

Game plan

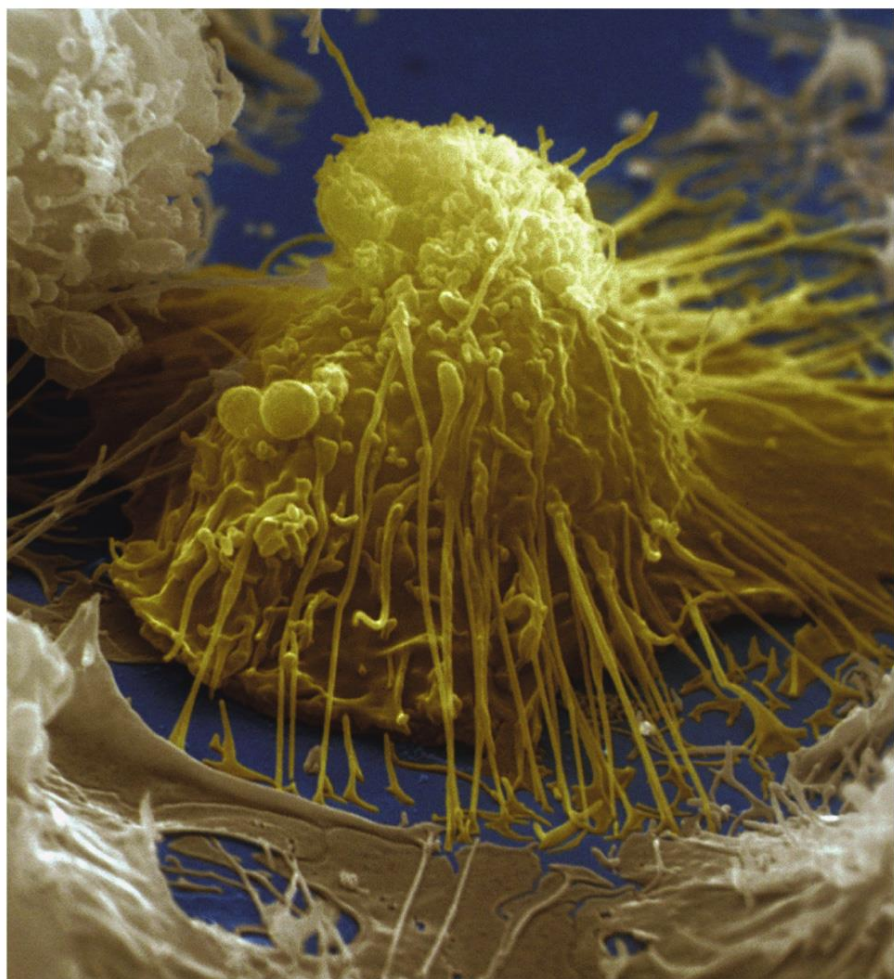
Lecture

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

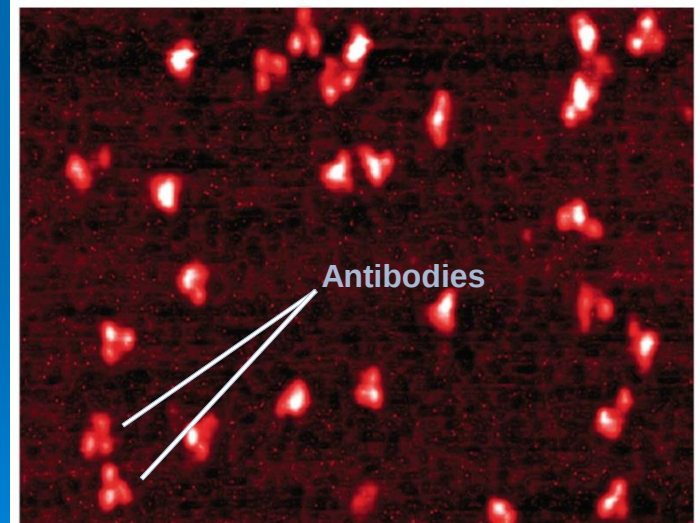
Lab

Continue Staph, Strep and Enteric Unknowns





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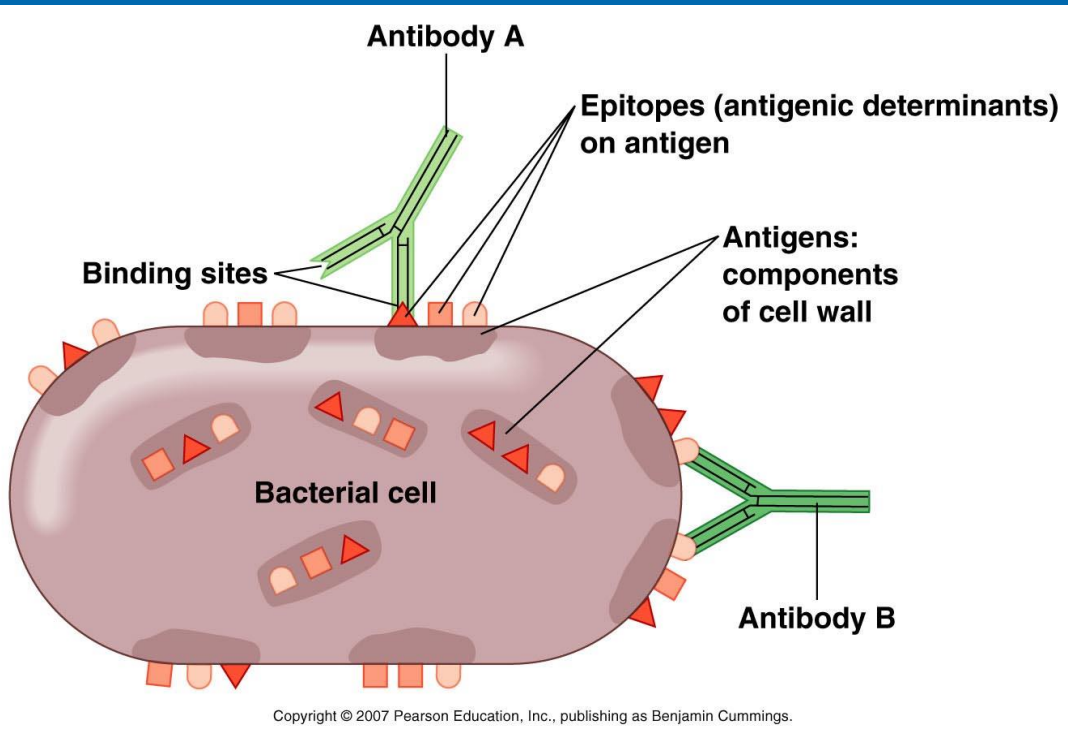


(c)

AFM 5 nm

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Antibodies and antigens



Antigens (Ag):

- Protein or large polysaccharide
- Can be attached or free from cell
- Each antigen contains multiple epitopes that are recognized by...

Antibodies (Ab):

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

Antibody structure

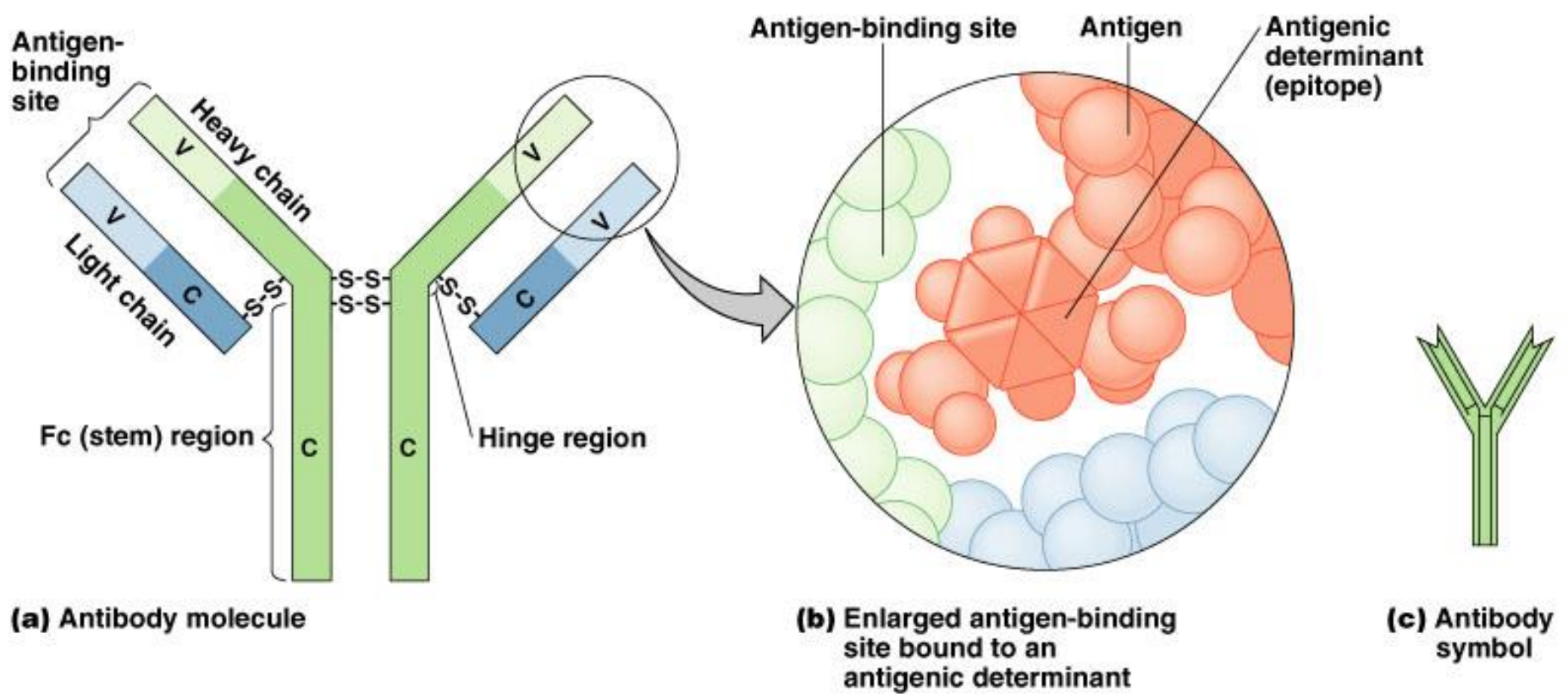
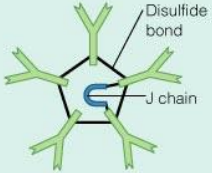
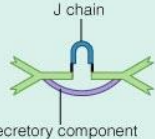


Figure 17.3

Antibody classes

TABLE 17.1

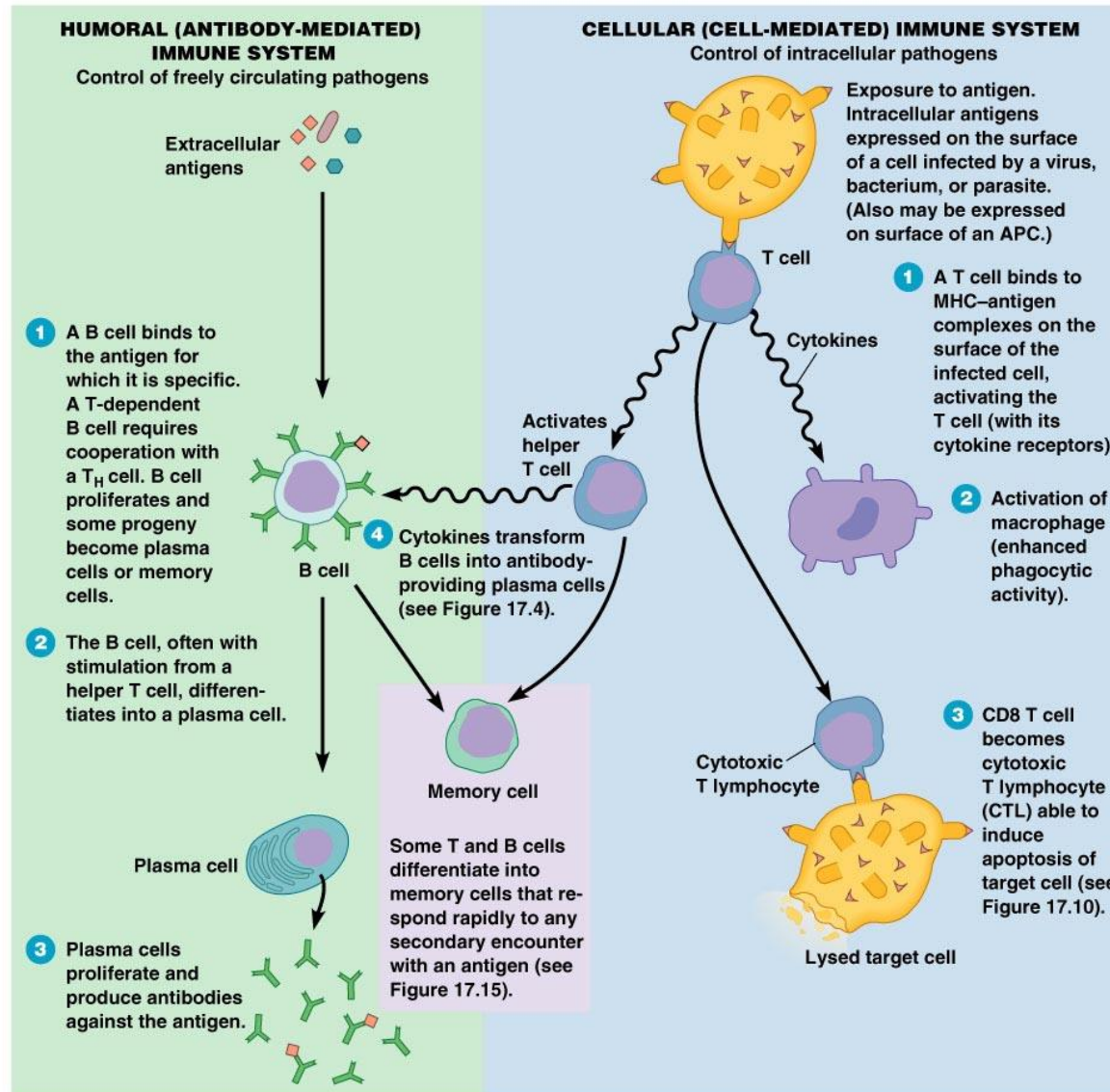
A Summary of Immunoglobulin Classes

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

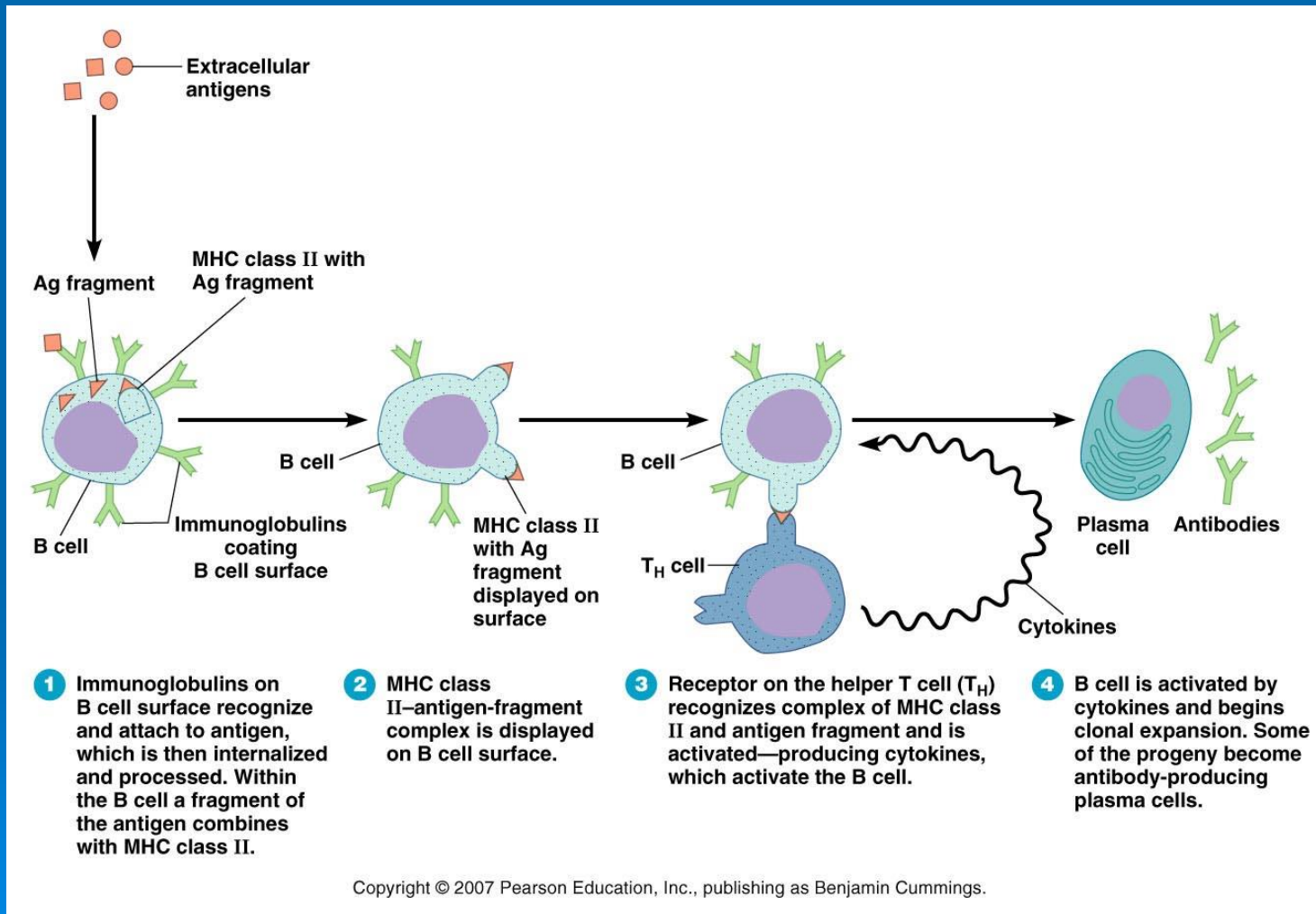
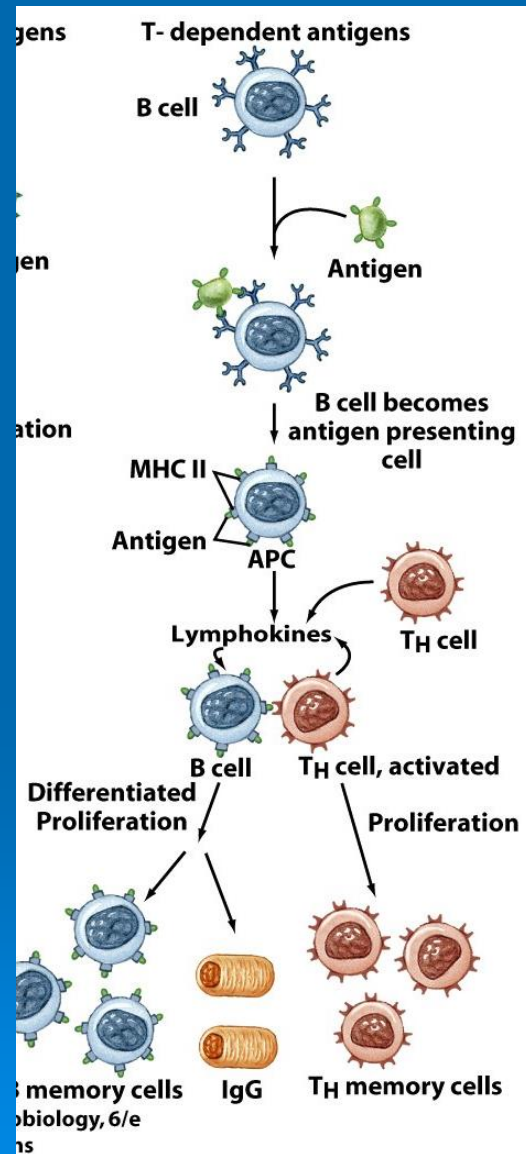


Figure 17.4 - Overview

T-dependent antigens



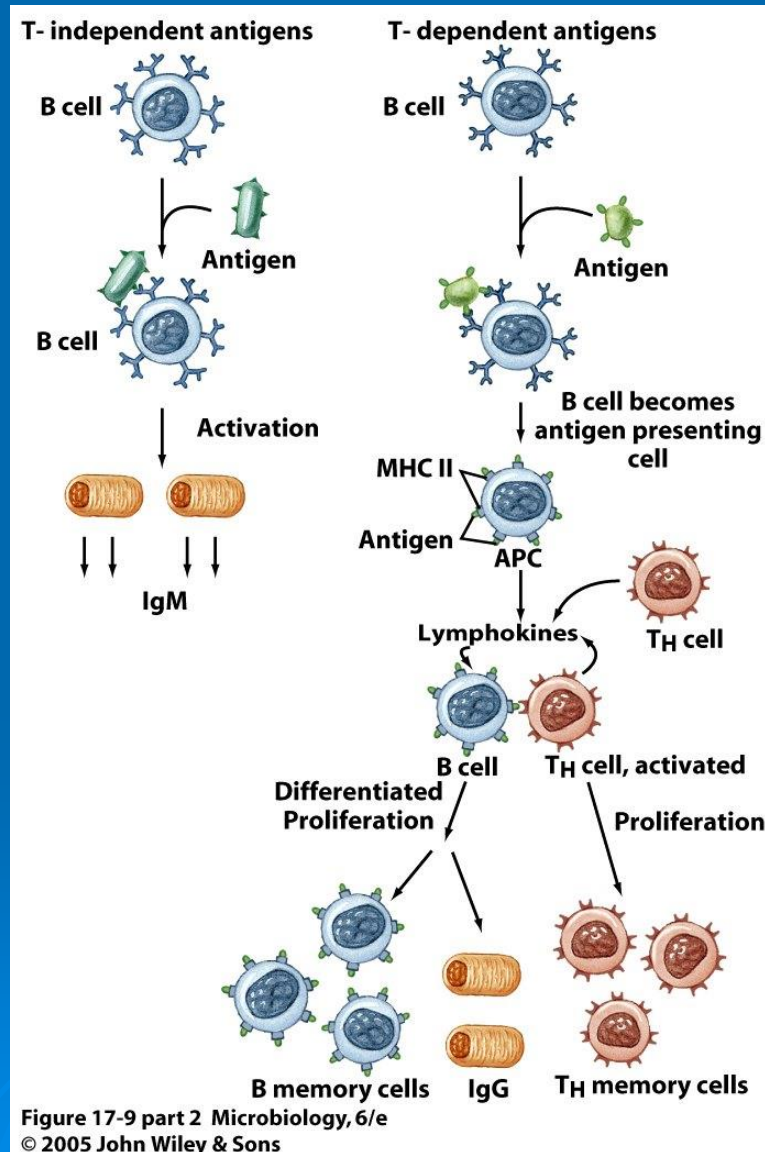
T- dependent antigens

Proteins (viruses, bacteria, RBC) and haptens

T-independent vs. T-dependent antigens

T-independent antigens

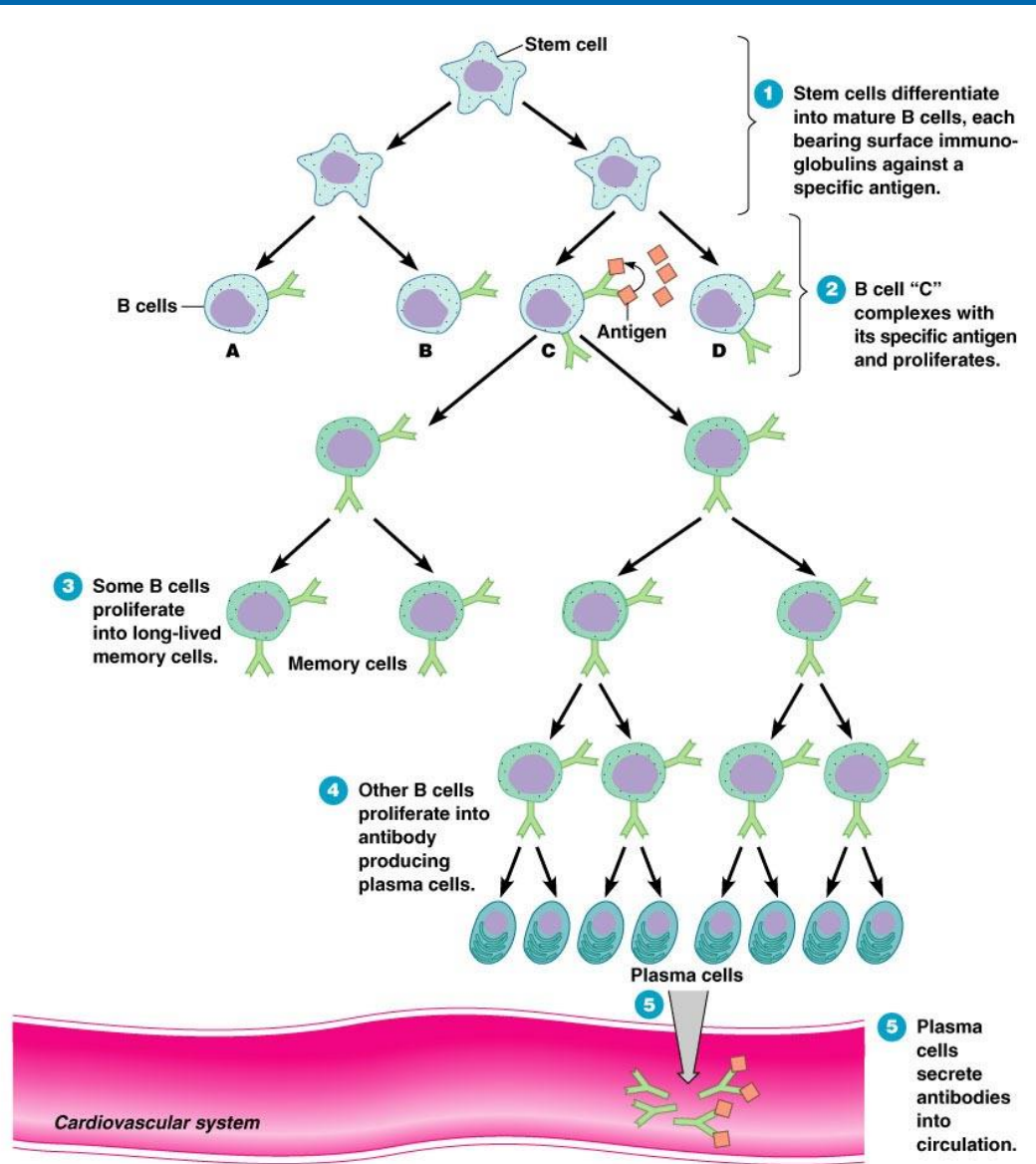
Repeating subunits such as polysaccharides, lipopolysaccharides, and capsules



T-dependent antigens

Proteins (viruses, bacteria, RBC) and haptens

Clonal selection



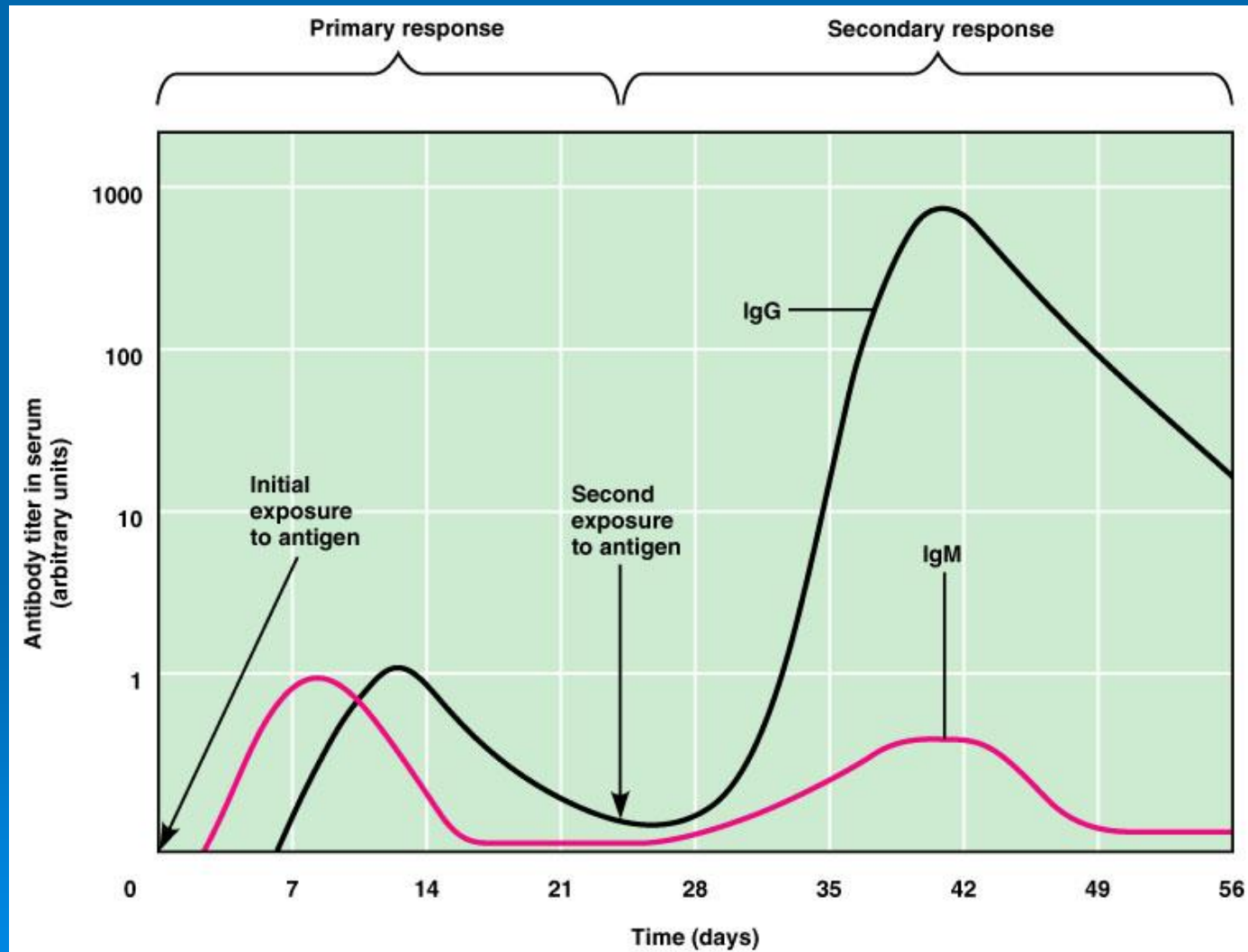
Clonal selection outcomes

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



Figure 17.5 - Overview

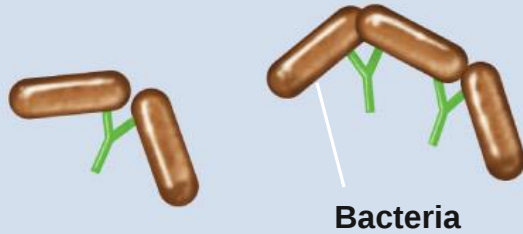
Clonal selection and immunological memory



RESULTS: Antibody- Antigen Binding

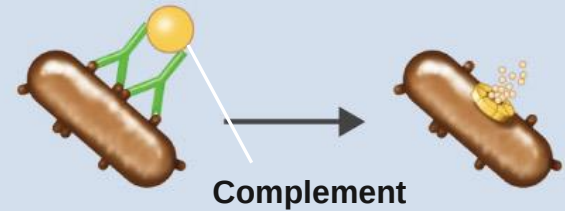
Agglutination

Reduces number of infectious units to be dealt with



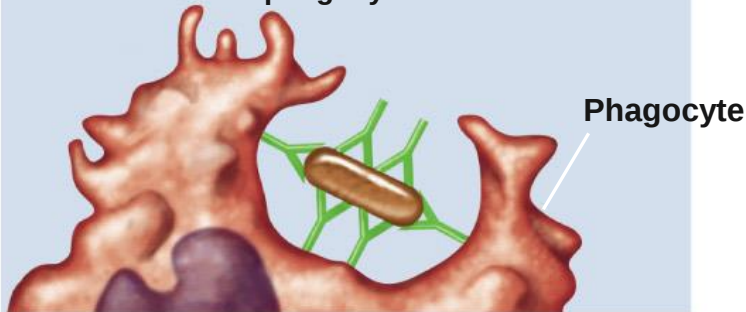
Activation of complement

Causes inflammation and cell lysis



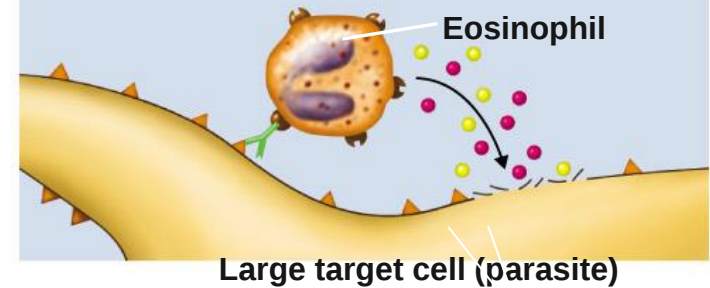
Opsonization

Coating antigen with antibody enhances phagocytosis



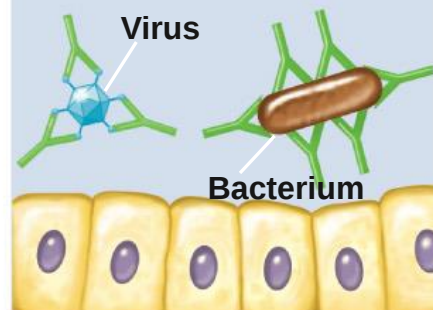
Antibody-dependent cell-mediated cytotoxicity

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



Neutralization

Blocks adhesion of bacteria and viruses to mucosa



Toxin

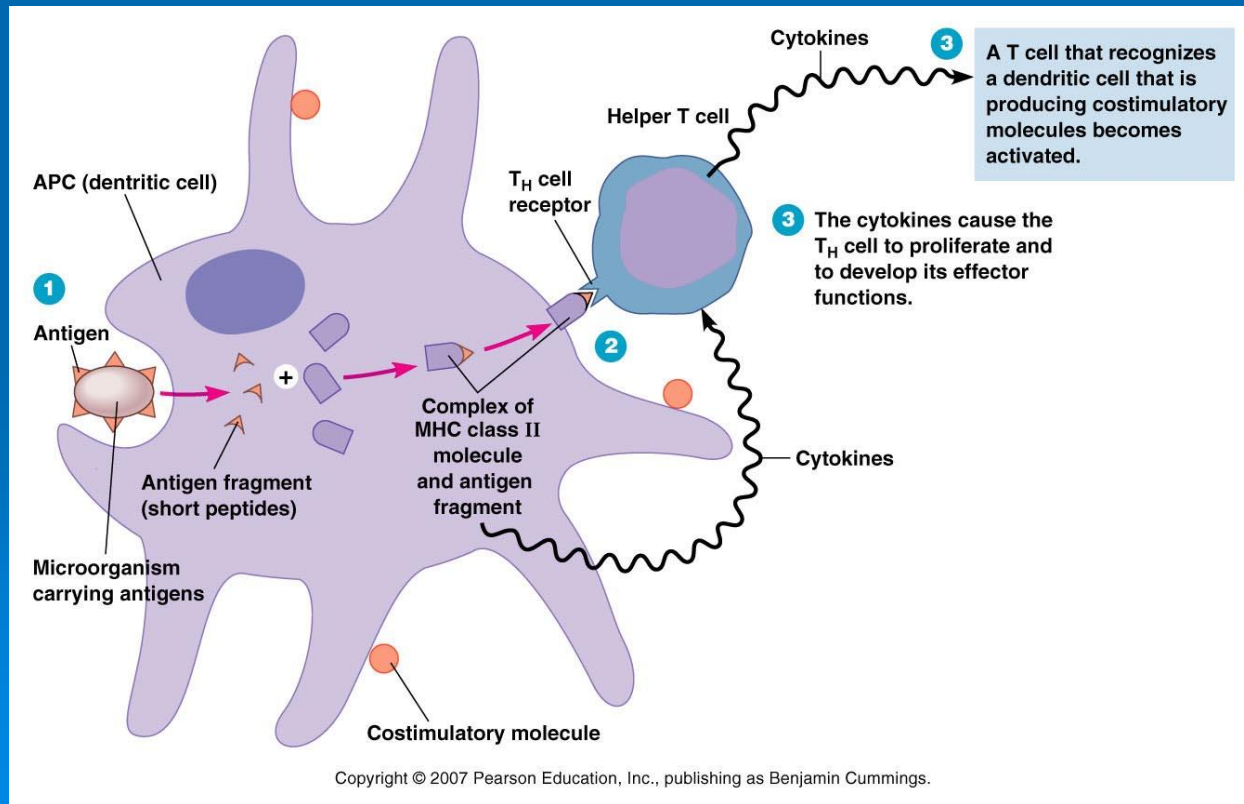
Blocks attachment of toxin



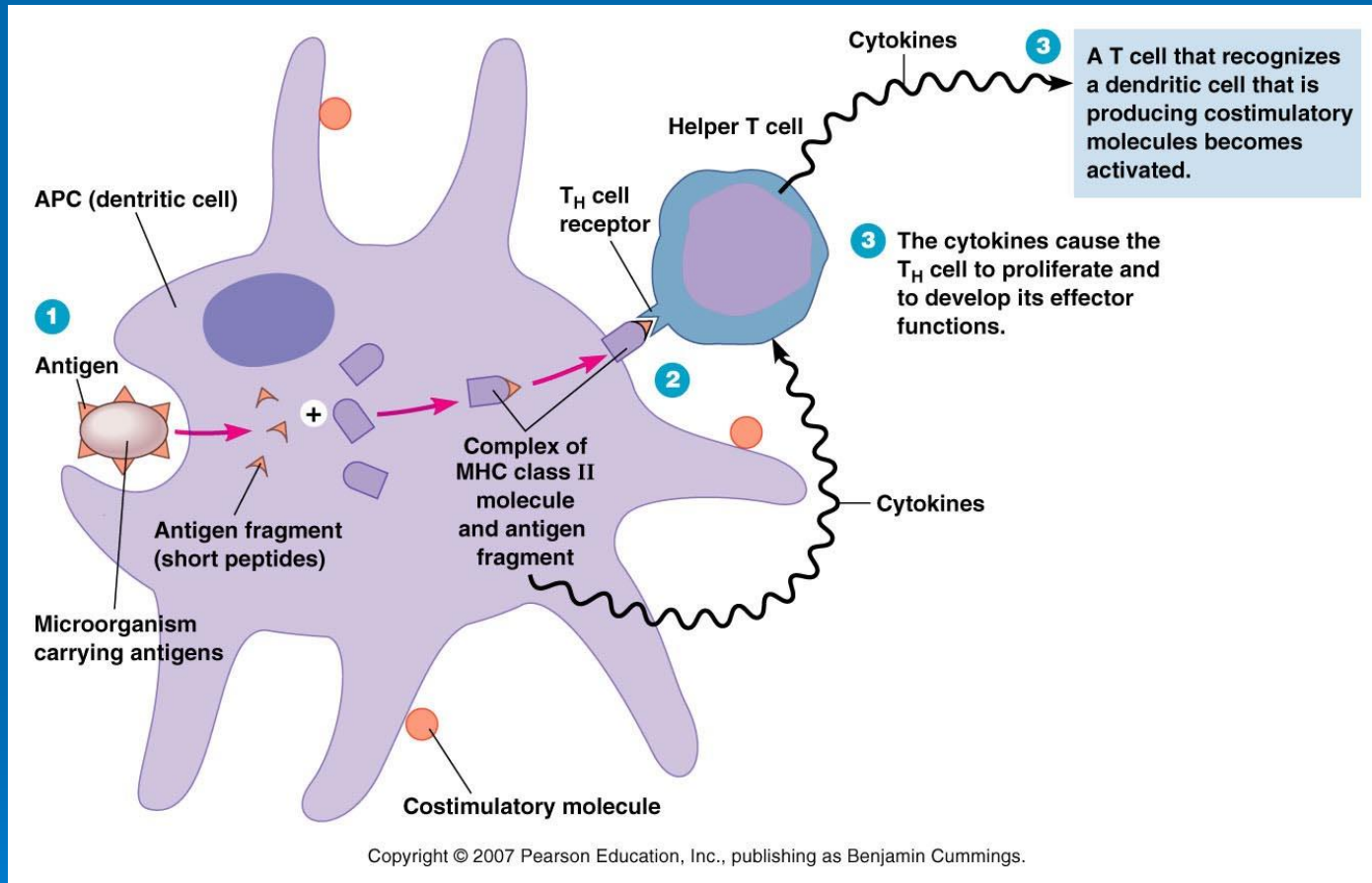
Cellular immunity- control of *intracellular* pathogens

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

- Dendritic cells
- Macrophage



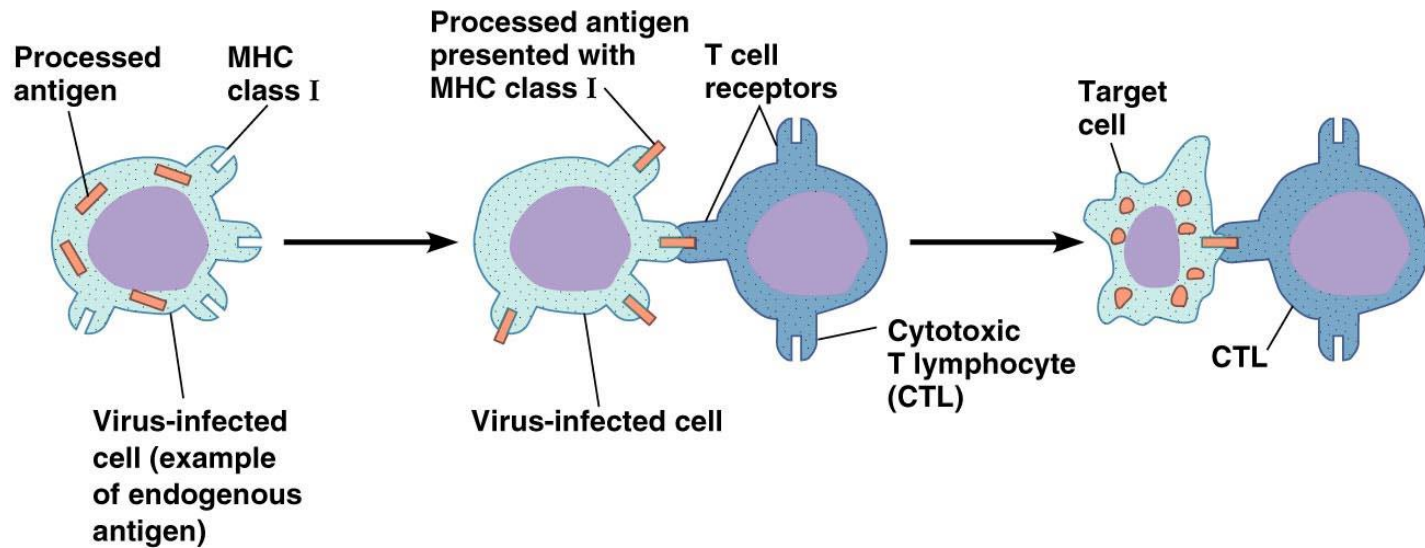
Cellular immunity- APCs and T_H cells



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

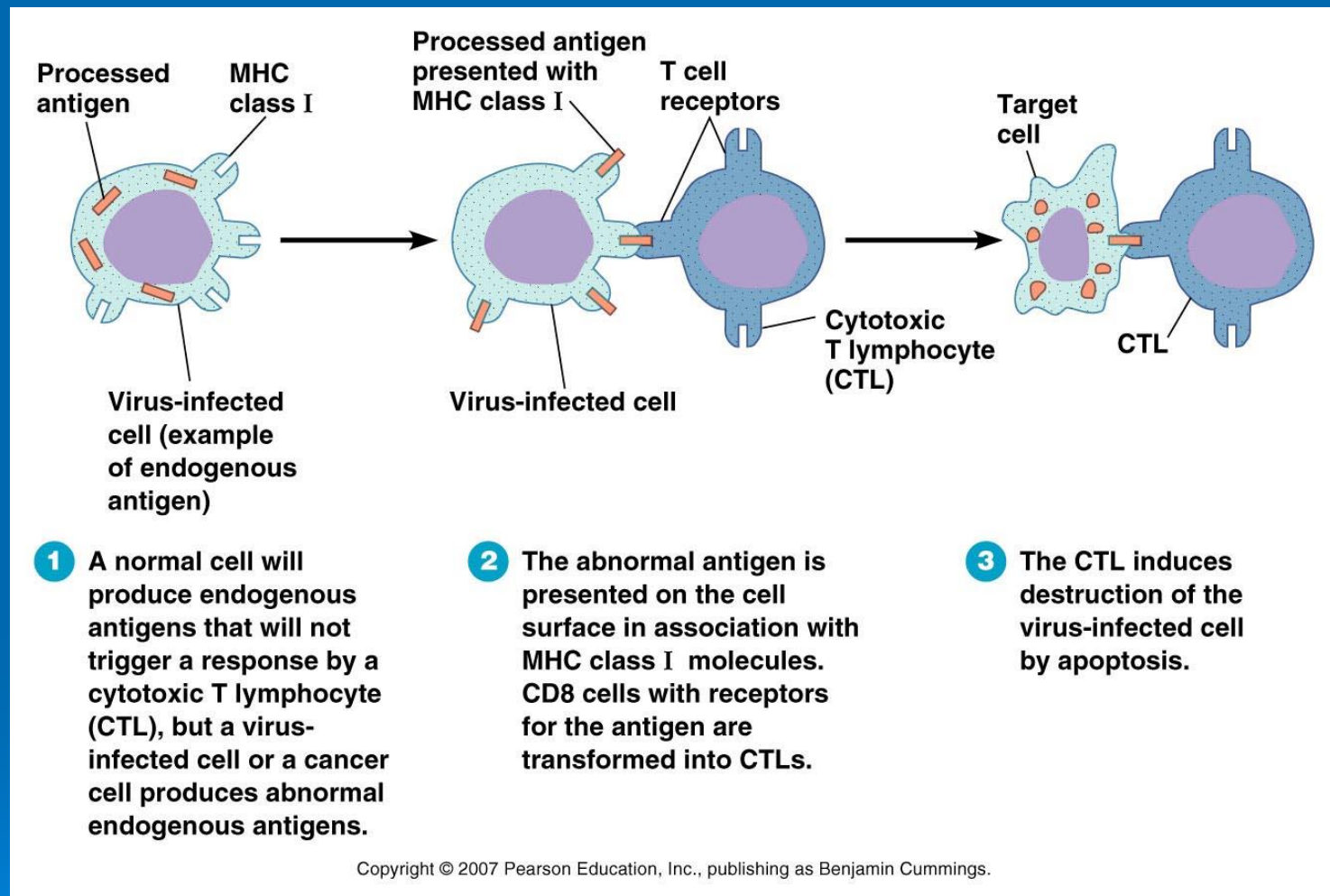


1 A normal cell will produce endogenous antigens that will not trigger a response by a cytotoxic T lymphocyte (CTL), but a virus-infected cell or a cancer cell produces abnormal endogenous antigens.

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.

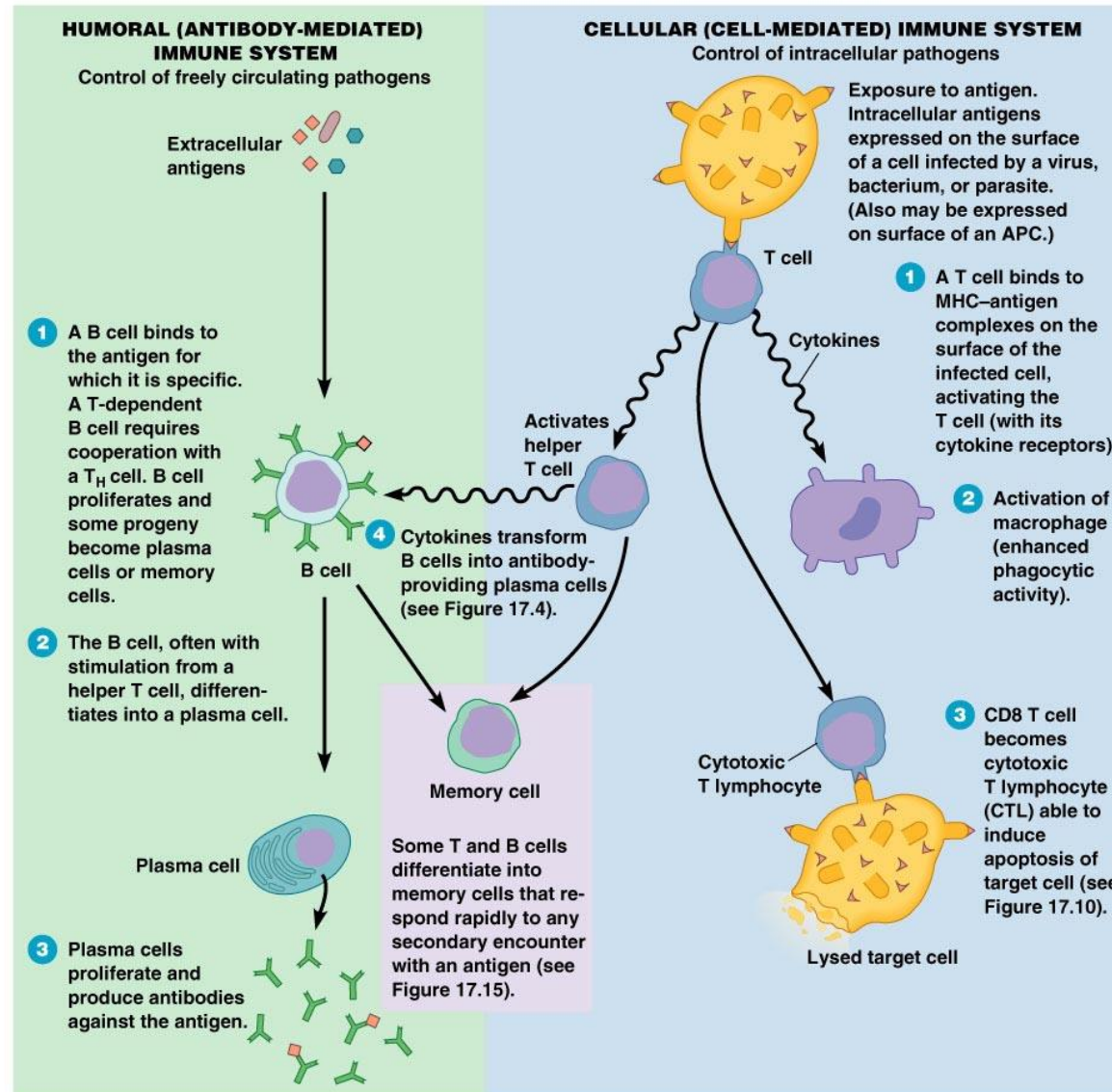
3 The CTL induces destruction of the virus-infected cell by apoptosis.

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

The two arms of adaptive immunity



Independent study

1. Review humoral and cellular immunity

