

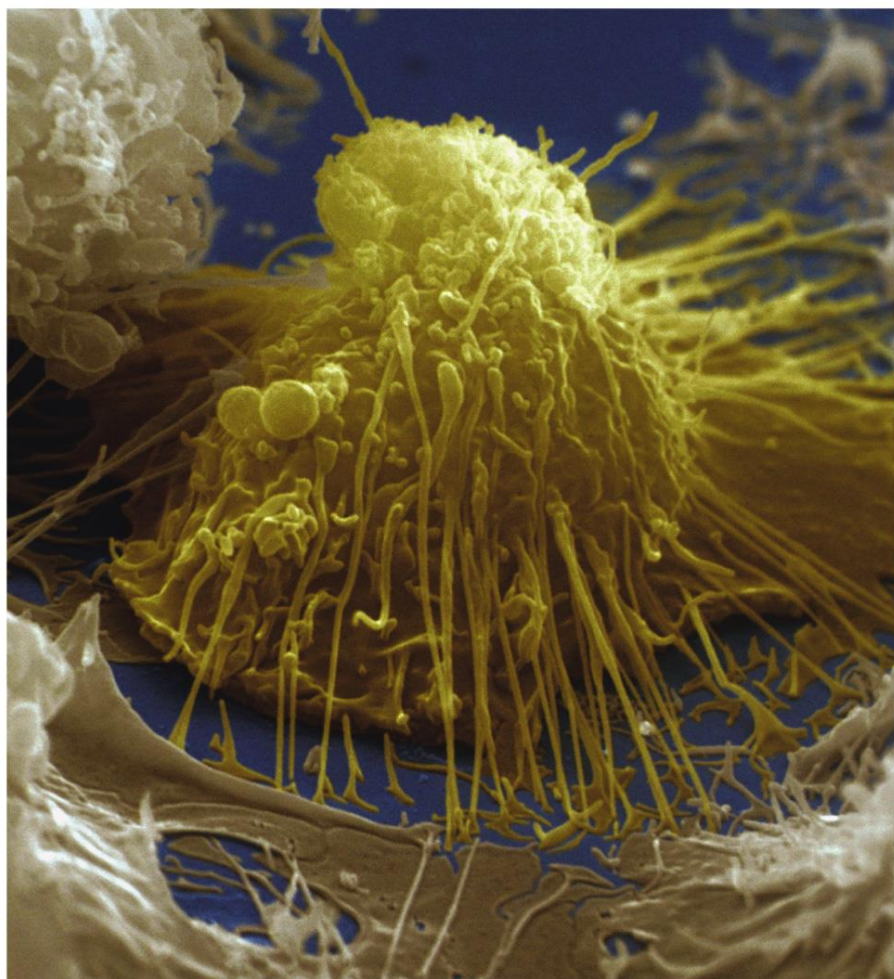
Game plan

Lecture

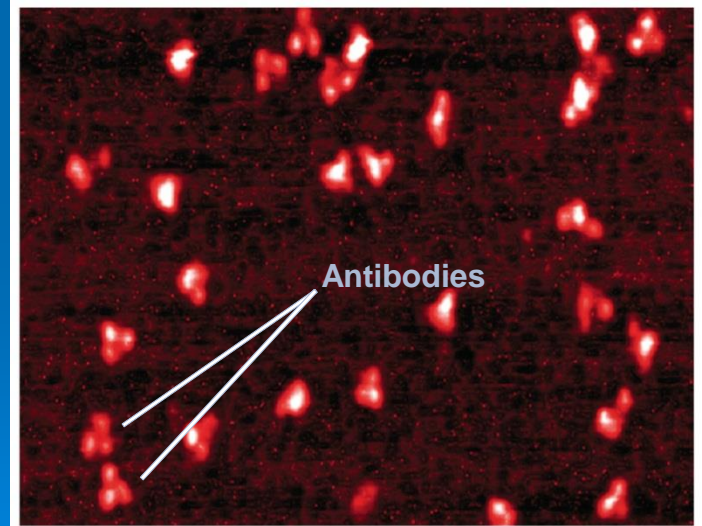
Antibody- antigen binding
Humoral immunity
Cellular immunity
Clonal selection and immunological memory

Lab

Staph, Strep and
Enteric Unknowns



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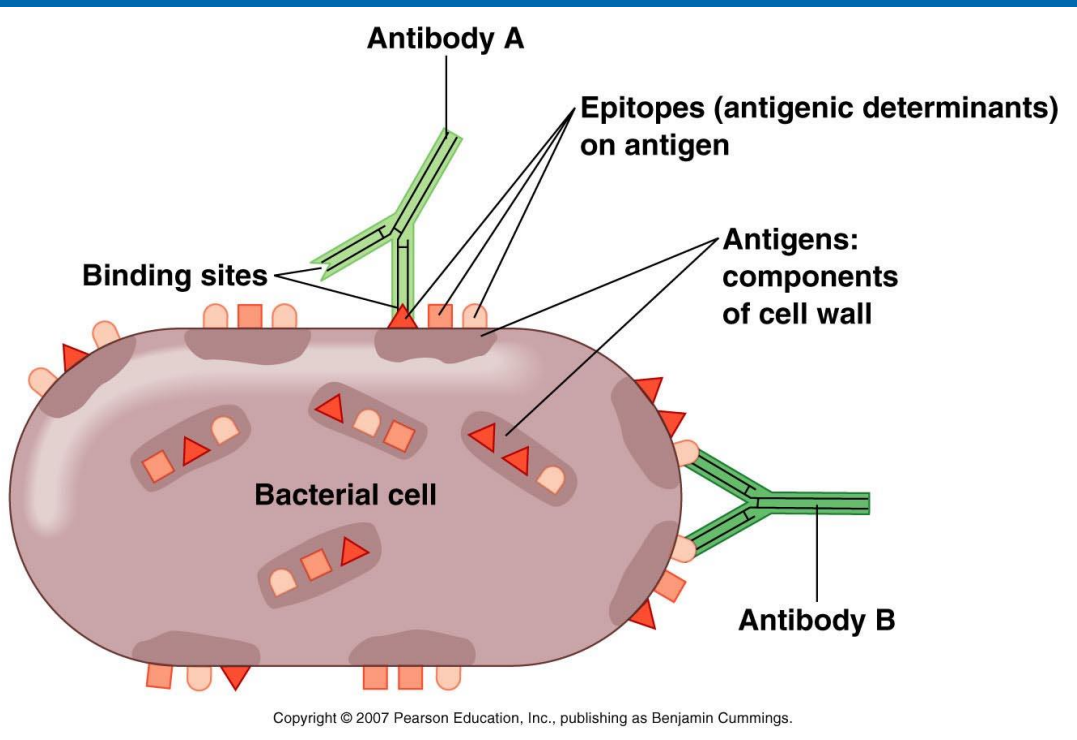
Antibodies

(c)

AFM 5 nm

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Antibodies and antigens



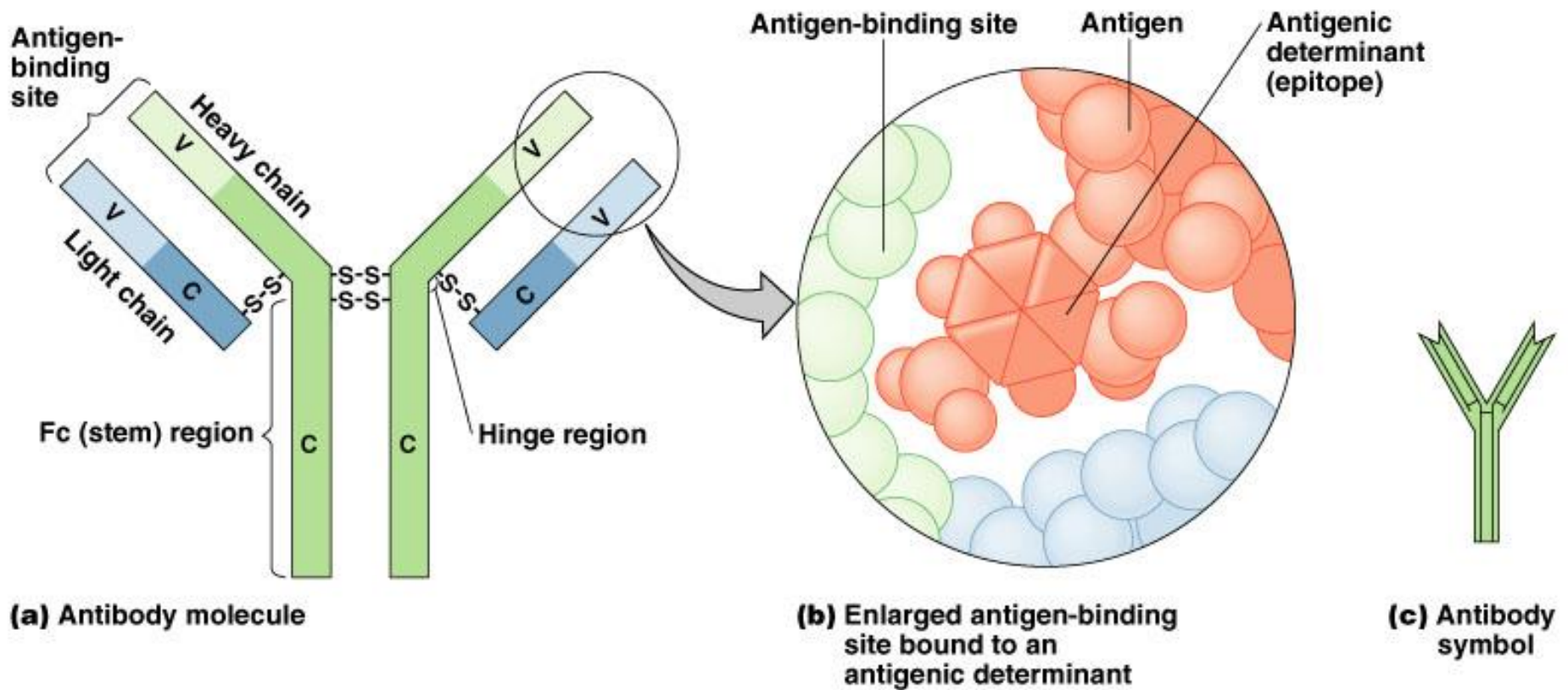
Antigens (Ag):

- Proteins or large polysaccharide
- Small molecules called haptens combine with carriers to be antigenic
- Each antigen contains multiple epitopes that are recognized by...

Antibodies (Ab):


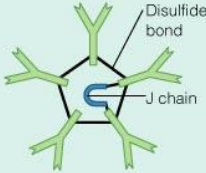
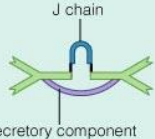


- “Immuno- Globulin” proteins (Ig)
- Specific for 1 Ag epitope

Antibody structure



Antibody classes

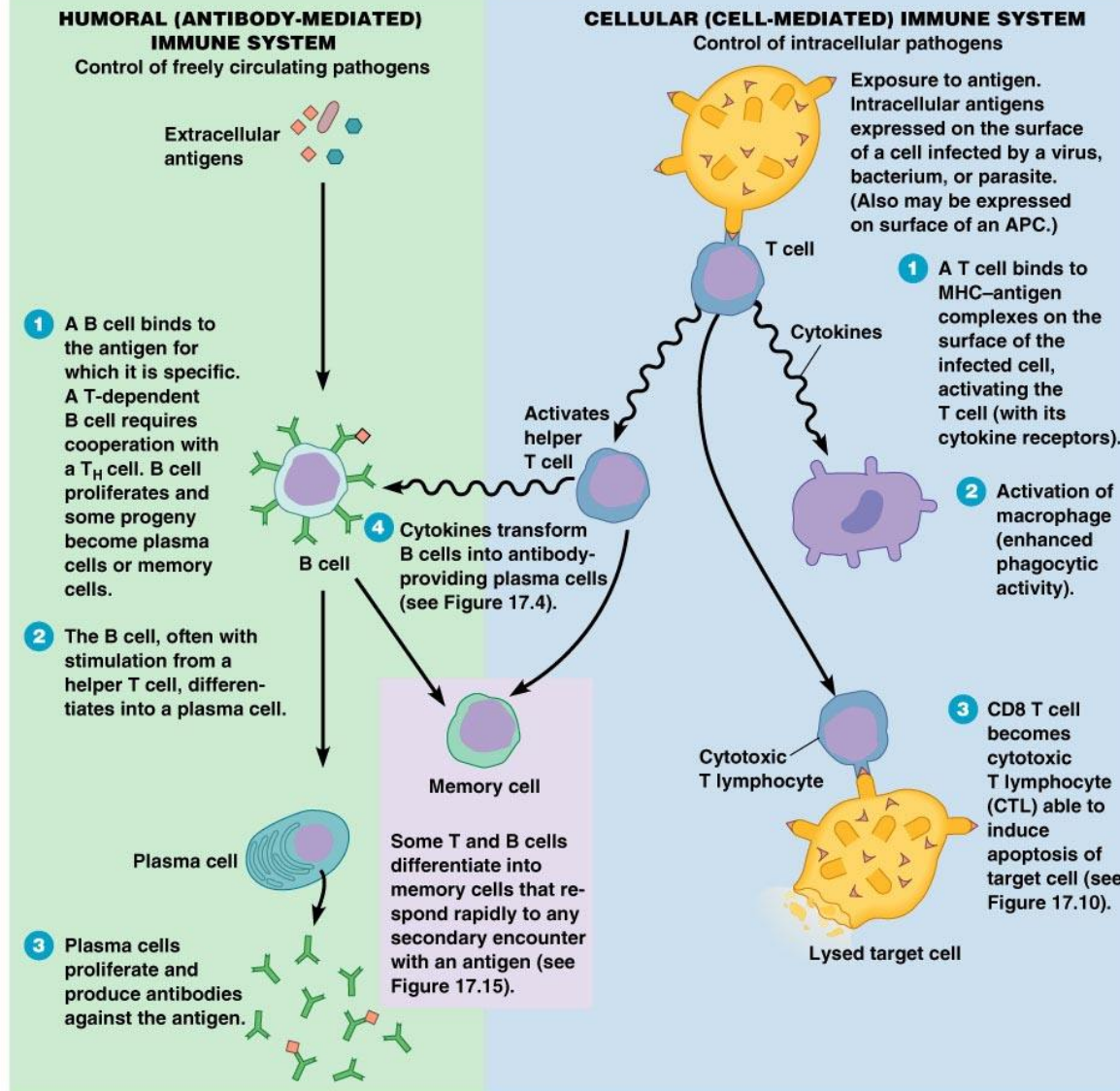
TABLE 17.1 A Summary of Immunoglobulin Classes

Characteristics	IgG	IgM	IgA	IgD	IgE
					
Structure	Monomer	Pentamer	Dimer (with secretory component)	Monomer	Monomer
Percentage of total serum antibody	80%	5–10%	10–15%*	0.2%	0.002%
Location	Blood, lymph, intestine	Blood, lymph, B cell surface (as monomer)	Secretions (tears, saliva, mucus, intestine, milk), blood, lymph	B cell surface, blood, lymph	Bound to mast and basophil cells throughout body, blood
Molecular weight	150,000	970,000	405,000	175,000	190,000
Half-life in serum	23 days	5 days	6 days	3 days	2 days
Complement fixation	Yes	Yes	No [†]	No	No
Placental transfer	Yes	No	No	No	No
Known functions	Enhances phagocytosis; neutralizes toxins and viruses; protects fetus and newborn	Especially effective against microorganisms and agglutinating antigens; first antibodies produced in response to initial infection	Localized protection on mucosal surfaces	Serum function not known; presence on B cells functions in initiation of immune response	Allergic reactions; possibly lysis of parasitic worms

*Percentage in serum only; if mucous membranes and body secretions are included, percentage is much higher.

[†] May be yes via alternate pathway.

The two arms of adaptive immunity



Humoral immunity: control of freely circulating pathogens

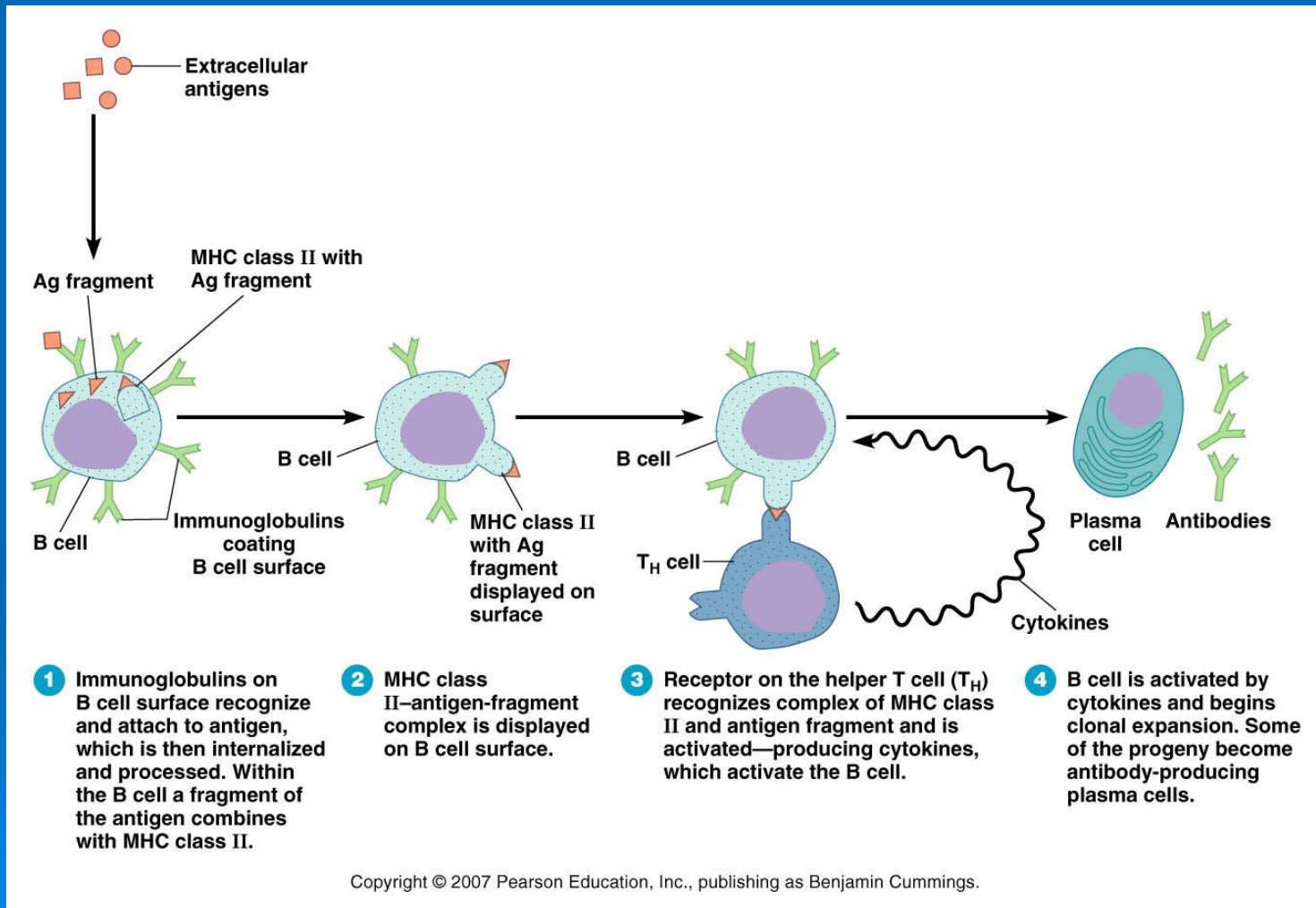
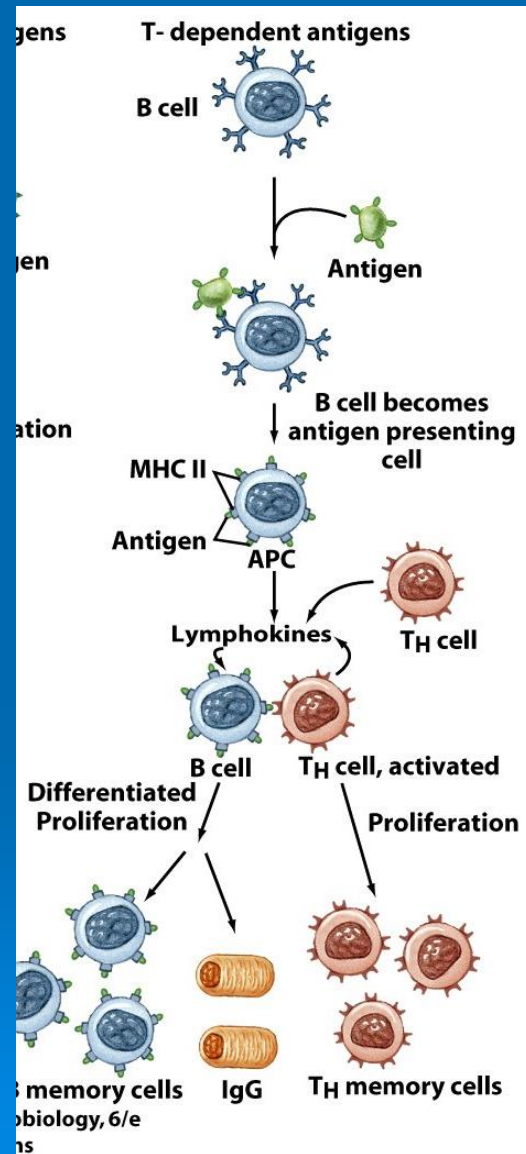


Figure 17.4 - Overview

T-dependent antigens



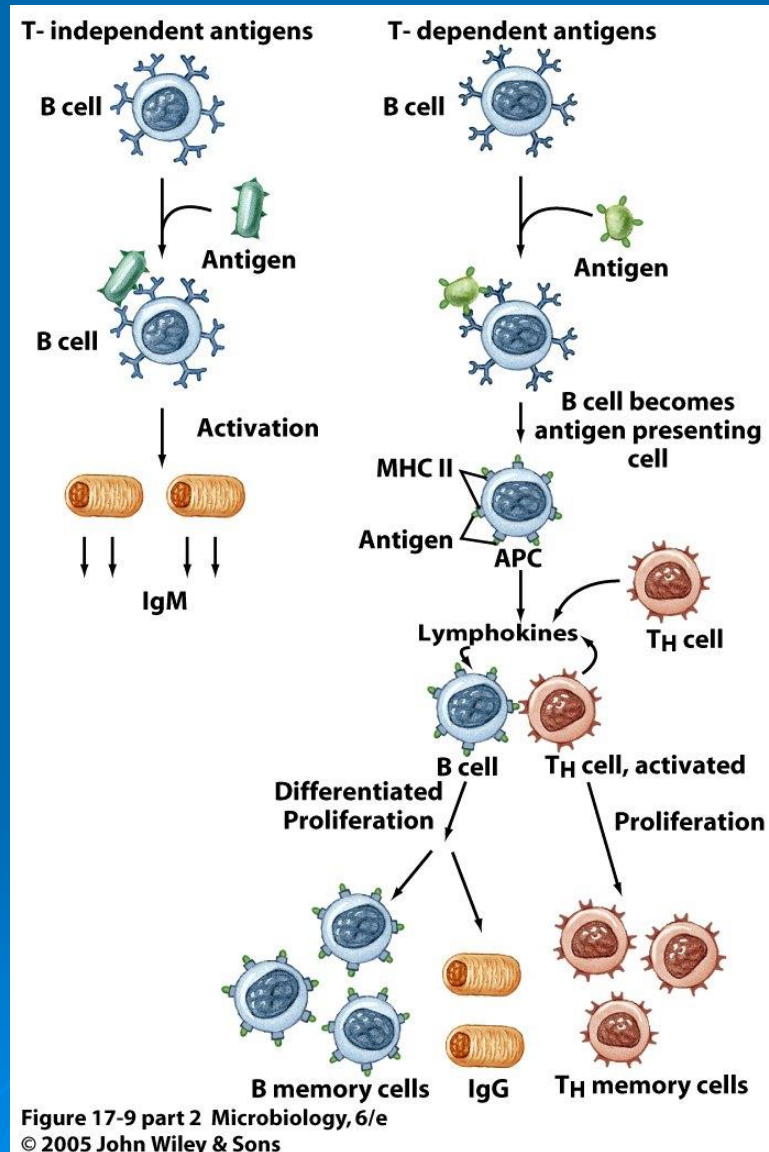
T-dependent antigens

Proteins (viruses, bacteria, RBC) and haptens

T-independent vs. T-dependent antigens

T-independent antigens

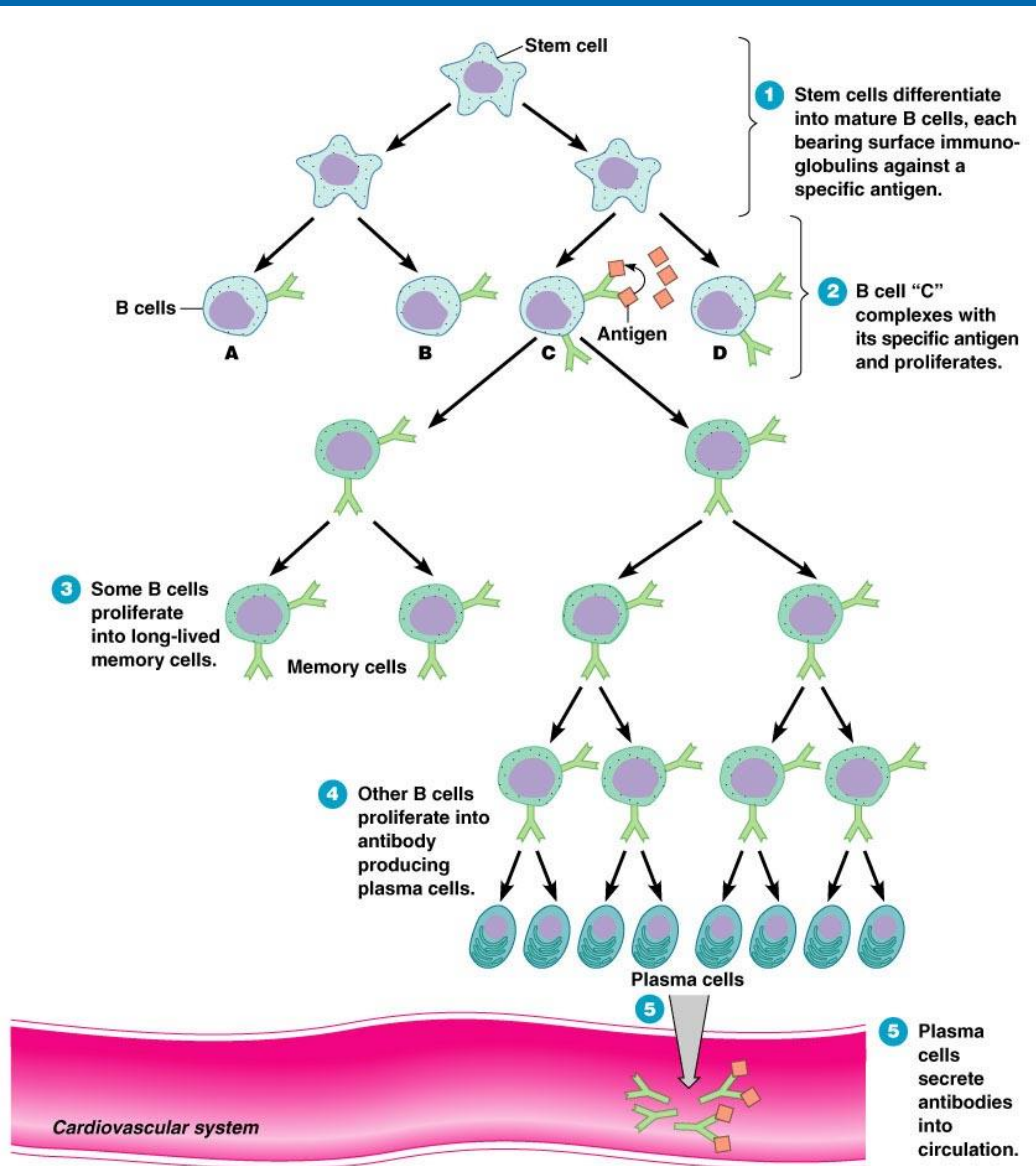
Repeating subunits such as polysaccharides, lipopolysaccharides, and capsules



T-dependent antigens

Proteins (viruses, bacteria, RBC) and haptens

Clonal selection

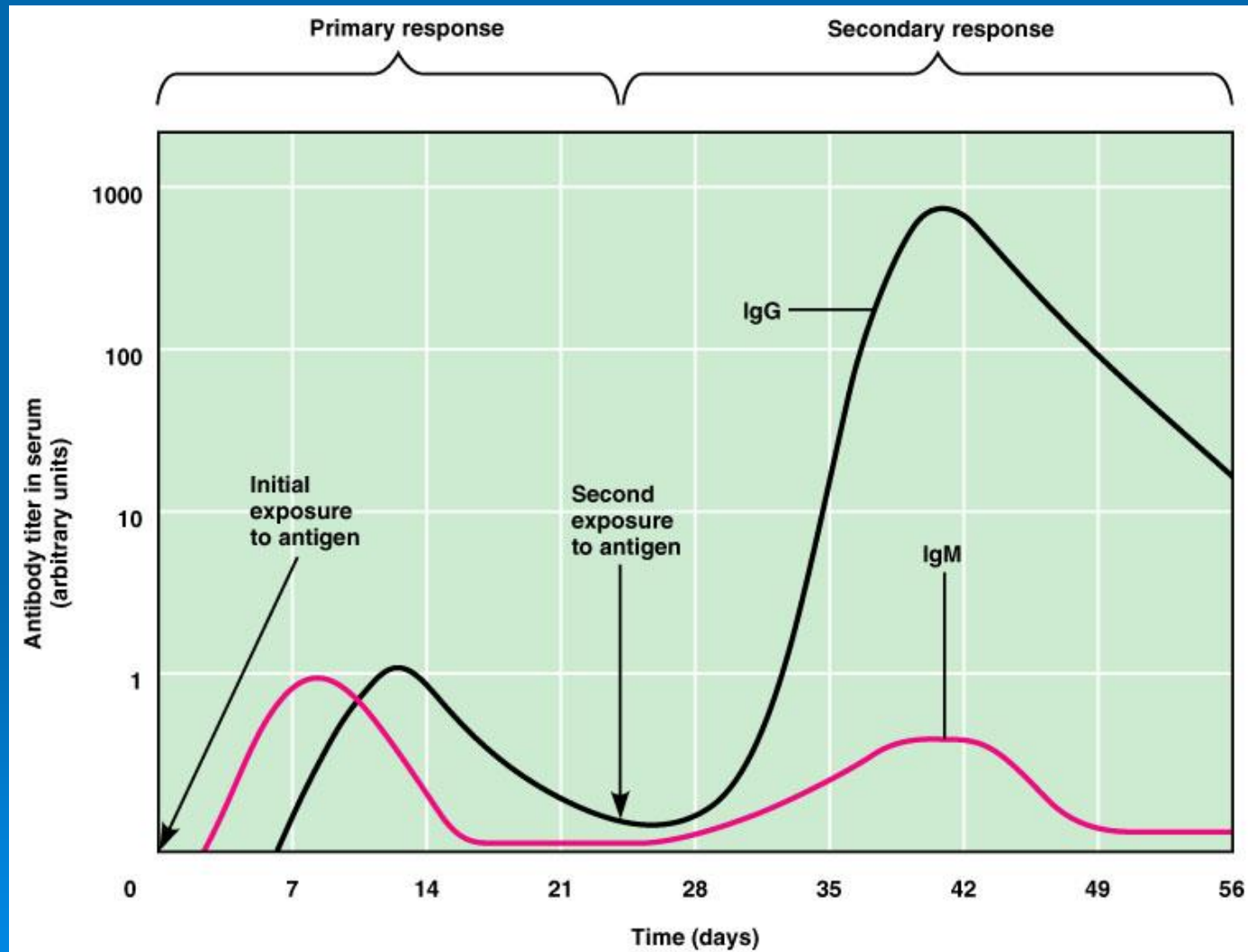


Clonal selection outcomes

1. Proliferation of Ag-specific B cells and T_H cells
2. Differentiation of B cells
 - Plasma cells
 - Memory cells
3. Production of Ag-specific IgG and IgM



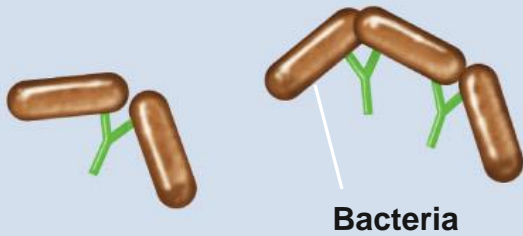
Clonal selection and immunological memory



RESULTS: Antibody- Antigen Binding

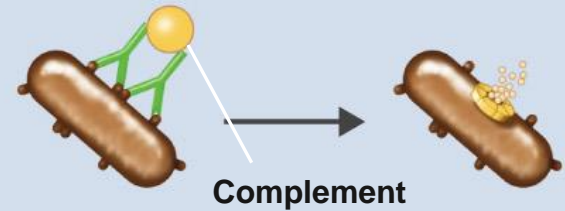
Agglutination

Reduces number of infectious units to be dealt with



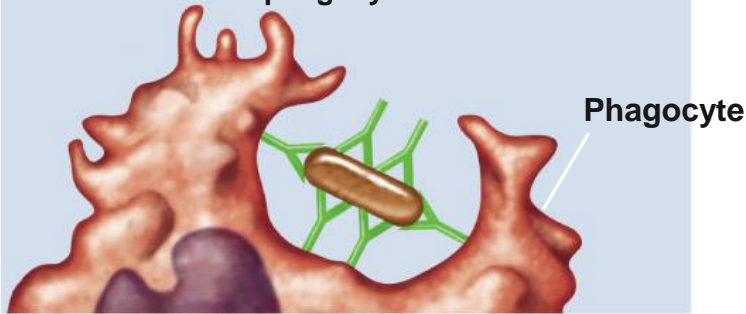
Activation of complement

Causes inflammation and cell lysis



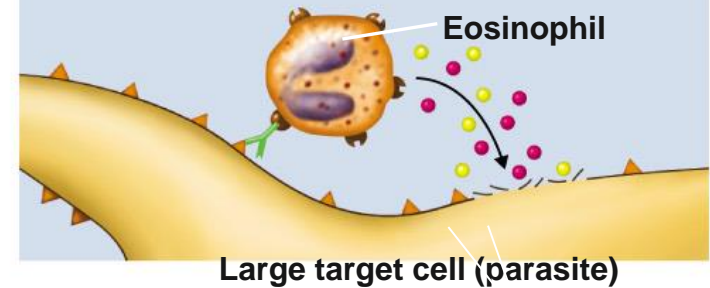
Opsonization

Coating antigen with antibody enhances phagocytosis



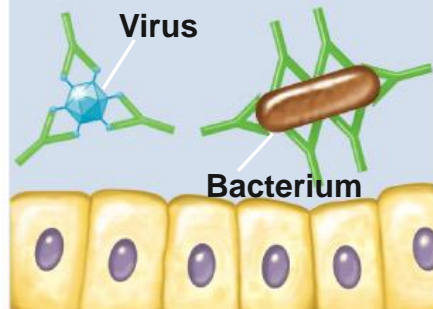
Antibody-dependent cell-mediated cytotoxicity

Antibodies attached to target cell cause destruction by macrophages, eosinophils, and NK cells



Neutralization

Blocks adhesion of bacteria and viruses to mucosa

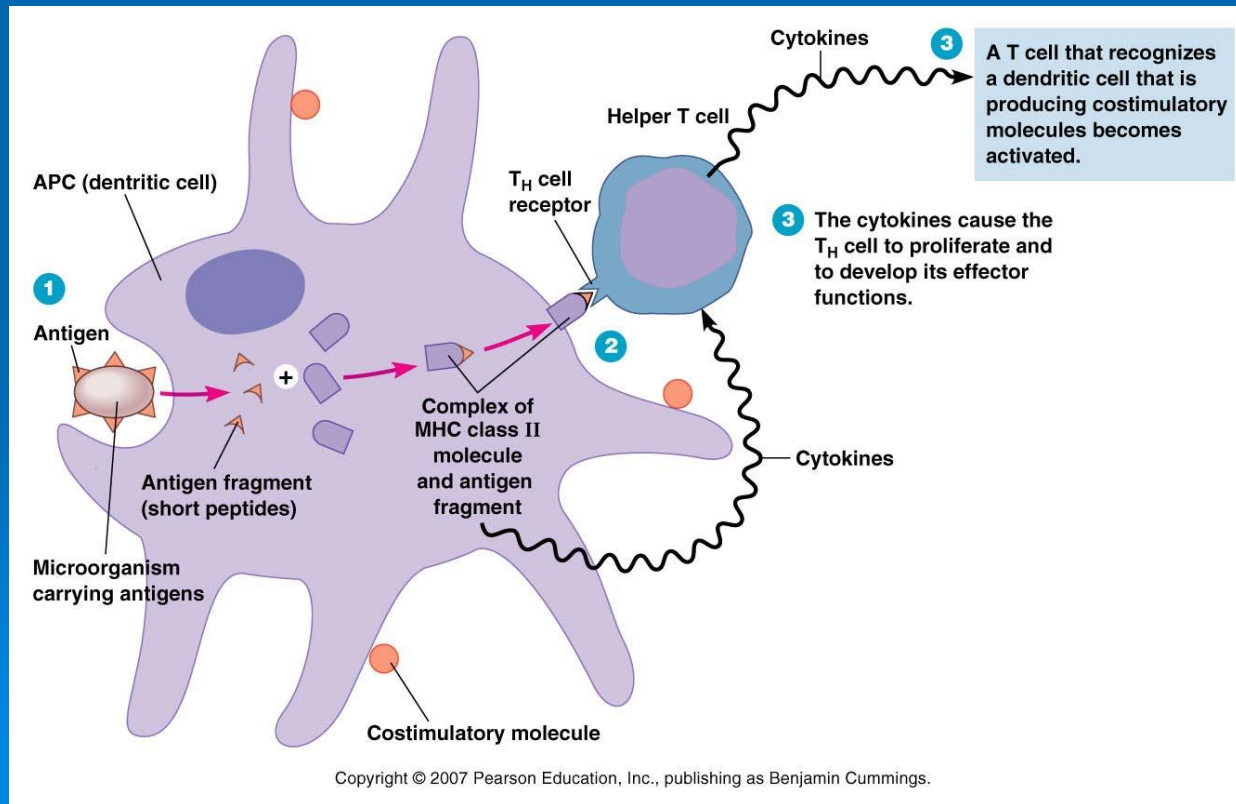


Blocks attachment of toxin

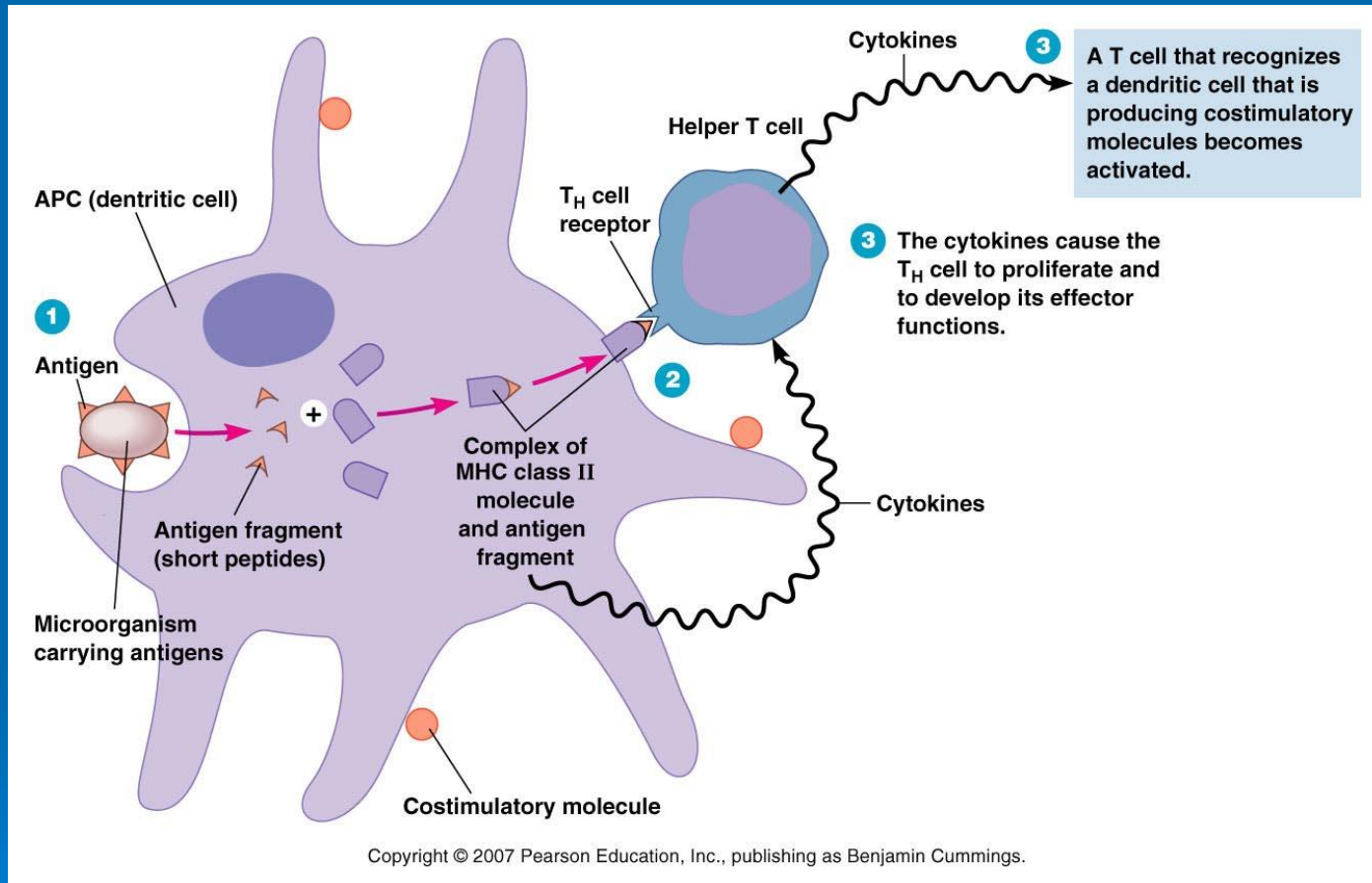
Cellular immunity- control of *intracellular* pathogens

Antigen presenting cells (APCs): Antigenic fragments of pathogens are presented on specific cells (APCs) using MHC II complexes

- Dendritic cells
- Macrophage



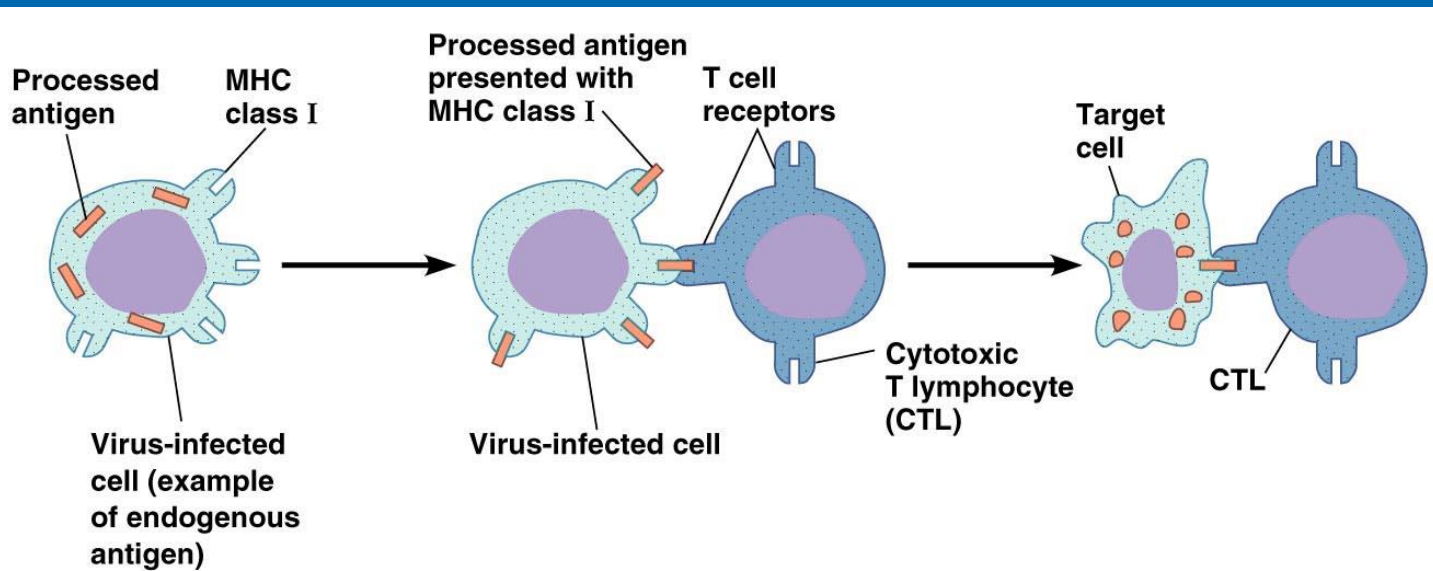
Cellular immunity- APCs and T_H cells



Helper T cells (T_H or CD 4): recognizes APC and presented Ag → activates cells related to cell-mediated immunity, macrophages, NK cells, T_c cells, and humoral response (B cells).

Cellular immunity: infected host cells and CTLs

Infected host cells: self-cells that have been infected with a pathogen (or are tumor cells) that present “endogenous antigens”

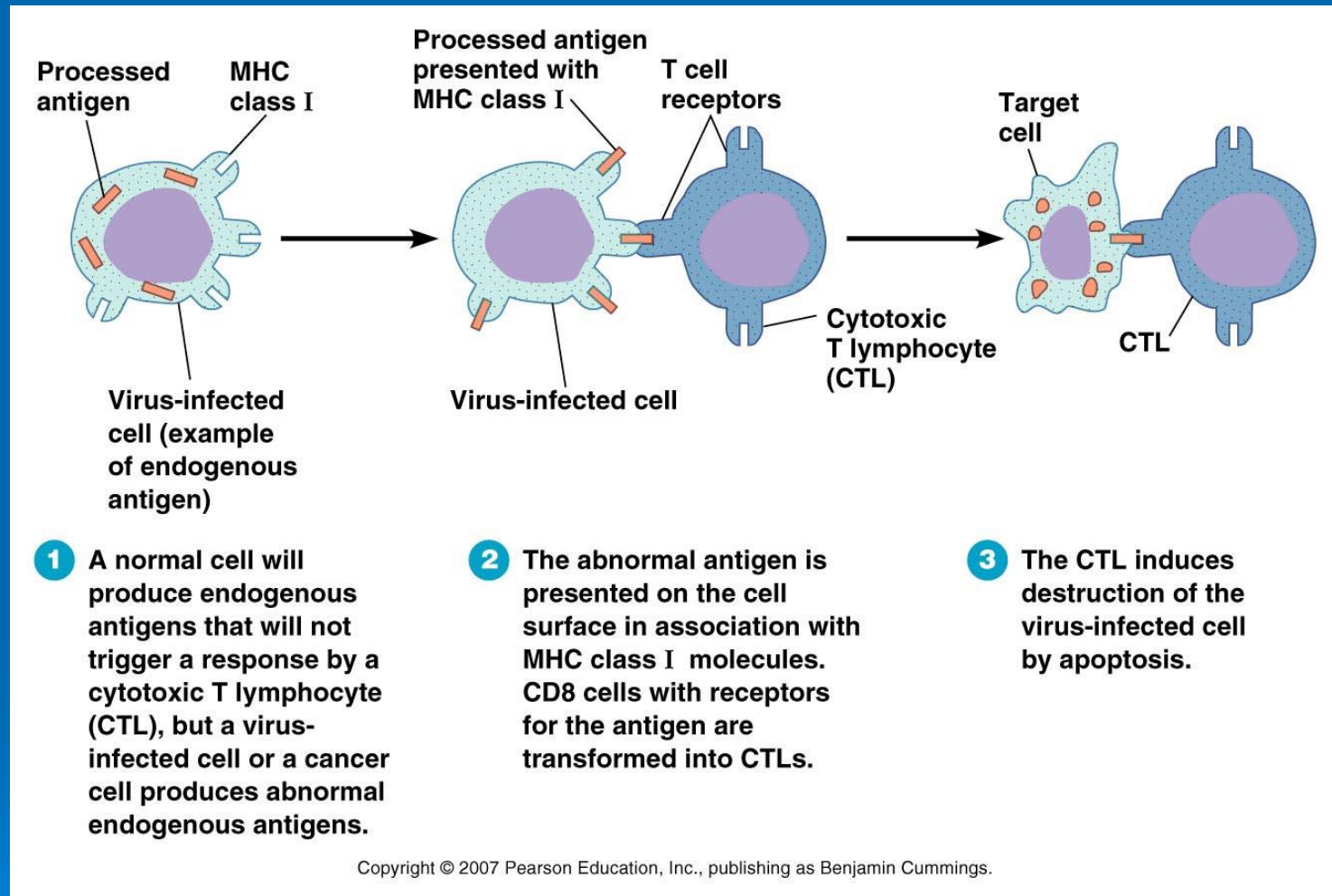


1 A normal cell will produce endogenous antigens that will not trigger a response by a cytotoxic T lymphocyte (CTL), but a virus-infected cell or a cancer cell produces abnormal endogenous antigens.

2 The abnormal antigen is presented on the cell surface in association with MHC class I molecules. CD8 cells with receptors for the antigen are transformed into CTLs.

3 The CTL induces destruction of the virus-infected cell by apoptosis.

Cellular immunity: infected host cells and CTLs



Cytotoxic T cells (T_c or CD8): differentiate into cytotoxic T Lymphocytes (CTLs) that destroys target cells on contact

Independent study

1. Review humoral and cellular immunity

