Topics

- First – line defense
- Cells of the immune system
- Cell communication

First – line defense

Physical barriers
Antimicrobial substances
Normal flora

15-1

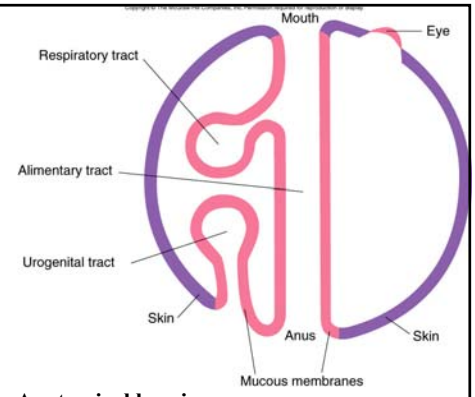

Figure 15.1 - Anatomical barriers

15-2

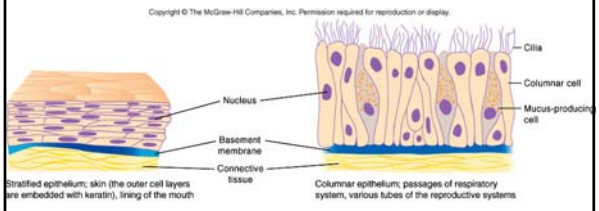

Figure 15.2 - Epithelial barriers

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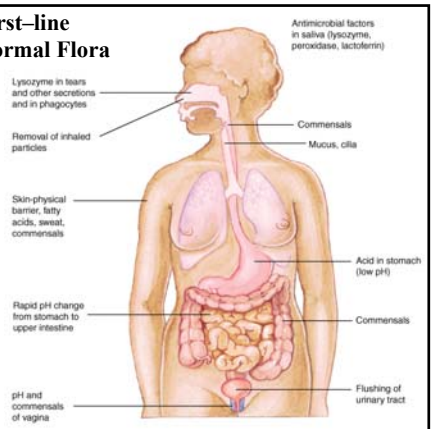
Figure 15.3 - First–line defenses and Normal Flora



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Cells of the immune system

- **Granulocytes**
- **Mononuclear phagocytes**
- **Lymphocytes**

15-5

Table 15.2 Human Leukocytes

Cell Type (% of Blood Leukocytes)	Morphology	Location in body	Functions
Granulocytes			
Neutrophils (polymorphonuclear neutrophilic leukocytes or PMNs, often called polys; 55%–65%)	Lobed nucleus; granules in cytoplasm; ameboid appearance	Account for most of the circulating leukocytes; few in tissues except during inflammation and in reserve locations	Phagocytize and digest engulfed materials
Eosinophils (2%–4%)	Large eosinophilic granules; non-segmented or bilobed nucleus	Few in tissues except in certain types of inflammation and allergies	Participate in inflammatory reaction and immunity to some parasites
Basophils (0%–1%), Mast cells	Lobed nucleus; large basophilic granules	Basophils in circulation; mast cells present in most tissues	Release histamine and other inflammation-causing chemicals from the granules
Mononuclear Phagocytes			
Monocytes (3%–8%),	Single nucleus; abundant cytoplasm	In circulation; they differentiate into either macrophages or dendritic cells when they migrate into tissue	Phagocytize and digest engulfed materials
Macrophages	Single nucleus, abundant cytoplasm	Present in virtually all tissues; given various names based on the tissue in which they are found	Phagocytize and digest engulfed materials
Dendritic cells	Branched	Initially in tissues, but they migrate to lymph nodes and other secondary lymphoid organs	Gather antigen from the tissues and then present it to the lymphocytes that congregate in the secondary lymphoid organs
Lymphocytes			
Several types (25%–35%)	Single nucleus; little cytoplasm before differentiation	In lymphoid organs (such as lymph nodes, spleen, thymus, appendix, tonsils); also in circulation	Participate in adaptive immune responses

Figure 15.5
Mononuclear phagocytes

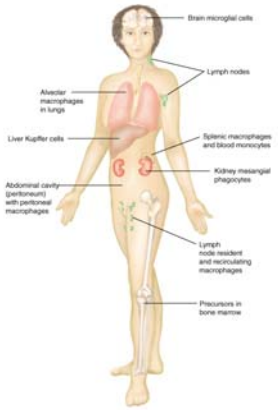

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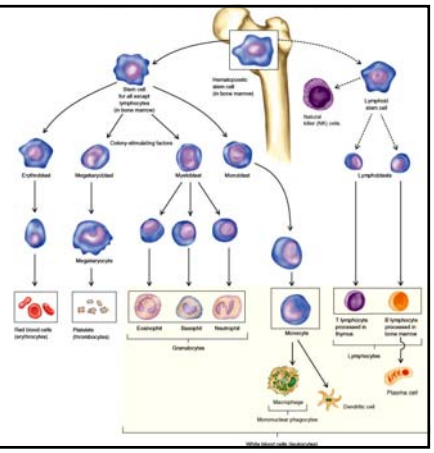
Figure 15.4
Development Of Blood and Lymphocytes



15-8

Cell communication

- **Surface receptors**
- **Cytokines**
- **Adhesion molecules**

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Surface receptors

- **Ligand**
- **Signal response - chemotaxis**
- **Specific**

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Table 15.3 Some Important Cytokines

Cytokine	Source	Effects
Chemokines	Various cells	Chemotaxis
Colony-Stimulating Factors (CSFs)	Fibroblasts, endothelium, other cells	Stimulation of growth and differentiation of different kinds of leukocytes
Interferons		
Interferon alpha	Leukocytes	Antiviral; induces fever; contributes to inflammation
Interferon beta	Fibroblasts	Antiviral
Interferon gamma	T lymphocytes	Antiviral; macrophage activation; development and regulation of adaptive immune responses
Interleukins (ILs)		
IL–1	Macrophages, epithelial cells	Proliferation of lymphocytes; macrophage production of cytokines, induce adhesion molecules for PMNs on blood vessel cells; induce fever
IL–2 (T-cell growth factor)	T lymphocytes	Changes in growth of lymphocytes; activation of natural killer cells; promote adaptive cell-mediated immune responses
IL–3	T lymphocytes, mast cells	Changes in growth of precursors of blood cells and also of mast cells
IL–4, IL–5, IL–10, IL–14	T lymphocytes, mast cells, other cells	Promote antibody responses
IL–6	T lymphocytes, macrophages	T- and B-cell growth; production of acute-phase proteins; fever
Tumor Necrosis Factors (TNFs)		
Alpha	Macrophages, T lymphocytes, other cell types, mast cell granules	Initiation of inflammatory response; cytotoxicity for some tumor cells; regulation of certain immune functions; induce fever; chemotactic for granulocytes
Beta	T lymphocytes	Killing of target cells by T cytotoxic cells and natural killer (NK) cells

15-11 **Table 15.3 - Cytokines**

Adhesion molecules

- **Allow cells to adhere to other cells**
- **Ex. Endothelial cells bind to phagocytic cells**
- **Slow down phagocytic cell movement**

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