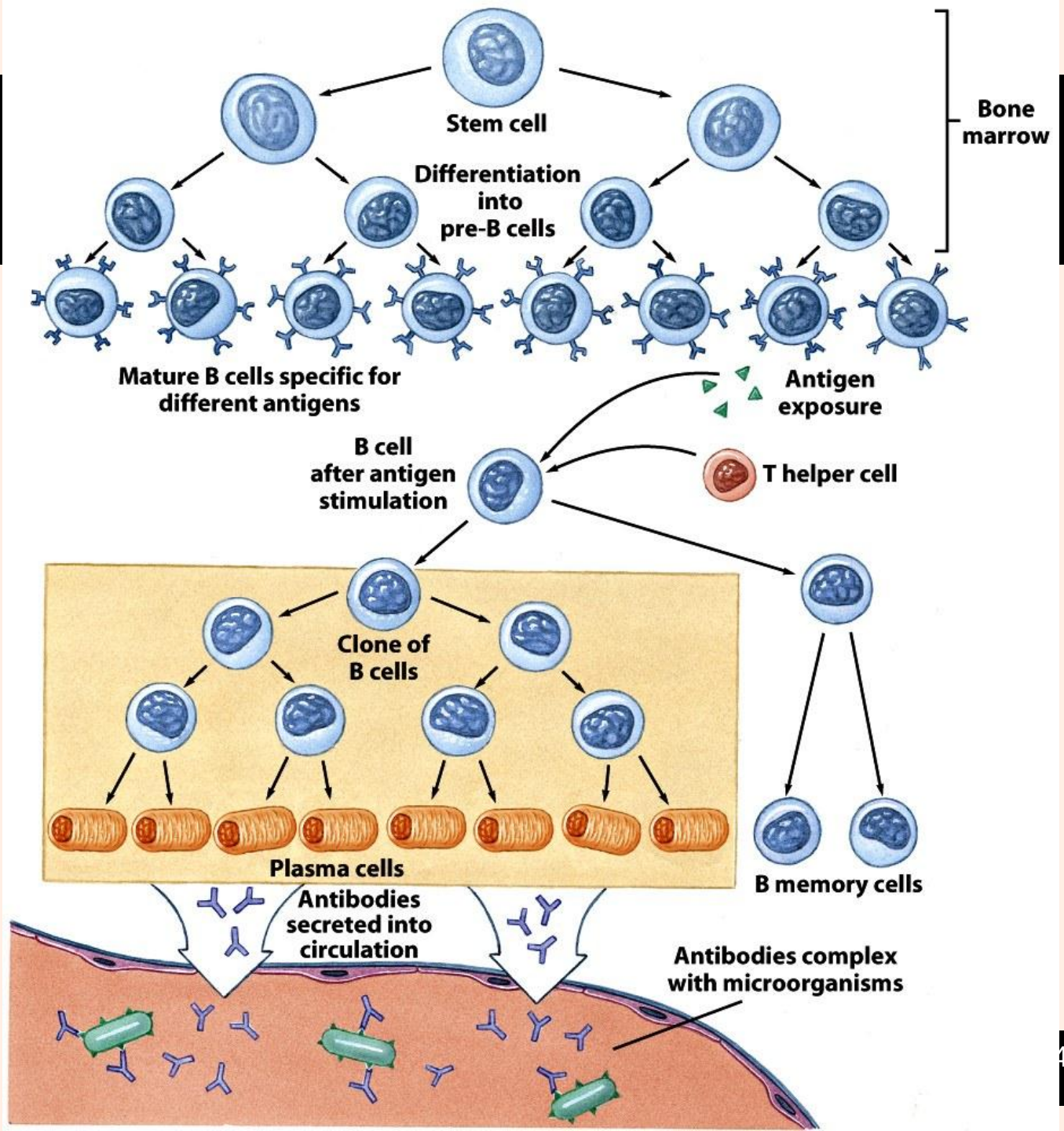


Antibodies and Cells

- B lymphocytes
- T lymphocytes
- Natural Killer cells



Immune system



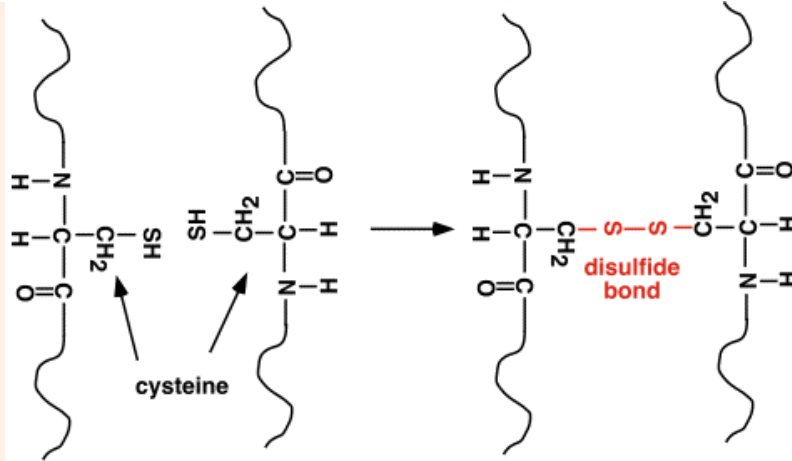
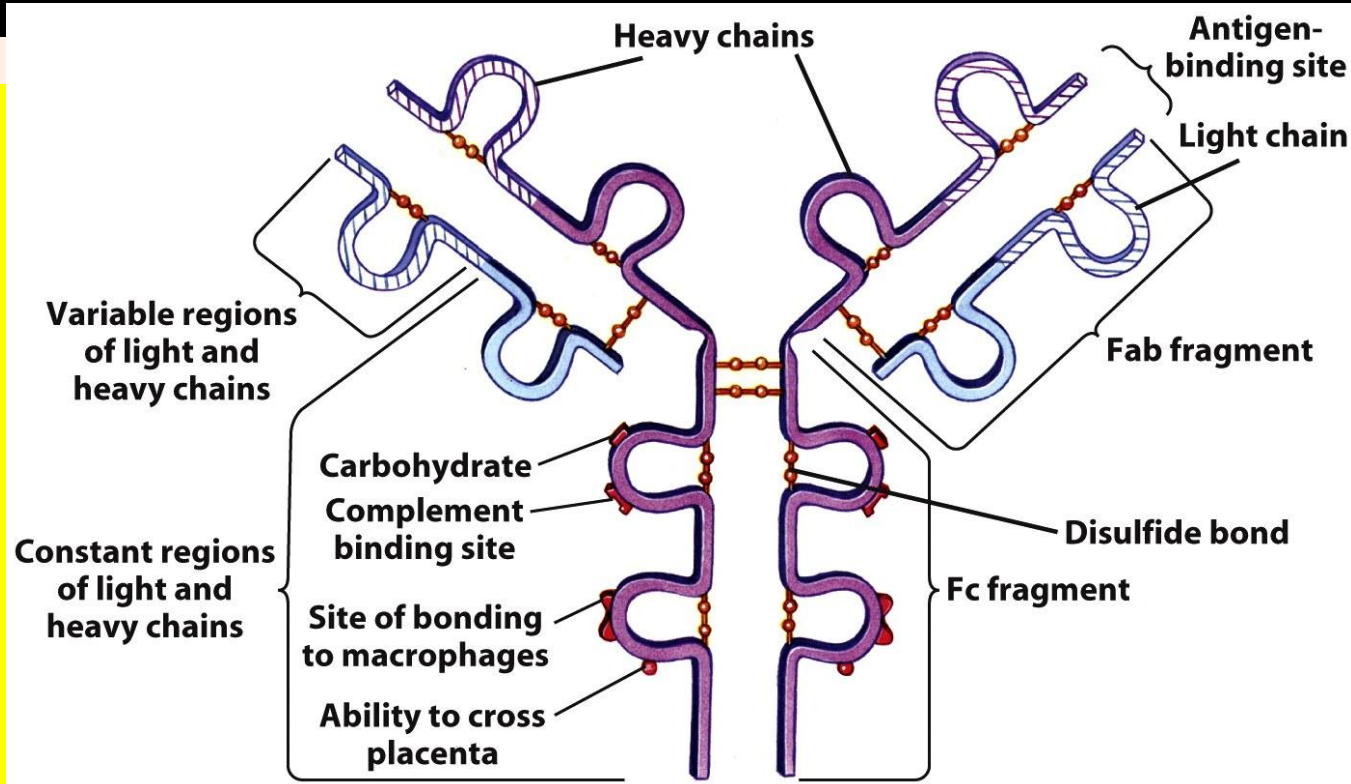
Antibody Anatomy

■ Heavy/Light Chains

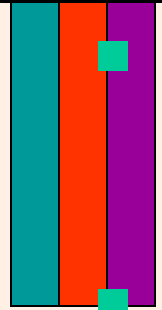
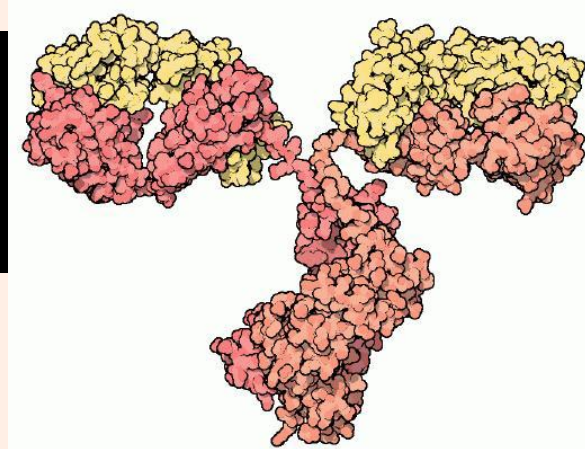
■ Variable/
Constant Regions

■ Antigen Binding Site

■ Disulfide Bridges



Immunoglobulin Classes



■ **Ig G** (most common in blood)

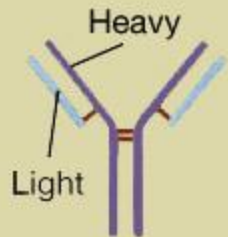
■ **Ig M** (blood type ABO)

■ **Ig A** (mucosal immunity)

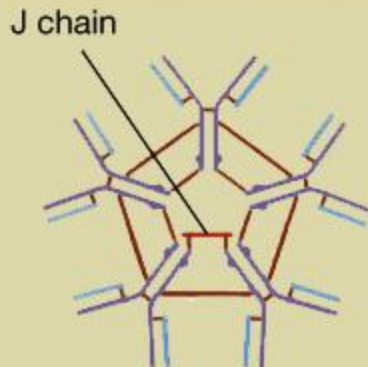
■ **Ig D**
(B cell activation)

■ **Ig E**
(allergy, parasites)

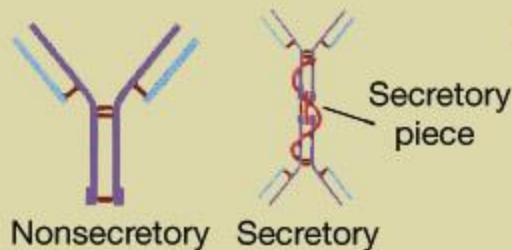
IgG



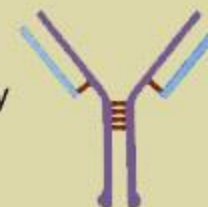
IgM



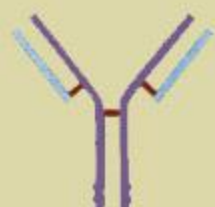
IgA



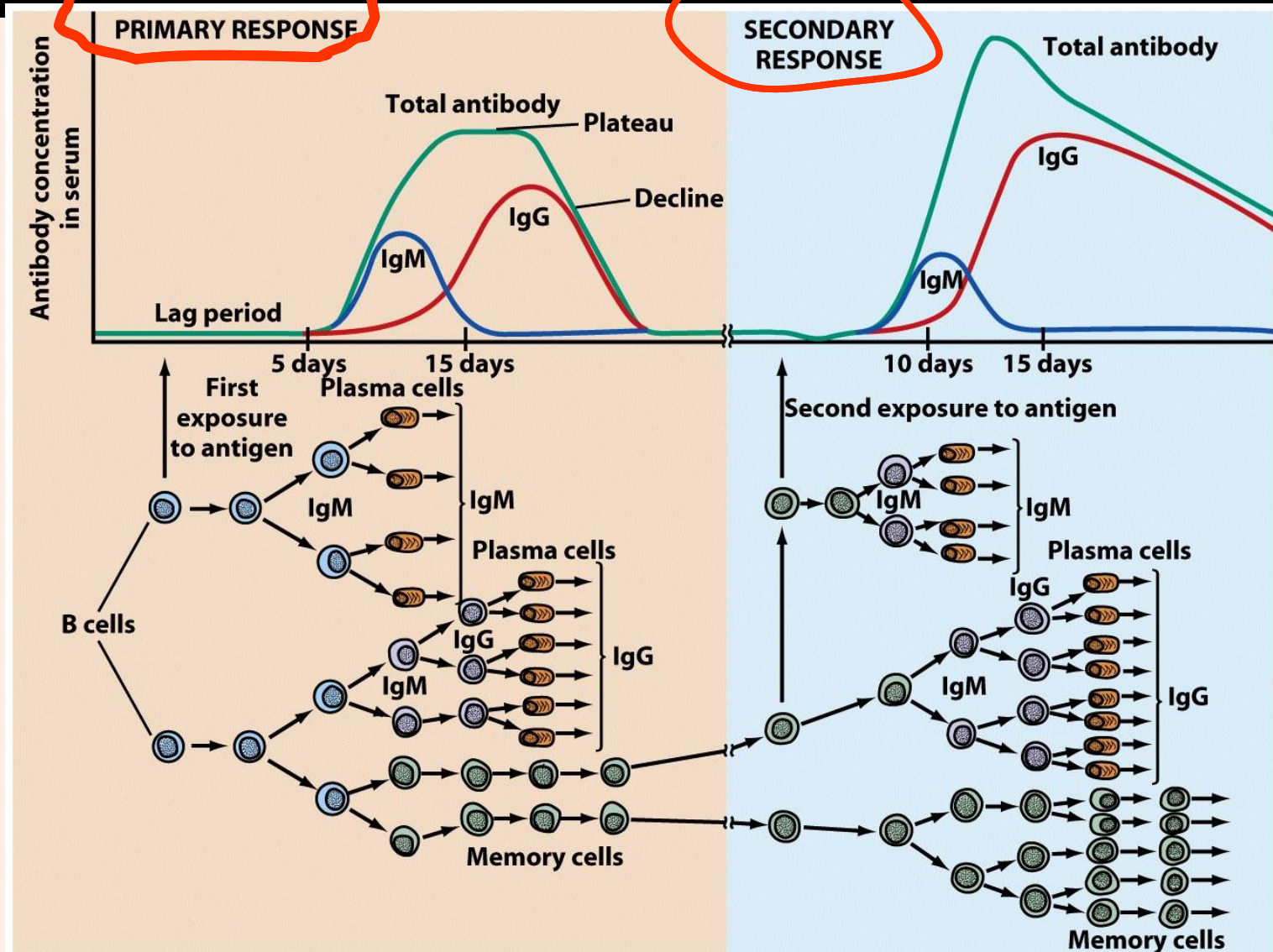
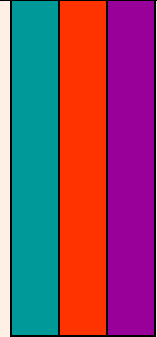
IgE



IgD



Immune Memory

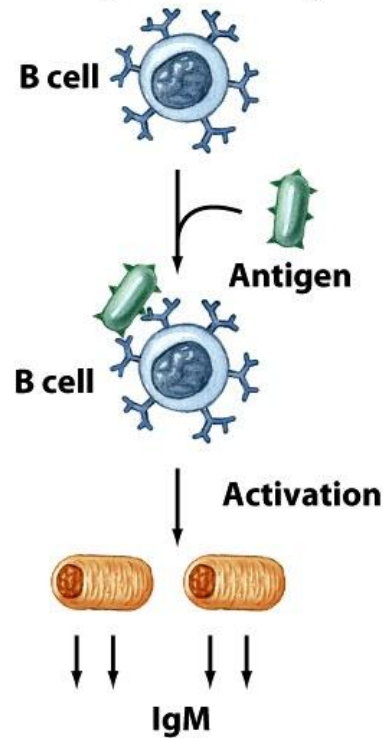


Antigen Types

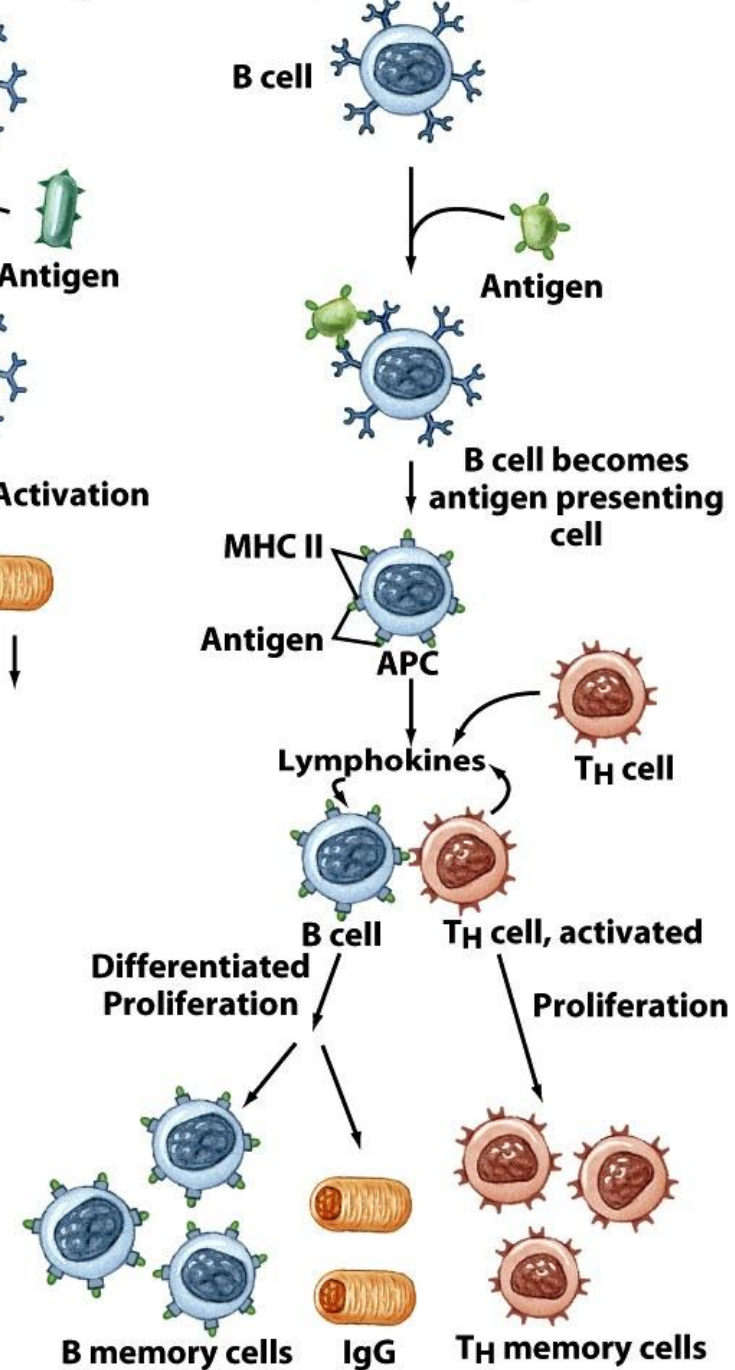
■ T-independent

■ T-dependent

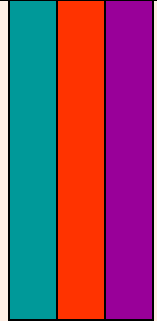
T-independent antigens



T-dependent antigens



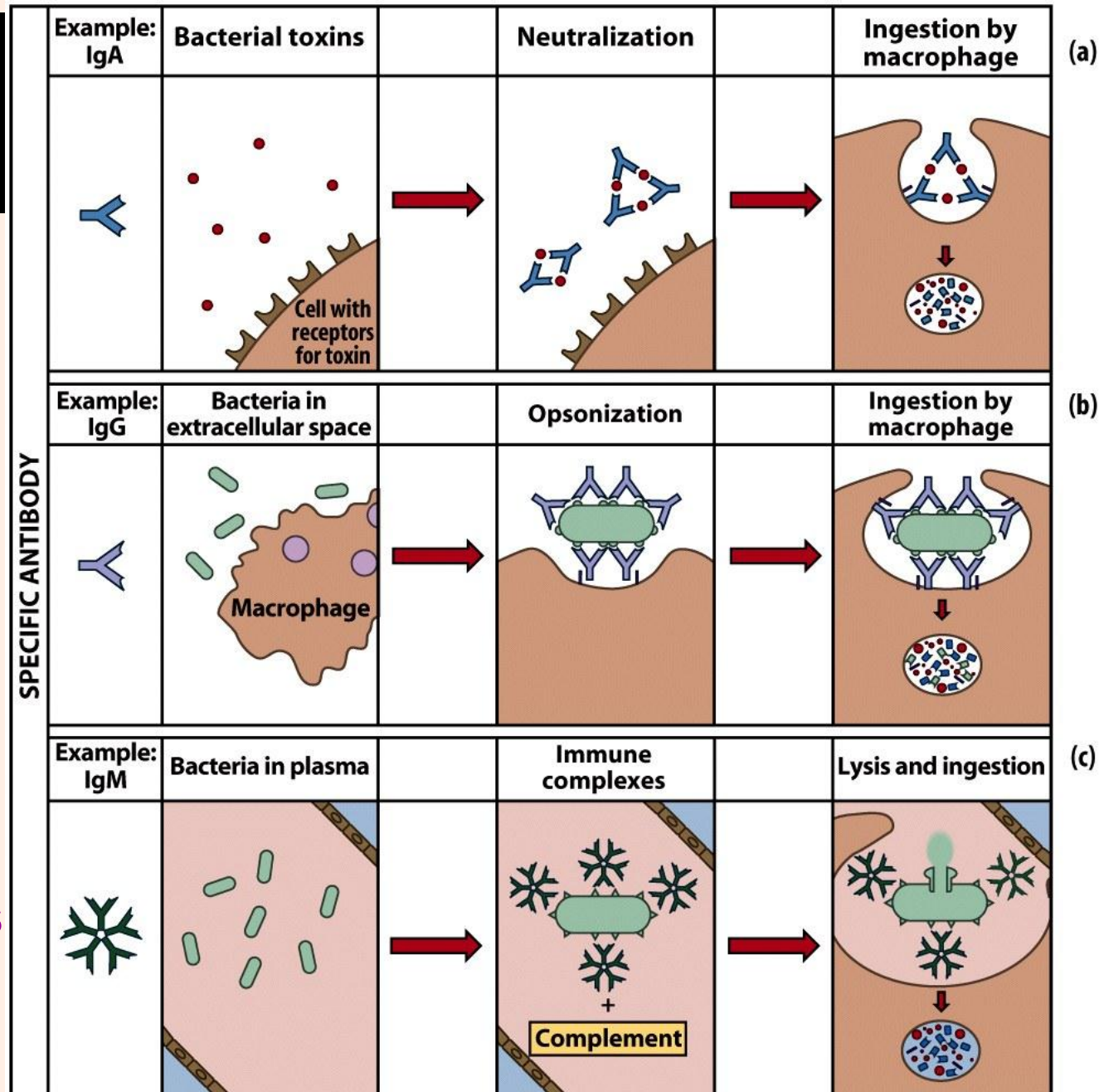
Antibody Responses



■ Agglutination

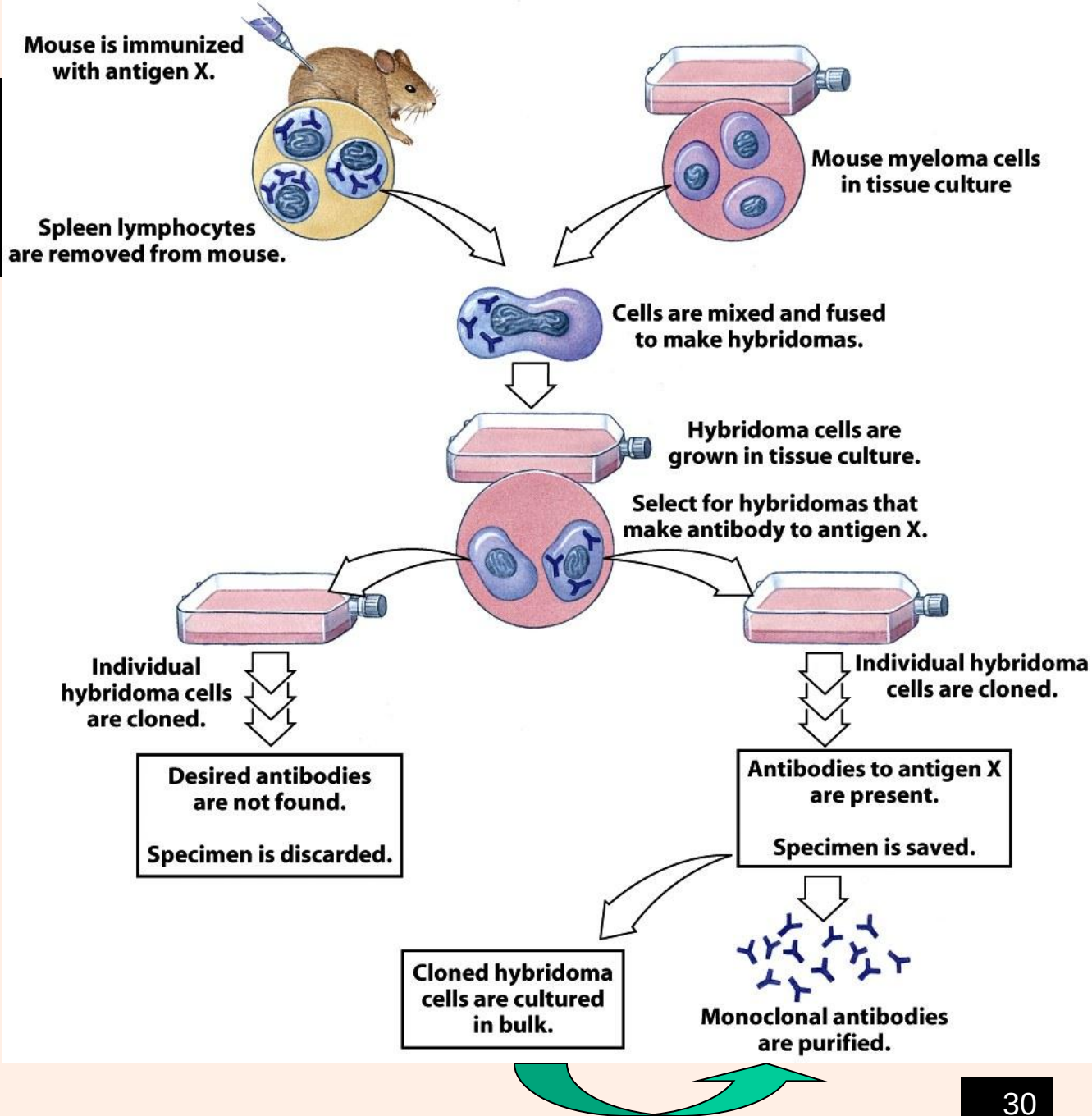
■ Neutralization

■ Complement-mediated effects

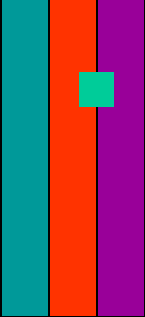


Monoclonal Antibodies

■ MAbs



Nature of the Immune system



■ Humoral Immunity

Humoral immunity refers to **antibody** production, and the accessory processes that accompany it

■ Cell-mediated Immunity

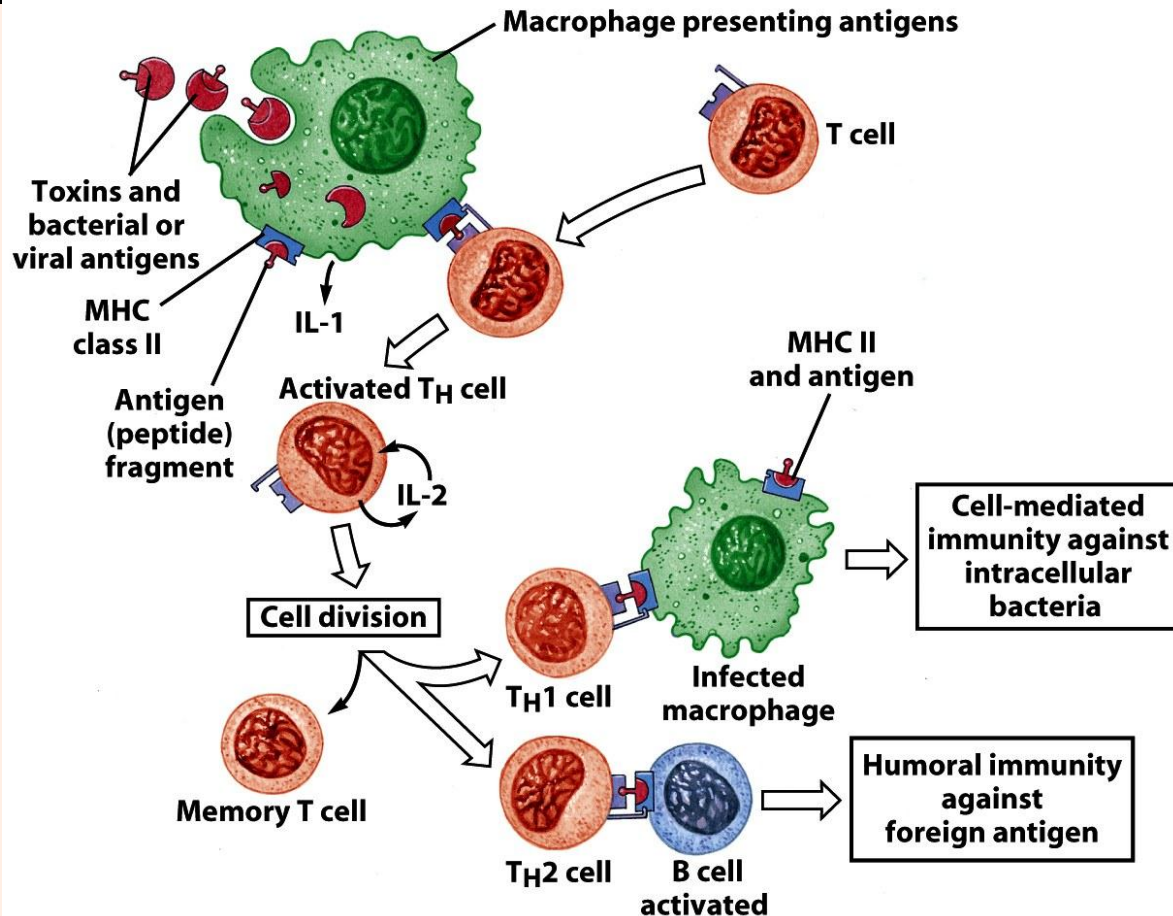
mediators

immune response that does not involve antibodies or complement but rather involves the activation of macrophages, natural killer cells (NK), antigen-specific cytotoxic T-lymphocytes, and the release of various cytokines in response to an antigen.

Cell Mediated Immunity

- Helper T cell (T_H)
- Delayed Hypersensitivity T cell (T_D)

ACTIVATION OF HELPER T CELLS



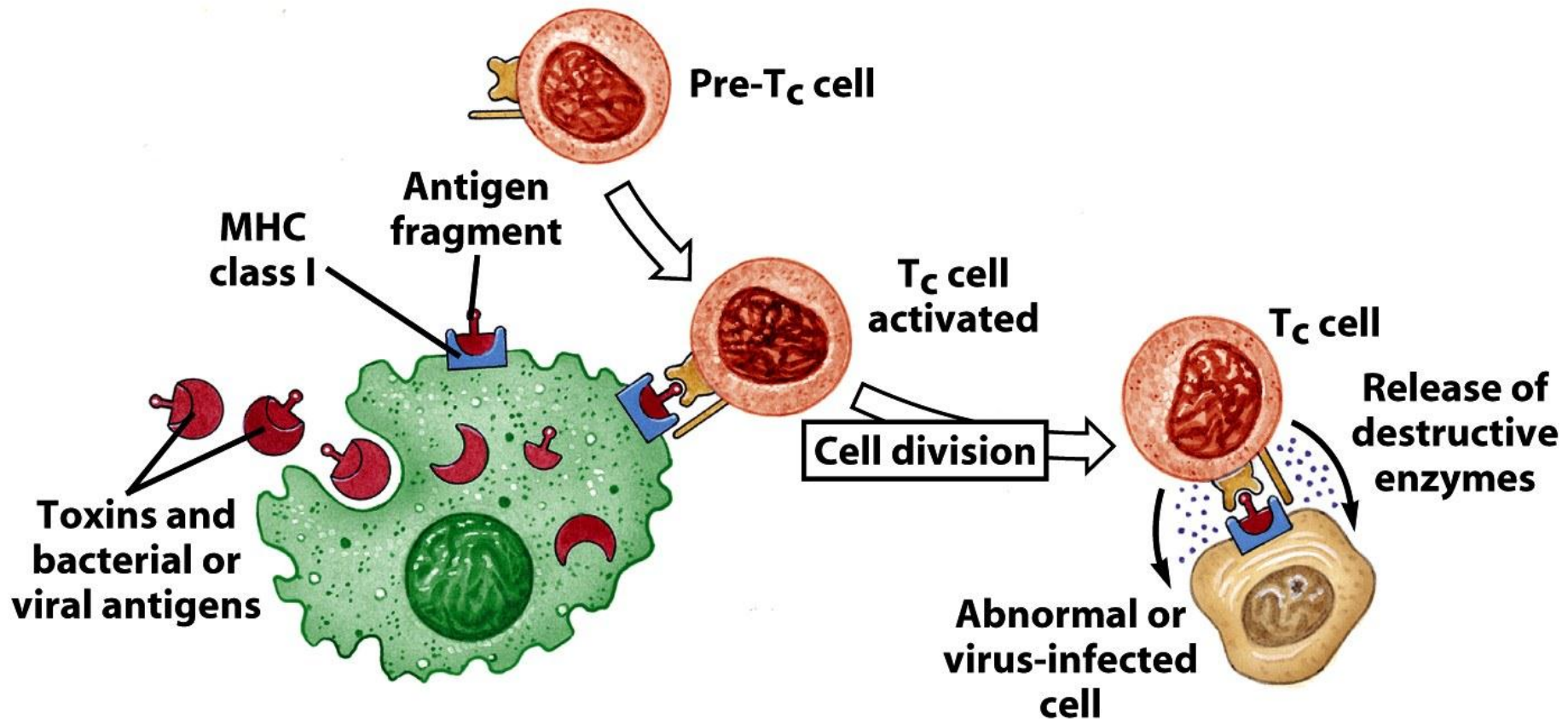
■ Activation

■ Antigen presenting cells

T Cell Types

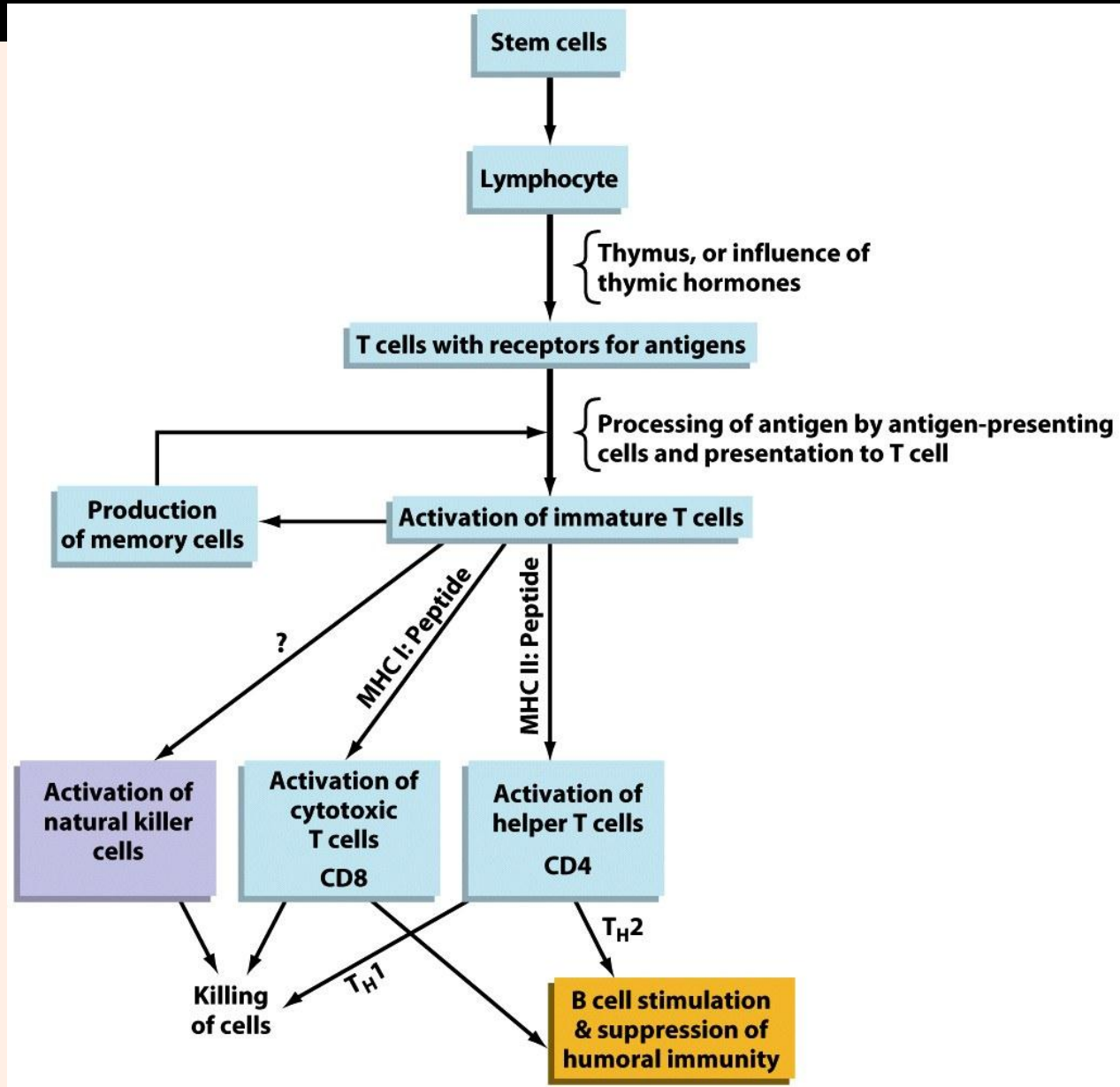
- Cytotoxic T cell (T_c)
- Natural Killer cell
- Memory T cells

ACTIVATION OF CYTOTOXIC T CELLS

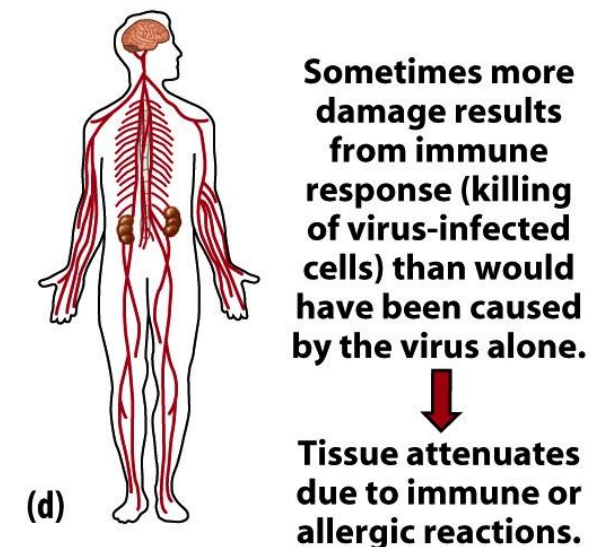
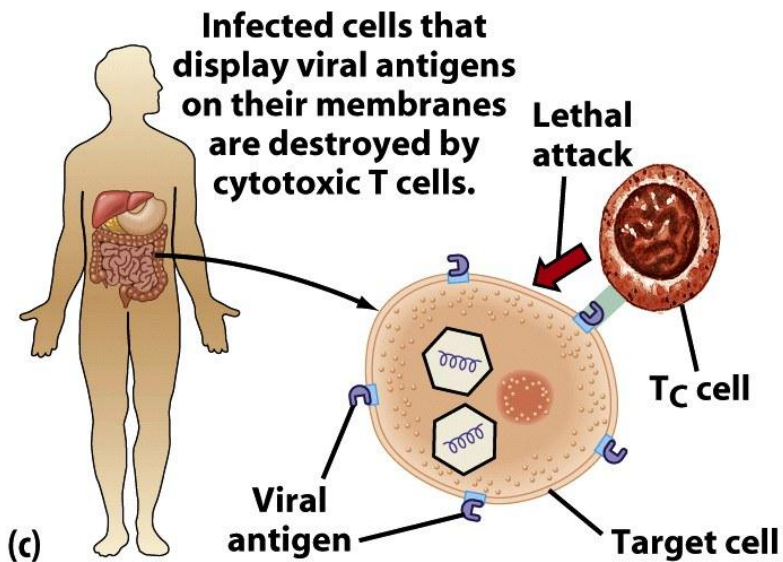
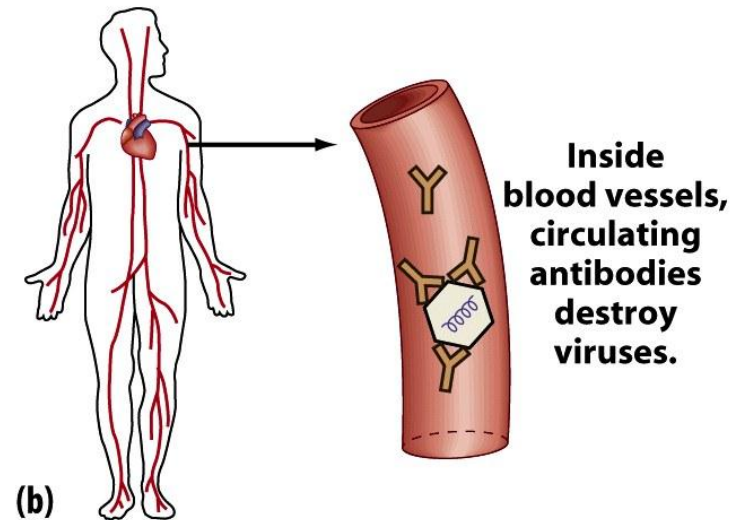
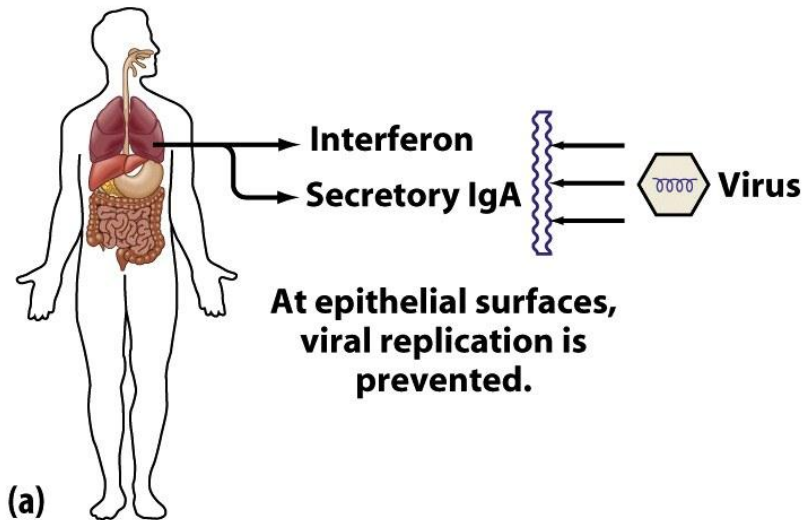


How Killer Cells “Kill”

- Roles of activated macrophages
- Superantigens



Mucosal Immune System: location





Review: host defense



Q1: What's innate immunity?

The defense system the host born with, in lower specificity

Q2: What's the relationship between antigen and antibody?

Antigen: molecule induces antibody production

Antibody: host produced protein to trigger highly specific defense

Q3: What's humoral immunity?

Humoral immunity refers to **antibody** production, and the accessory processes that accompany it