

Body Defense; Part II



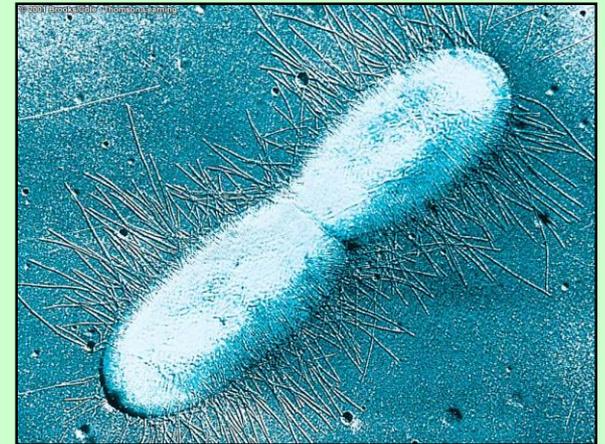
Anatomy/Physiology: Immunity

Chapter 22

Lines of Defense

⌘ Pathogens

☒ **Viruses, bacteria, fungi, protozoa, parasitic worms, etc.**



⌘ 3 Lines of Defense

- 1. A shield – your skin**
- 2. Chemical weapons – natural drugs**
- 3. White Blood Cells**

Surface Barriers



- ⌘ Most pathogens can't penetrate your skin
- ⌘ "good" bacteria living on the mucous lining of your vagina out compete the pathogens
- ⌘ You have enzymes that destroy pathogens in your tears, saliva, & gastric fluids – **lysozyme** is a common enzyme
- ⌘ Diarrhea quickly pushes out pathogens from your gut

Nonspecific & Specific Responses



- ⌘ All vertebrates have internal defenses waiting for pathogens.
- ⌘ Most of these defenses, WBCs for example, will go after any pathogen – this is called a **nonspecific response**.
- ⌘ Other WBCs go after a specific pathogen – this is called a **specific response**.

Phagocytes: “We Eat So You Can Live”

⌘ Neutrophils

- ☒ Most abundant; They ingest, kill & digest

⌘ Eosinophils

- ☒ Parasitic worms: produce
- ☒ enzymes that put holes in worms

⌘ Basophils

- ☒ Histamine: causes **inflammation**

⌘ Macrophages; “big eaters”

- ☒ Engulf and digest foreign objects



Inflammation



⌘ Redness

- ⊞ Vasodilation

⌘ Warmth

- ⊞ Increase blood flow

⌘ Swelling

- ⊞ Increase capillary permeability

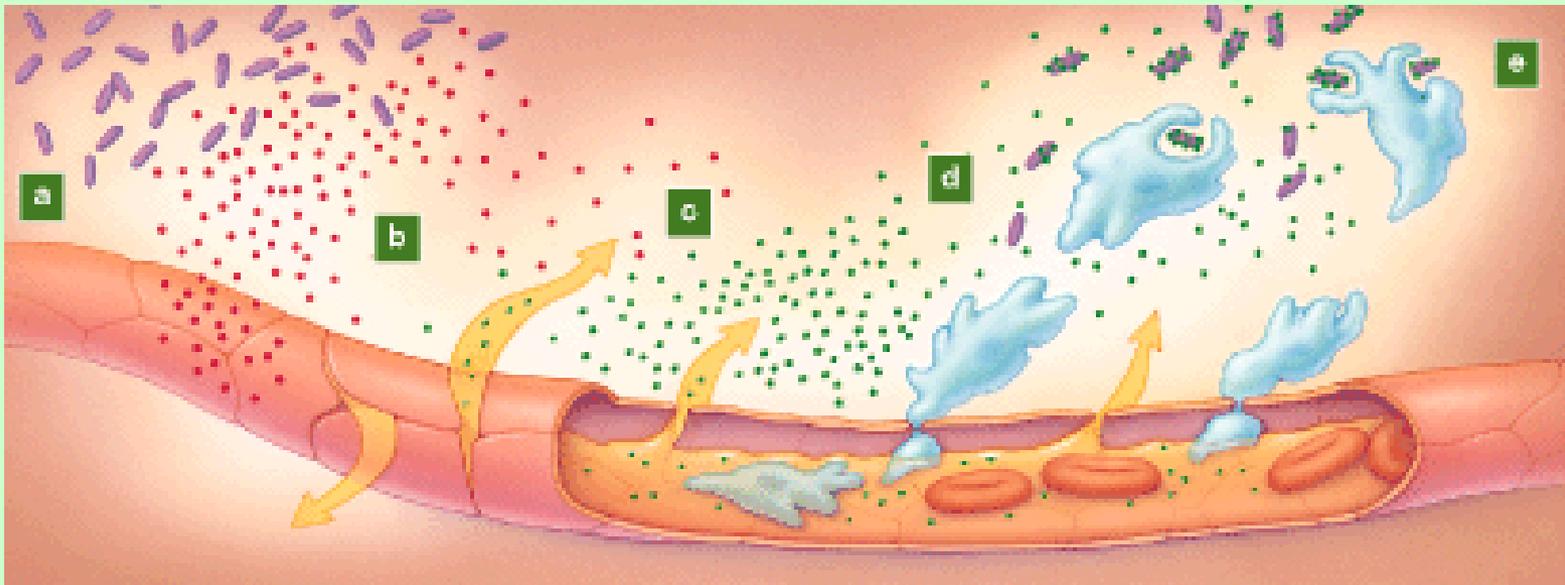
⌘ Pain

- ⊞ Nociceptors stimulated by increase fluid pressure

Acute Inflammation

Bacterial Invasion

- ⌘ **Chemotaxis:** attracts phagocytes to the area
- ⌘ **Histamine (vasodilators):** vessels become “leaky”
- ⌘ **Pyrogen** causes a fever
- ⌘ **Interleukin-1:** stimulates B & T cells



The Immune System

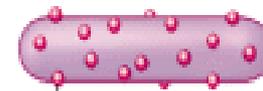
- ⌘ **B and T lymphocytes**
- ⌘ **MHC (your IFF)**
- ⌘ **Antigen - MHC complex**
- ⌘ **Antigen invokes response**
- ⌘ **Antigen-presenting cell**



MHC marker that designates "self" (it occurs only at the surface of body's own cells)
T cells and B cells ignore this



processed antigen, bound to MHC marker, at surface of an antigen-presenting cell
T cells initiate an immune response



antigen (any unprocessed foreign or abnormal molecular configuration that lymphocytes recognize as nonself)

B cells initiate an immune response

Key Players in the Immune Response

⌘ Activation of T or B lymphocytes

⌘ T cells

- ☑ Helper

- ☑ Cytotoxic: kill specific infected body cells

- ☑ Memory

⌘ B cells: produce...

- ☑ Antibodies

- ☑ Memory

Cell-Mediated Responses

- ⌘ **Stem cells in bone marrow make T cells**
- ⌘ **Thymus: matures T cells**
- ⌘ **T-helper cells: activates other immune cells**
- ⌘ **T-cytotoxic cells**
 - ⊞ **Respond to antigen-MHC complexes**
 - ⊞ **Perforin: causes holes in cell membranes**
- ⌘ **Rejection of tissue and organ transplant**

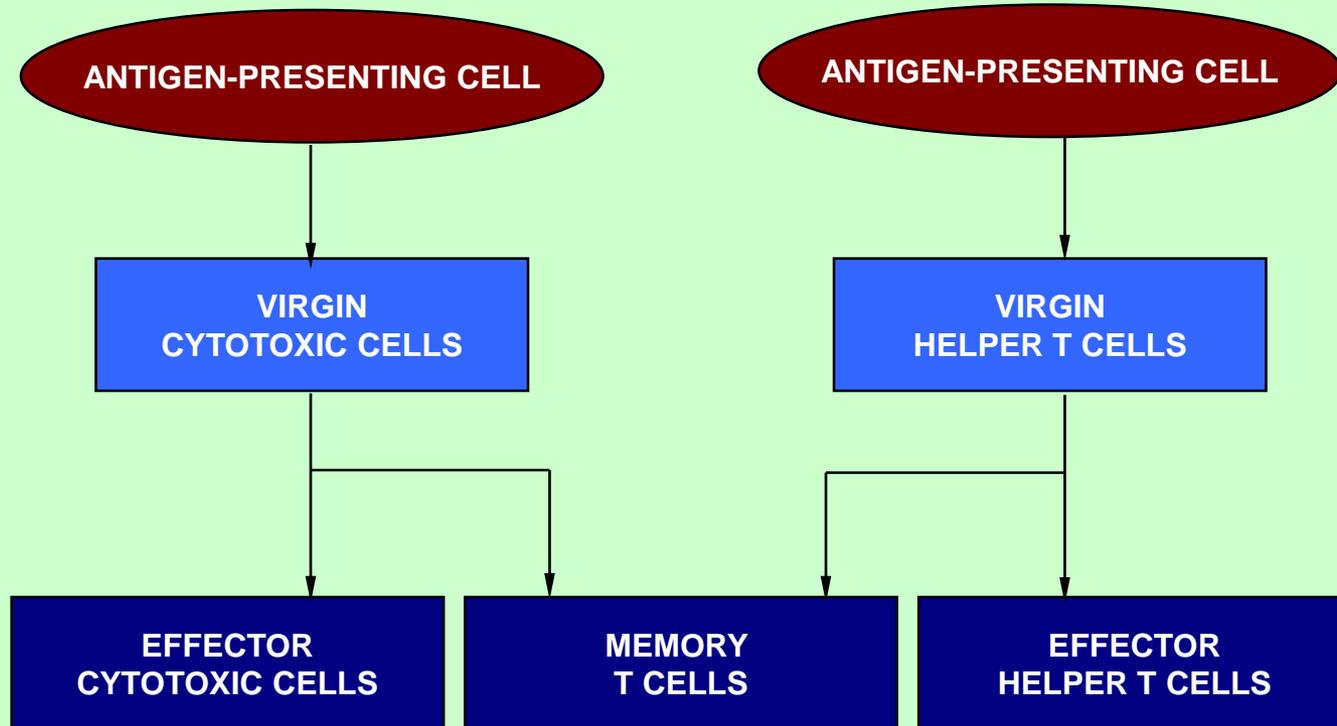


Fig. 40.7a, p. 695

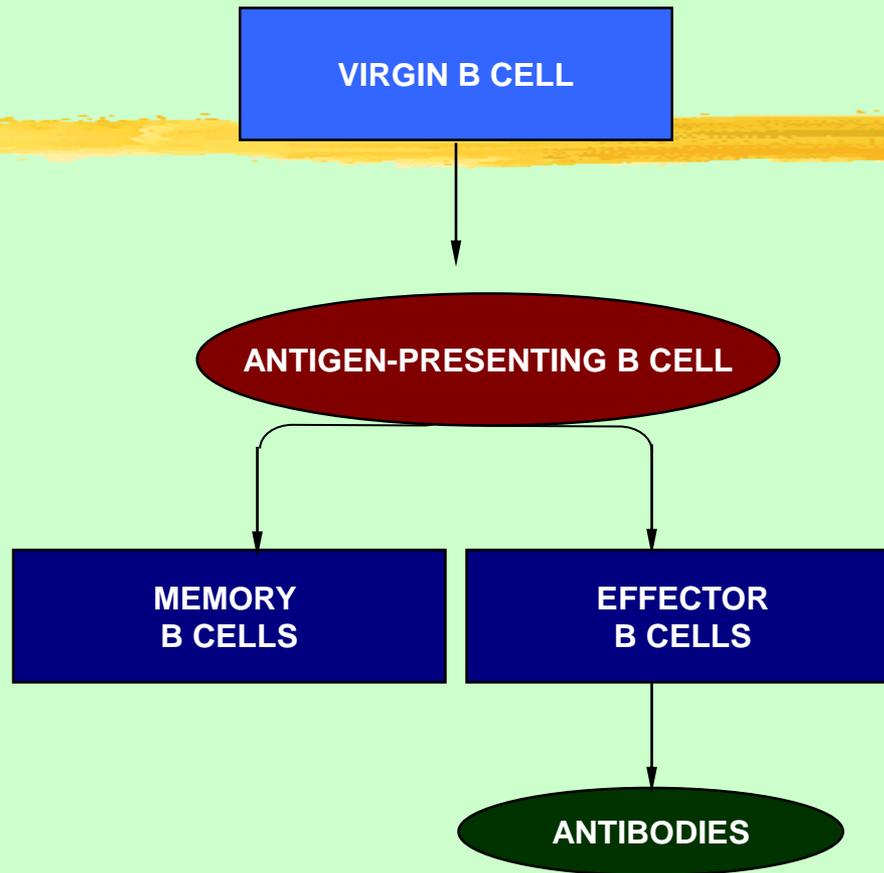


Fig. 40.7b, p. 695

Antibody-Mediated Responses

B Cells



- ⌘ **Stem cells in bone marrow**
- ⌘ **Make antibodies: proteins that “go after” foreign proteins or viruses**
- ⌘ **Immunoglobulins “Igs”; 5 classes of...**
 - ⊞ **Ig M**
 - ⊞ **Ig G**
 - ⊞ **Ig A**
 - ⊞ **Ig E**
 - ⊞ **Ig D**

Immunoglobulins

⌘ Ig M

- ☑ Secreted first
- ☑ Triggers complement

⌘ Ig G

- ☑ Triggers complement
- ☑ Neutralize toxins
- ☑ Crosses placenta
- ☑ Secreted in milk

⌘ Ig A

- ☑ On mucous surfaces

⌘ Ig E

- ☑ Triggers inflammation
- ☑ Parasitic worms

⌘ Ig D

- ☑ Function not understood

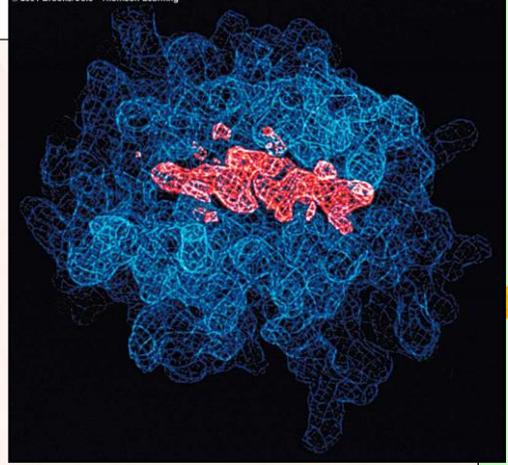
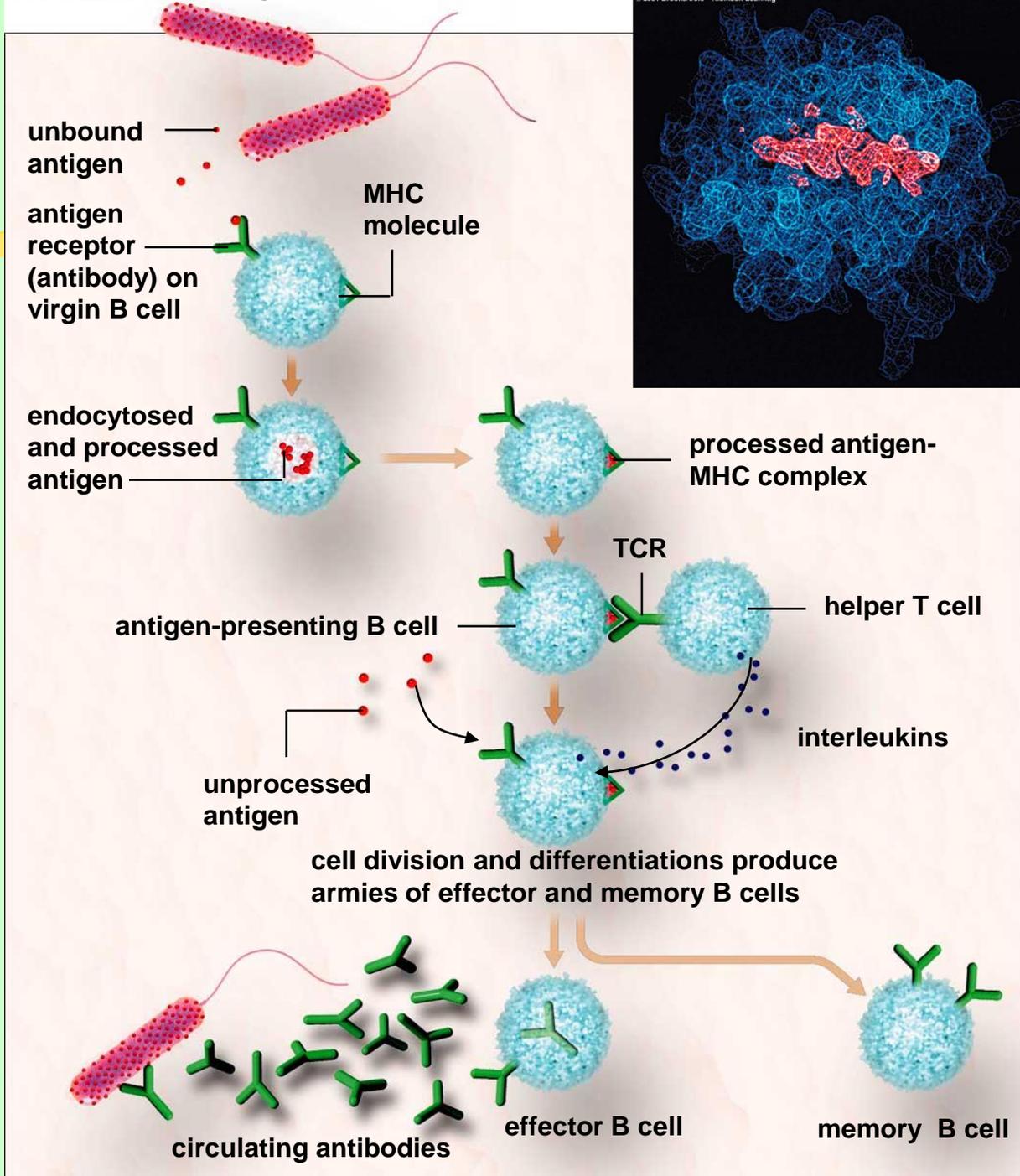
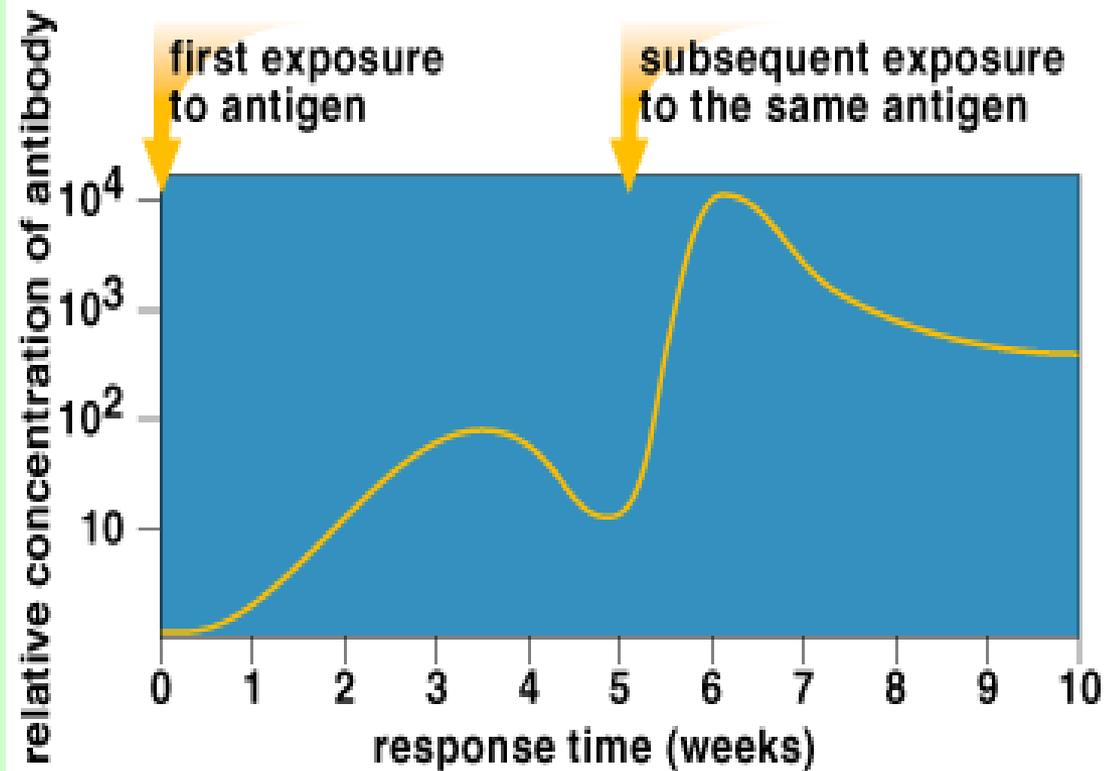


Fig. 40.10, p. 698

Immunological Memory

- ⌘ **First and secondary response to the same antigen**
- ⌘ **Memory cells**
 - ☒ **Activated on secondary exposure**



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Immunization

- ⌘ Vaccines are either taken orally or injected
- ⌘ They are usually weakened or killed pathogens
- ⌘ Some are harmless viruses that are similar to the pathogen

- Active**

- Vaccines**

- Passive**

- Antibody injection**



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Vaccination Schedule

RECOMMENDED VACCINES	RECOMMENDED AGES
Hepatitis B	Birth–2 months
Hepatitis B booster	1–4 months
Hepatitis B booster	6–18 months
Hepatitis B assessment	11–12 years
DTP (Diphtheria; Tetanus; and Pertussin, or whooping cough)	2, 4, and 6 months
DTP booster	15–18 months
DTP booster	4–6 years
DT	11–16 years
HiB (Hemophilus influenzae)	4 and 6 months
HiB booster	12–15 months
Polio	2 and 4 months
Polio booster	6–18 months
Polio booster	4–6 years
MMR (Measles, Mumps, Rubella)	12–15 months
MMR booster	4–6 years
MMR assessment	11–12 years
Varicella	12–18 months
Varicella assessment	11–12 years

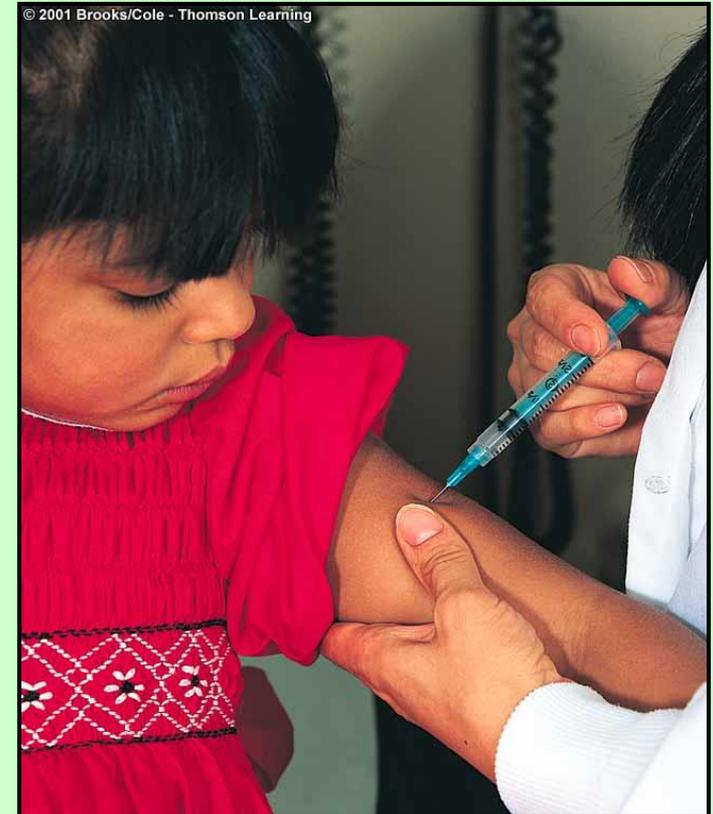
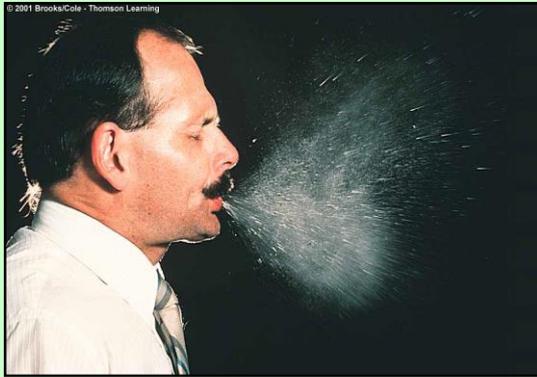


Fig. 40.16, p. 702

Allergies

⌘ Allergies



⊞ Allergens

⊗ Pollen, drugs, foods, dust mites, spores, insect bites

⊞ IgE and Mast cells

⊗ Histamine

⊗ Inflammatory response

⊗ mucous

AIDS

⌘ Human Immunodeficiency virus

⊞ Retrovirus

⌘ Symptoms

⊞ Flu-like

⊞ Weight loss, fever, fatigue,
night sweats

⊞ Enlarged lymph nodes

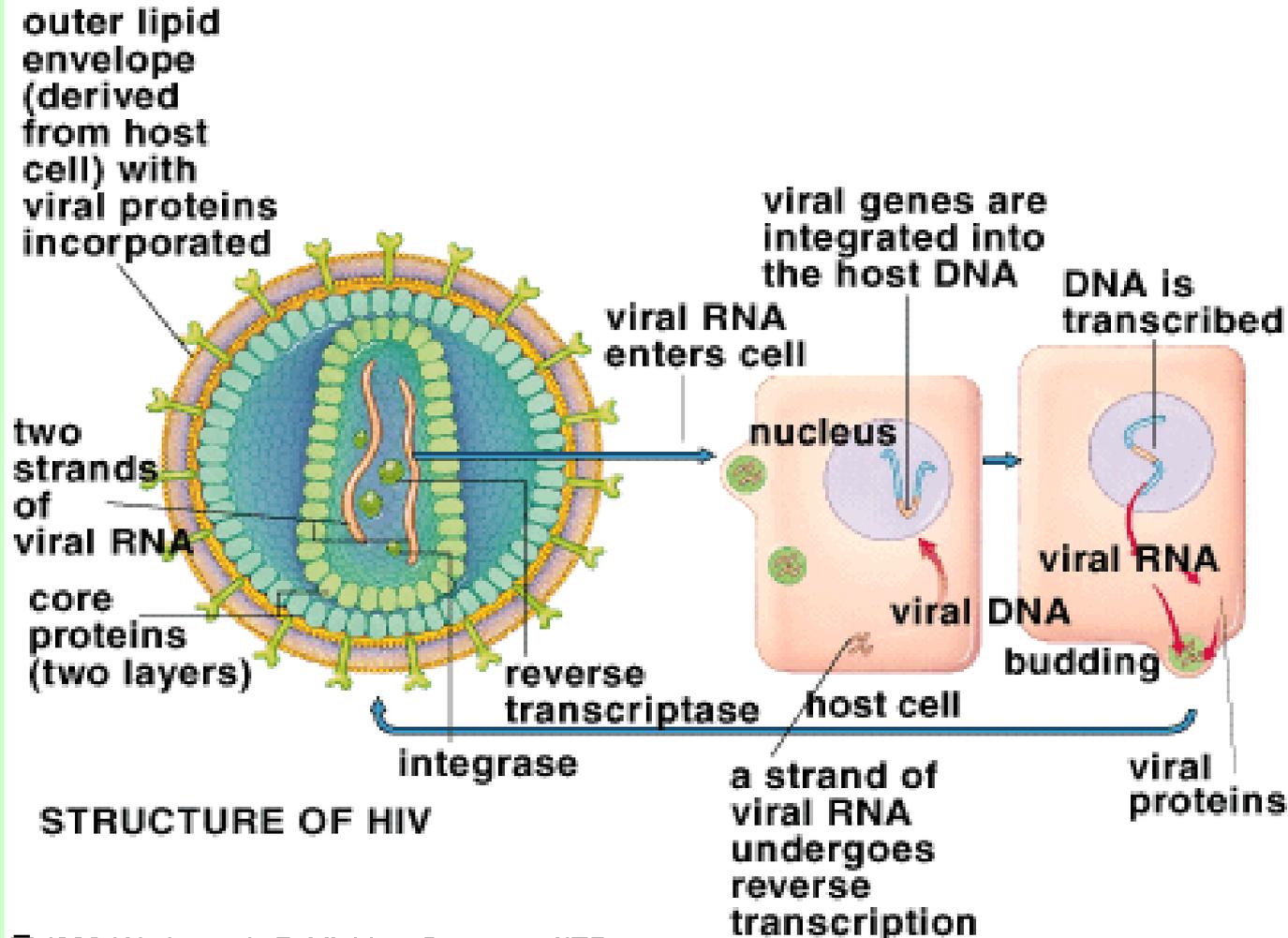
⊞ Opportunistic infections

⊞ *Pneumocystis carinii* pneumonia

⊞ Kaposi's sarcoma



Life Cycle of HIV



Study Guide Questions



- ⌘ Describe the organization & function of the lymphatic system (pages 770-771)
- ⌘ List describe the different types of lymphocytes (page 774)
- ⌘ What is the function of the spleen & thymus? (page 778)
- ⌘ What is the difference between nonspecific & specific defense?(pages 781 & 787)

In Conclusion



- ⌘ ***Physical and chemical barriers help fend off pathogens***
- ⌘ ***Non-specific defenses and specific immunity also help protect against infections***
- ⌘ ***Intact skin, secretions, and their flow are barriers to infection***
- ⌘ ***Inflammatory responses occur in response to infection***

In Conclusion



- ⌘ ***Immune responses show specific memory and occurs in response to foreign antigens***
- ⌘ ***Lymphocytes have receptors that bind to antigen-MHC complexes***
- ⌘ ***Binding starts the specific immune response***
- ⌘ ***Clones of B and T cells are produced which make effector and memory cells***

In Conclusion



- ⌘ *T cells are responsible for whole cell responses*
- ⌘ *B cells produce antibodies*
- ⌘ *In active immunization, vaccines provoke immune responses*
- ⌘ *Allergic reactions are immune responses resulting in inflammation*

Key Concepts:



- ⌘ **Humans have physical, chemical, and cellular defenses against pathogenic organisms, tumors and other agents**
- ⌘ **Certain white blood cells can execute a nonspecific attack**
- ⌘ **Some white blood cells are specific and make immune responses**

Key Concepts:



- ⌘ **A foreign protein (called an antigen) triggers an immune response**
- ⌘ **One type of immune response involves the production of antibodies**
- ⌘ **Another type of immune response involves whole cell responses**