The human body is home for trillions of microorganisms of >500 species.

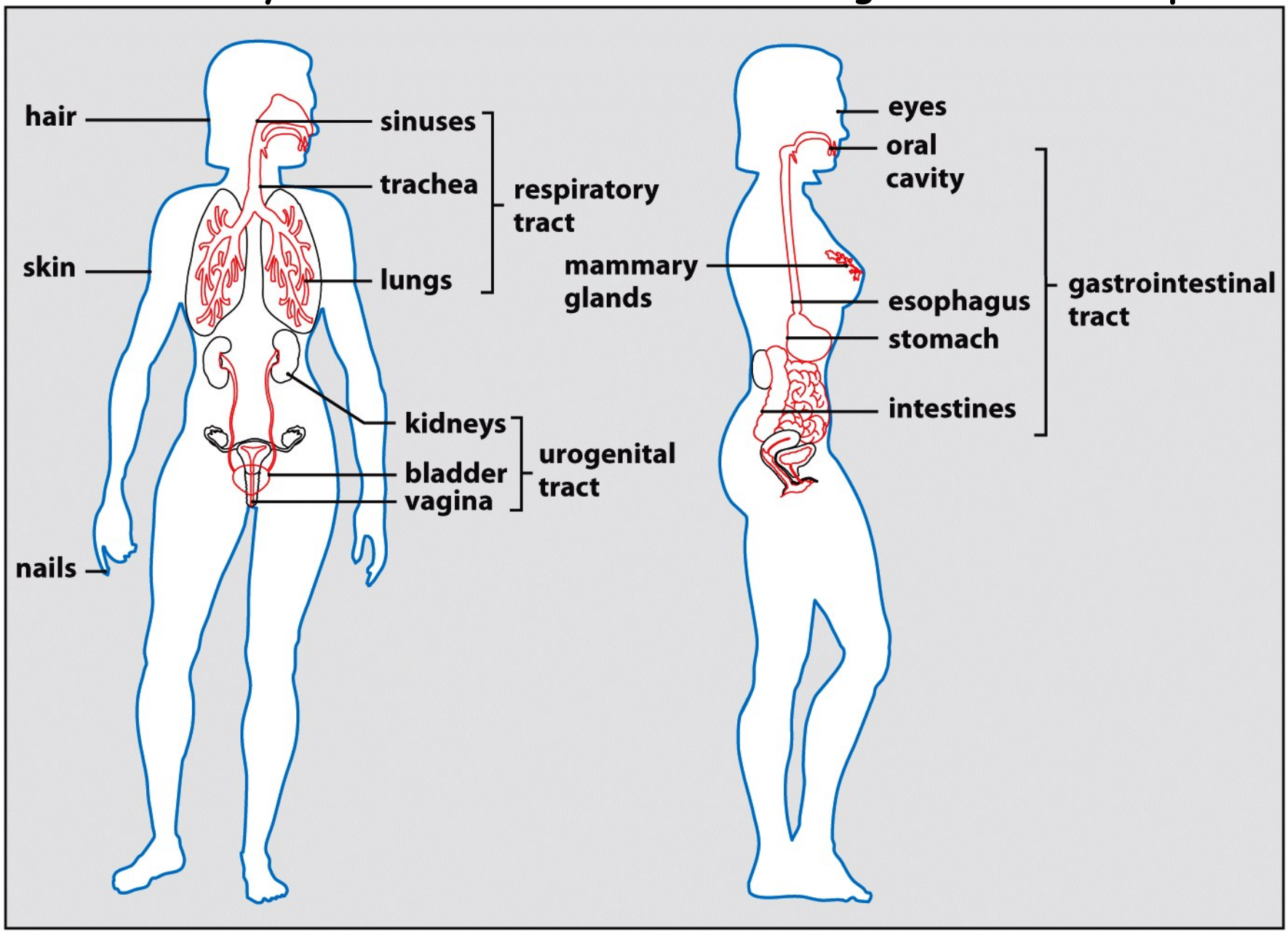

Figure 1.5 The Immune System, 3ed. (© Garland Science 2009)

Images of exceptional microbes that cause human disease

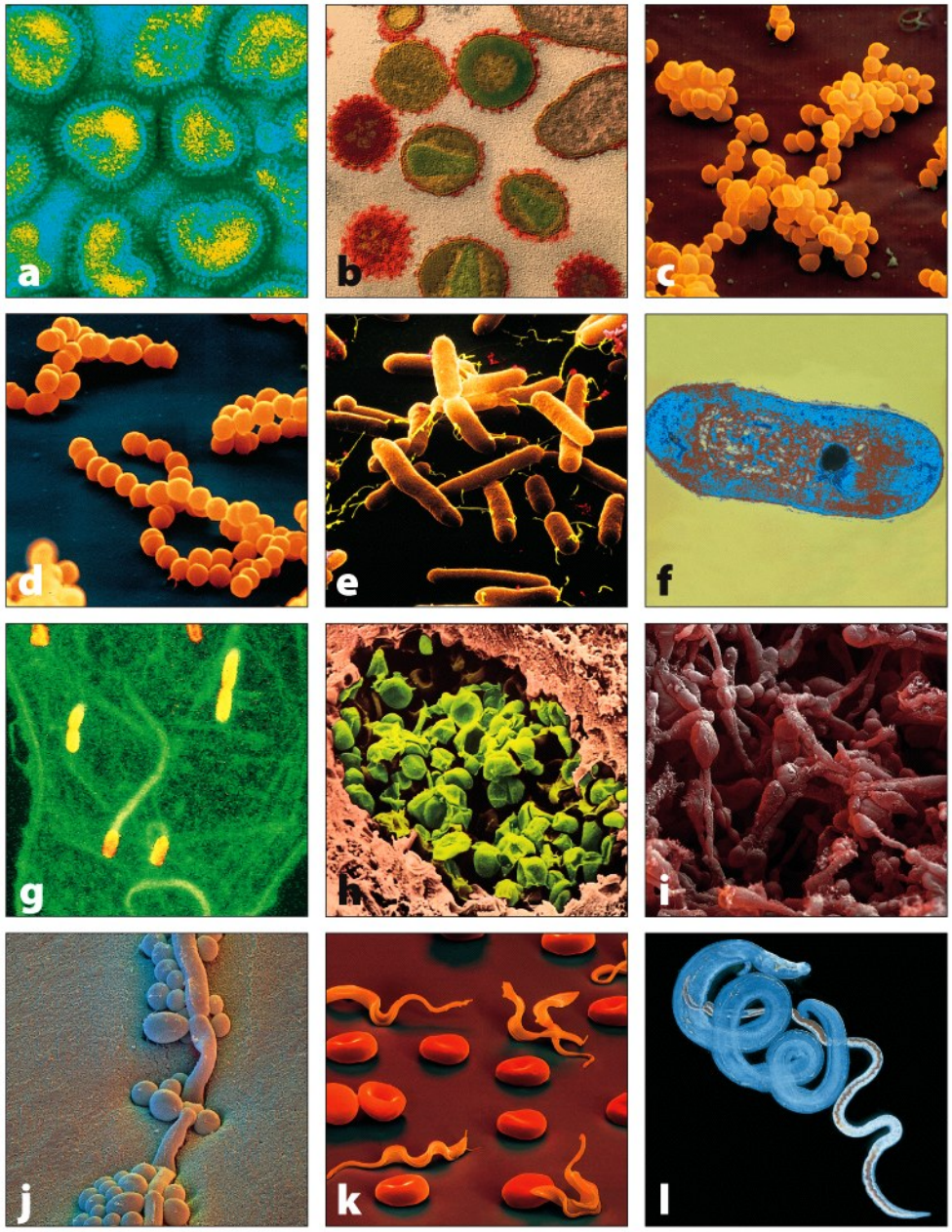

Figure 1.3 The Immune System, 3ed. (© Garland Science 2009)

Bacteria that cause human disease

Type	Disease	Pathogen	General classification*	Route of infection
Bacteria	Trachoma	*Chlamydia trachomatis*	Chlamydias	Oral/respiratory/ocular mucosa
	Bacillary dysentery	*Shigella flexneri*	Gram-negative bacilli	Oral
	Food poisoning	*Salmonella enteritidis, S. typhimurium*	Gram-negative bacilli	Oral
	Plague	*Yersinia pestis*	Gram-negative bacilli	Infected flea bite, respiratory
	Tularemia	*Pasteurella tularensis*	Gram-negative bacilli	Handling infected animals
	Typhoid fever	*Salmonella typhi*	Gram-negative bacilli	Oral
	Gonorrhea	*Neisseria gonorrhoeae*	Gram-negative cocci	Sexually transmitted
	Meningococcal meningitis	*Neisseria meningitidis*	Gram-negative cocci	Oral/respiratory
	Meningitis, pneumonia	*Haemophilus influenzae*	Gram-negative coccobacilli	Oral/respiratory
	Legionnaire's disease	*Legionella pneumophila*	Gram-negative coccobacilli	Inhalation of contaminated aerosol
	Whooping cough	*Bordetella pertussis*	Gram-negative coccobacilli	Oral/respiratory
	Cholera	*Vibrio cholerae*	Gram-negative vibrios	Oral
	Anthrax	*Bacillus anthracis*	Gram-positive bacilli	Oral/respiratory by contact with spores
	Diphtheria	*Corynebacterium diphtheriae*	Gram-positive bacilli	Oral/respiratory
	Tetanus	*Clostridium tetani*	Gram-positive bacilli (anaerobic)	Infected wound
	Boils, wound infections	*Staphylococcus aureus*	Gram-positive cocci	Wounds; oral/respiratory
	Pneumonia, scarlet fever	*Streptococcus pneumoniae*	Gram-positive cocci	Oral/respiratory
	Tonsillitis	*Streptococcus pyogenes*	Gram-positive cocci	Oral/respiratory
	Leprosy	*Mycobacterium leprae*	Mycobacteria	Infected respiratory droplets
	Tuberculosis	*Mycobacterium tuberculosis*	Mycobacteria	Oral/respiratory
	Respiratory disease	*Mycoplasma pneumoniae*	Mycoplasmas	Oral/respiratory
	Typhus	*Rickettsia prowazekii*	Rickettsias	Bite of infected tick
	Lyme disease	*Borrelia burgdorferi*	Spirochetes	Bite of infected deer tick
	Syphilis	*Treponema pallidum*	Spirochetes	Sexual transmission

Figure 1.4 part 2 of 3 The Immune System, 3ed. (© Garland Science 2009)

Viruses that cause human disease

Type	Disease	Pathogen	General classification*	Route of infection
Viruses	Severe acute respiratory syndrome	SARS virus	Coronaviruses	Oral/respiratory/ocular mucosa
	West Nile encephalitis	West Nile virus	Flaviviruses	Bite of an infected mosquito
	Yellow fever	Yellow fever virus	Flaviviruses	Bite of infected mosquito (*Aedes aegypti*)
	Hepatitis B	Hepatitis B virus	Hepadnaviruses	Sexual transmission; infected blood
	Chickenpox	Varicella-zoster	Herpes viruses	Oral/respiratory
	Mononucleosis	Epstein–Barr virus	Herpes viruses	Oral/respiratory
	Influenza	Influenza virus	Orthomyxoviruses	Oral/respiratory
	Measles	Measles virus	Paramyxoviruses	Oral/respiratory
	Mumps	Mumps virus	Paramyxoviruses	Oral/respiratory
	Poliomyelitis	Polio virus	Picornaviruses	Oral
	Jaundice	Hepatitis A virus	Picornaviruses	Oral
	Smallpox	Variola	Pox viruses	Oral/respiratory
	AIDS	Human immunodeficiency virus	Retroviruses	Sexual transmission, infected blood
	Rabies	Rabies virus	Rhabdoviruses	Bite of an infected animal
	Common cold	Rhinoviruses	Rhinoviruses	Nasal
	Diarrhea	Rotavirus	Rotaviruses	Oral
	Rubella	Rubella	Togaviruses	Oral/respiratory

Figure 1.4 part 1 of 3 The Immune System, 3ed. (© Garland Science 2009)

Fungi, protozoa and helminths that cause human disease

Type	Disease	Pathogen	General classification*	Route of infection
Fungi	Aspergillosis	*Aspergillus* species	Ascomycetes	Opportunistic pathogen, inhalation of spores
	Athlete's foot	*Tinea pedis*	Ascomycetes	Physical contact
	Candidiasis, thrush	*Candida albicans*	Ascomycetes (yeasts)	Opportunistic pathogen, resident flora
	Pneumonia	*Pneumocystis carinii*	Ascomycetes	Opportunistic pathogen, resident lung flora
Protozoan parasites	Leishmaniasis	*Leishmania major*	Protozoa	Bite of an infected sand fly
	Malaria	*Plasmodium falciparum*	Protozoa	Bite of an infected mosquito
	Toxoplasmosis	*Toxoplasma gondii*	Protozoa	Oral, from infected material
	Trypanosomiasis	*Trypanosoma brucei*	Protozoa	Bite of an infected tsetse fly
Helminth parasites (worms)	Common roundworm	*Ascaris lumbricoides*	Nematodes (roundworms)	Oral, from infected material
	Schistosomiasis	*Schistosoma mansoni*	Trematodes	Through skin by bathing in infected water

Figure 1.4 part 3 of 3 The Immune System, 3ed. (© Garland Science 2009)

The skin is a major line of defence

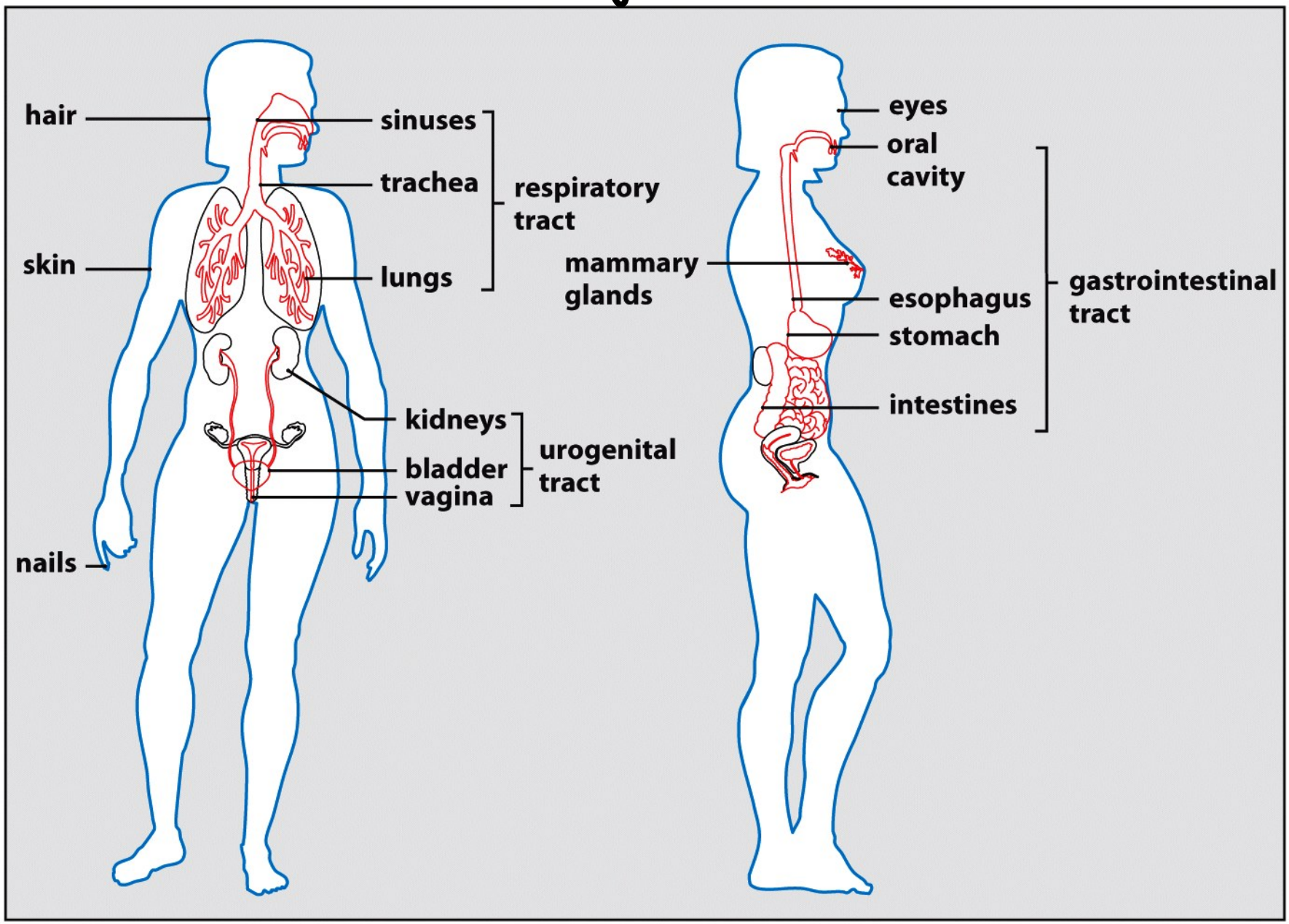

Figure 1.5 The Immune System, 3ed. (© Garland Science 2009)

Vulnerable areas are the sites of communication

Mechanical, chemical and microbiological lines of defence

	Skin	Gastrointestinal tract	Respiratory tract	Urogenital tract	Eyes
Mechanical	Epithelial cells joined by tight junctions				
	Flow of fluid, perspiration, sloughing off of skin	Flow of fluid, mucus, food, and saliva	Flow of fluid and mucus, e.g., by cilia Air flow	Flow of fluid, urine, mucus, sperm	Flow of fluid, tears
Chemical	Sebum (fatty acids, lactic acid, lysozyme)	Acidity, enzymes (proteases)	Lysozyme in nasal secretions	Acidity in vaginal secretions Spermine and zinc in semen	Lysozyme in tears
	Antimicrobial peptides (defensins)				
Microbiological	Normal flora of the skin	Normal flora of the gastrointestinal tract	Normal flora of the respiratory tract	Normal flora of the urogenital tract	Normal flora of the eyes

Figure 1.6 The Immune System, 3ed. (© Garland Science 2009)

The cells of the immune system

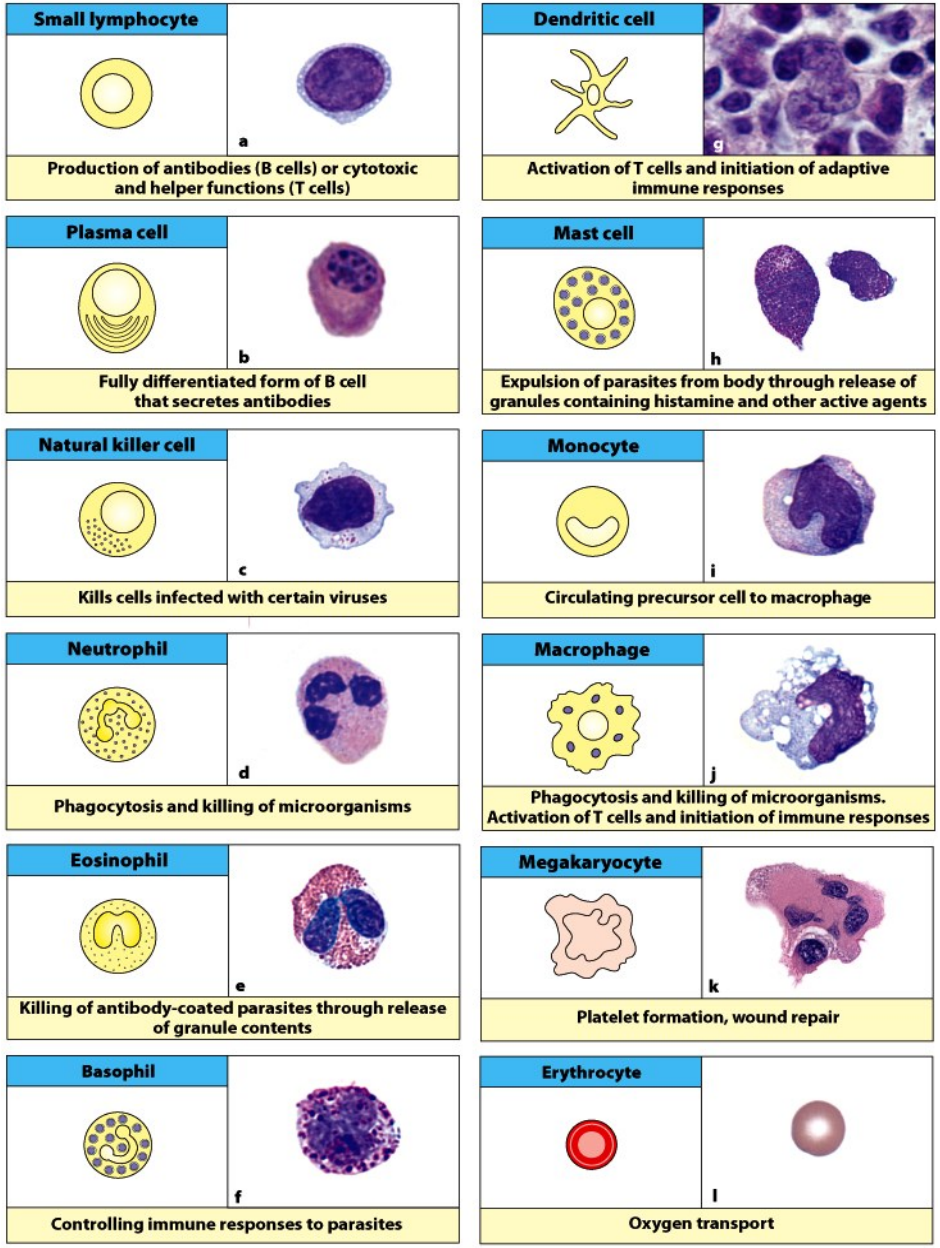

Figure 1.12 The Immune System, 3ed. (© Garland Science 2009)

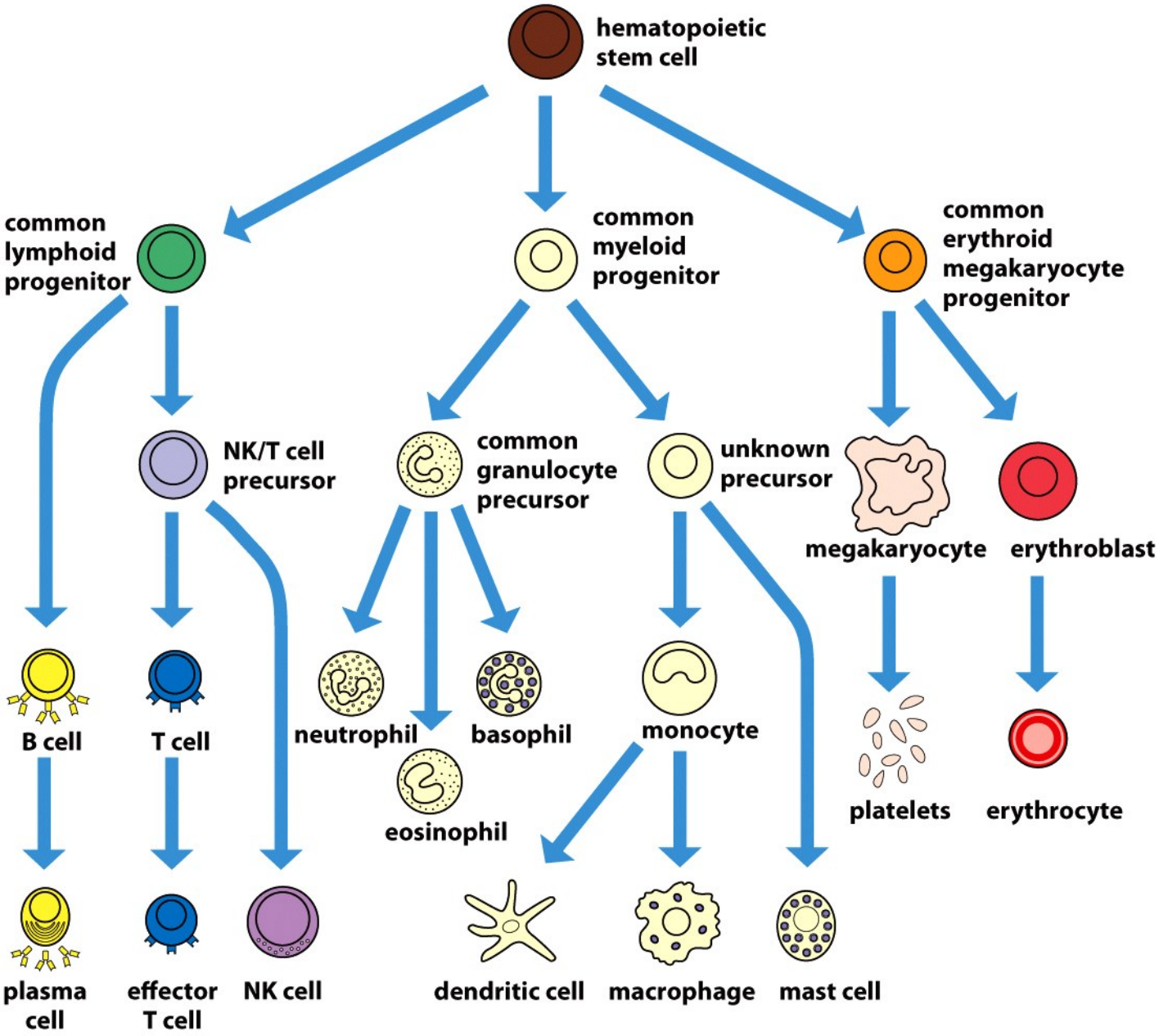

Figure 1.14 The Immune System, 3ed. (© Garland Science 2009)

The white cells of human blood

Cell type	Proportion of leukocytes (%)
Neutrophil	40–75
Eosinophil	1–6
Basophil	<1
Monocyte	2–10
Lymphocyte	20–50

Figure 1.15 The Immune System, 3ed. (© Garland Science 2009)

The immune system touches every cell in the human body

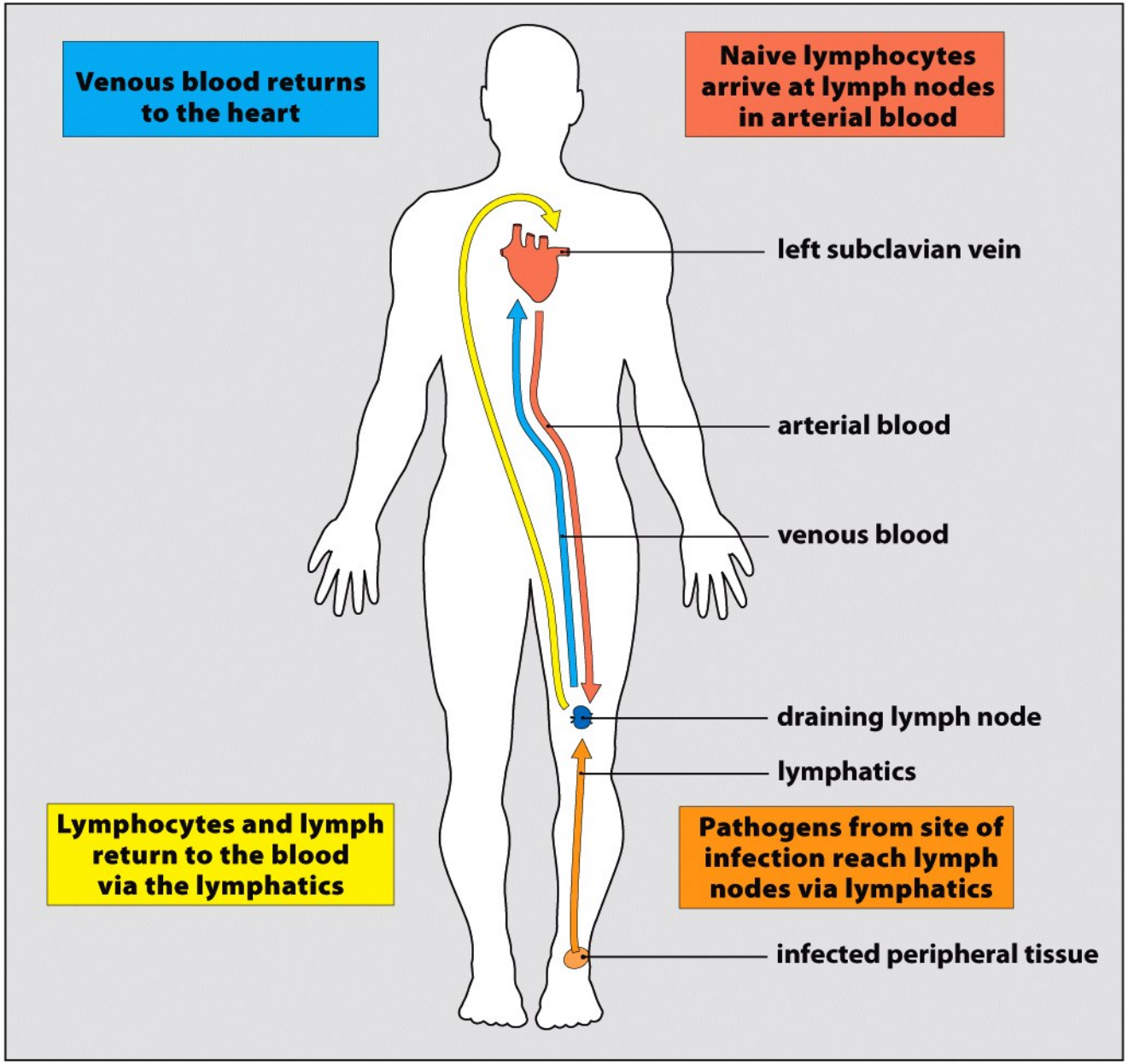

Figure 1.20 The Immune System, 3ed. (© Garland Science 2009)

Covalent Tagging of Invading Pathogens with Complement

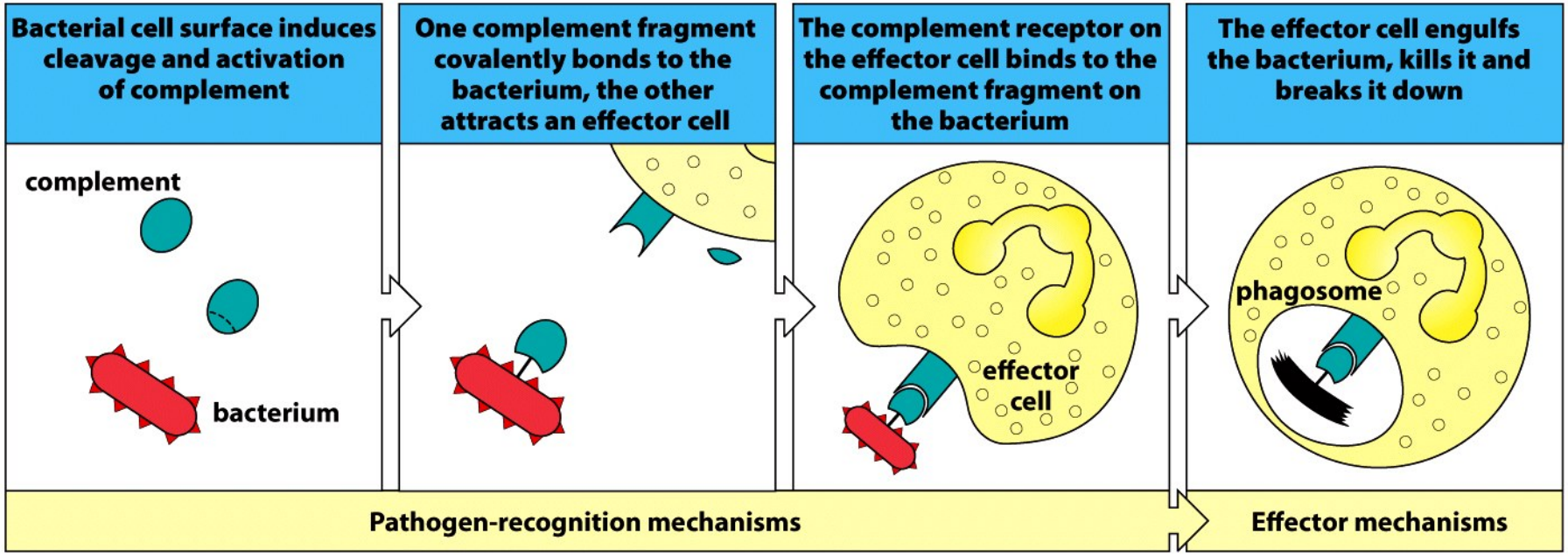

Figure 1.7 The Immune System, 3ed. (© Garland Science 2009)

Macrophages have a variety of receptors that bind pathogens and induce their endocytosis and destruction

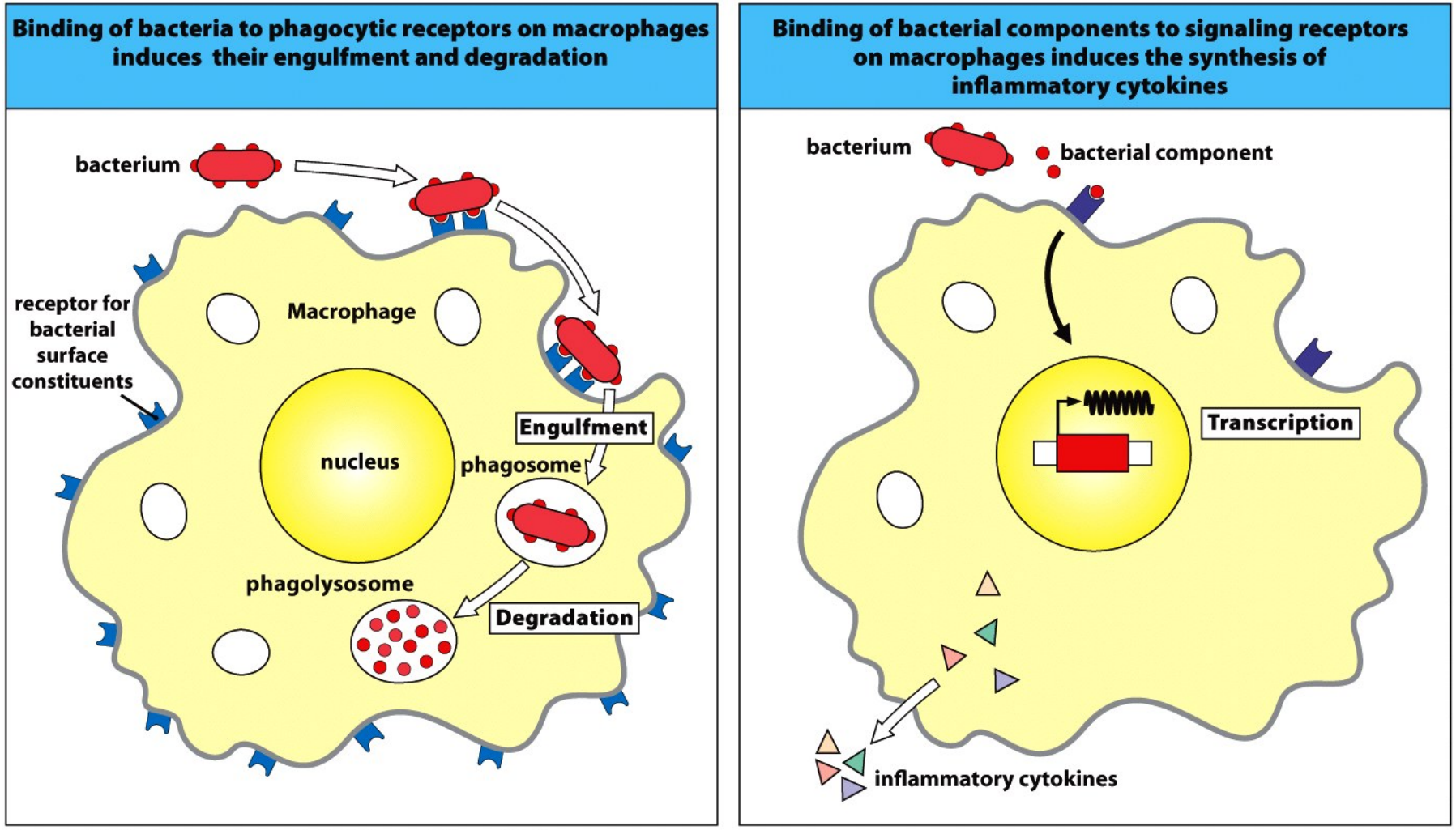

Figure 1.17 The Immune System, 3ed. (© Garland Science 2009)

Pathogen invasion sets off the alarm of inflammation

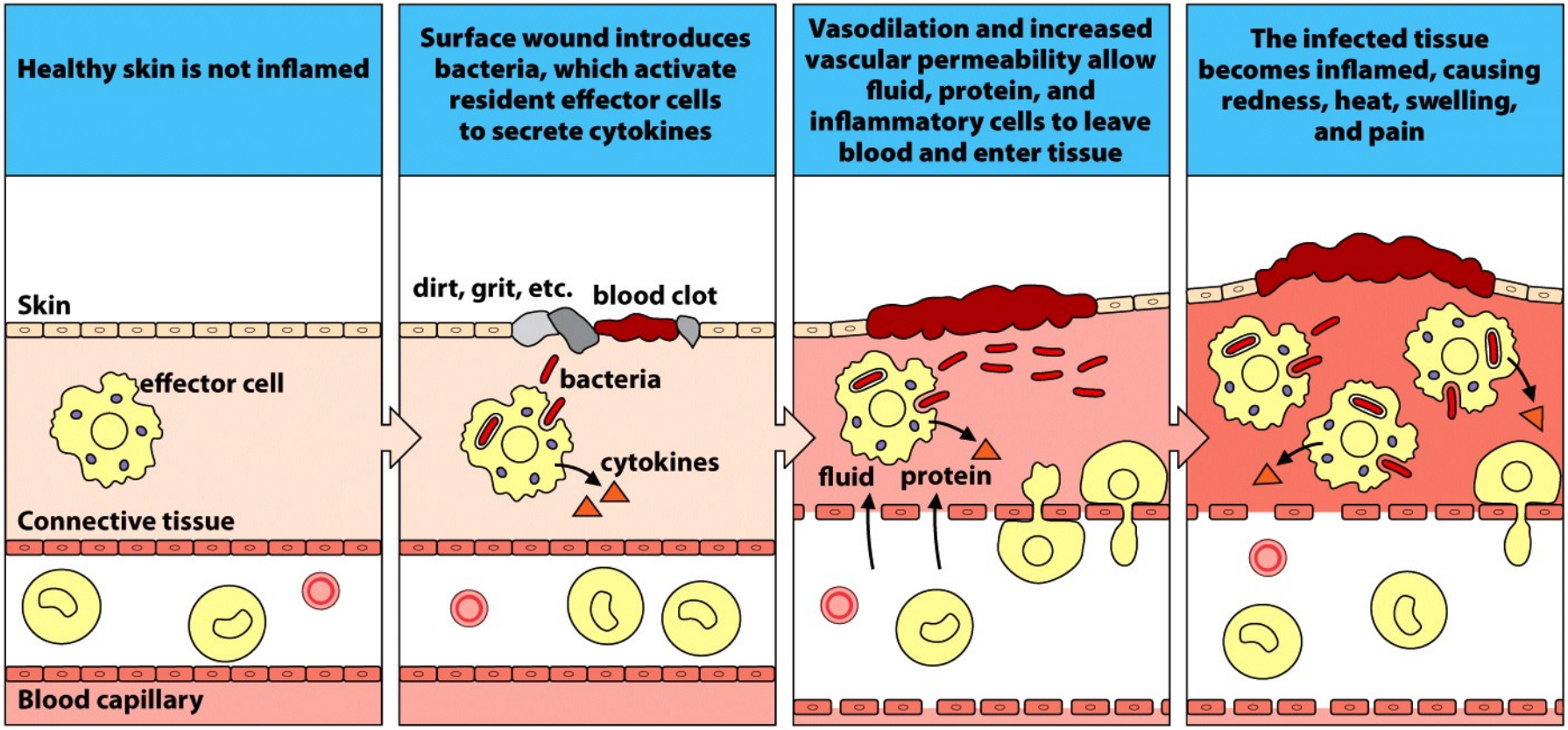

Figure 1.8 The Immune System, 3ed. (© Garland Science 2009)

Pathogens and their products are carried in the lymph to lymphoid tissue by dendritic cells

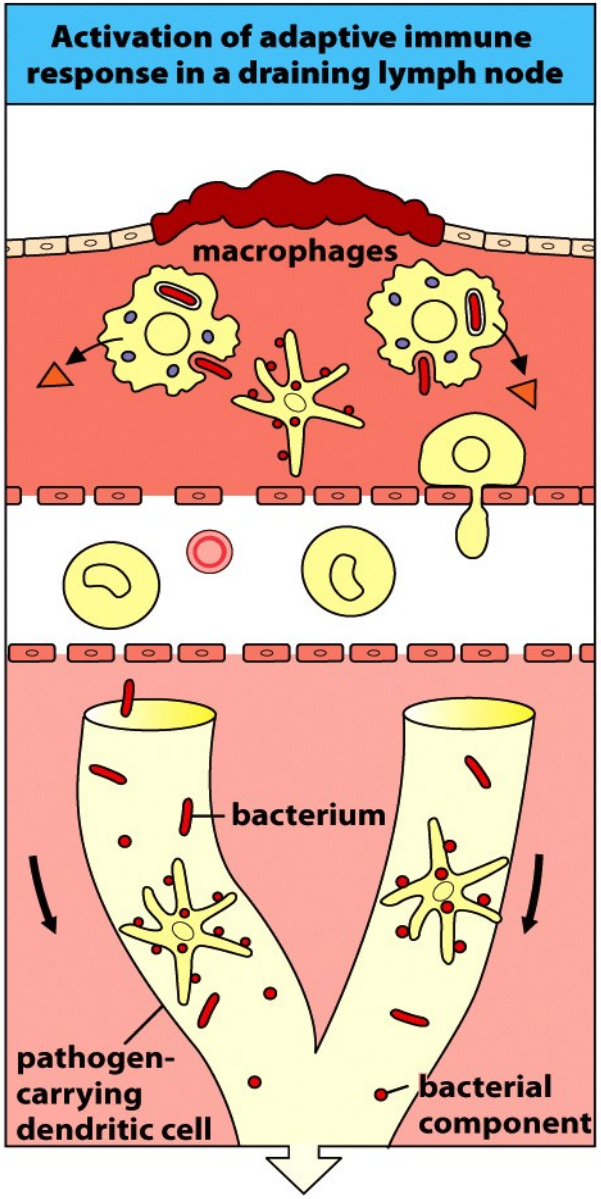

Figure 1.22 part 1 of 2 The Immune System, 3ed. (© Garland Science 2009)

The lymphoid tissues of the human body

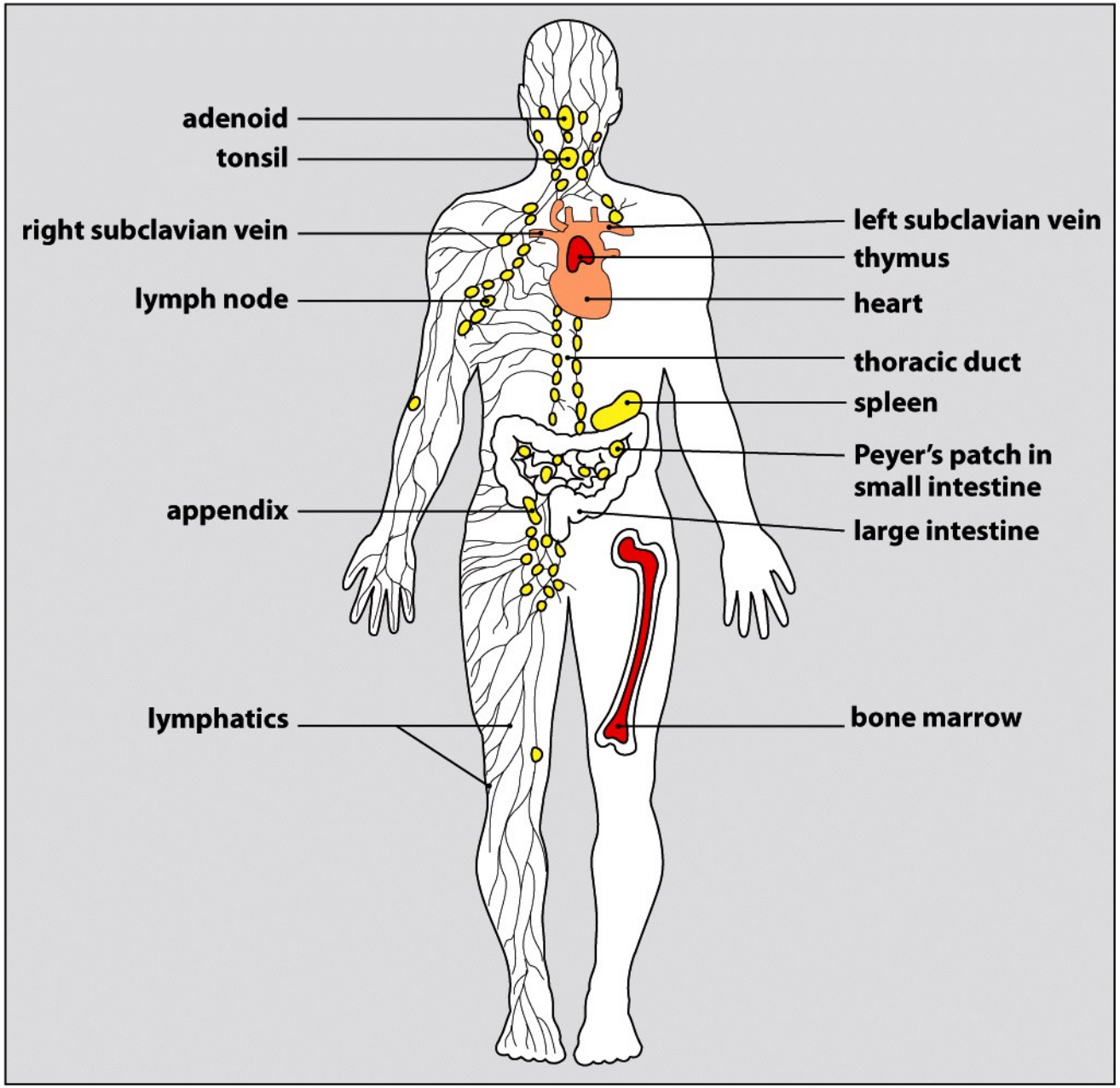

Figure 1.18 The Immune System, 3ed. (© Garland Science 2009)

Lymph nodes are sites where antigens from pathogens meet circulating B and T cells to make adaptive immunity

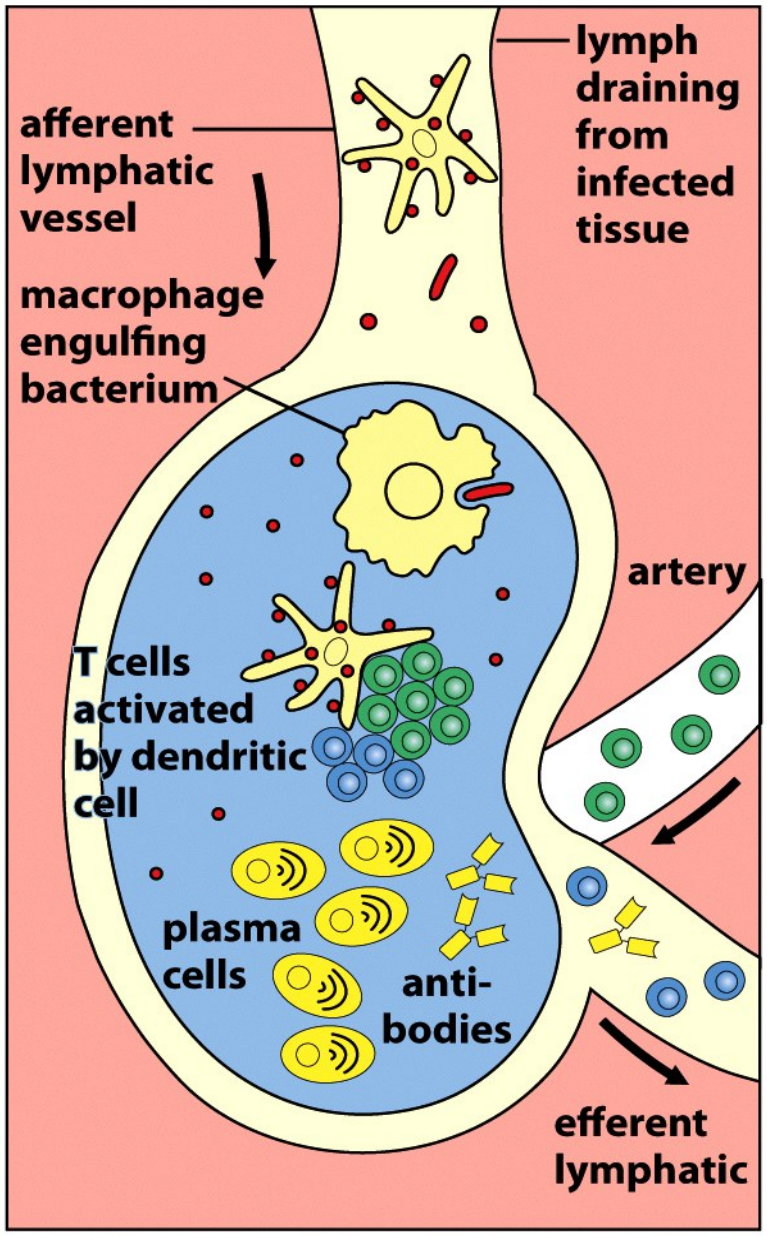

Figure 1.22 part 2 of 2 The Immune System, 3ed. (© Garland Science 2009)

Clonal selection of the antigen receptors of B and T cells

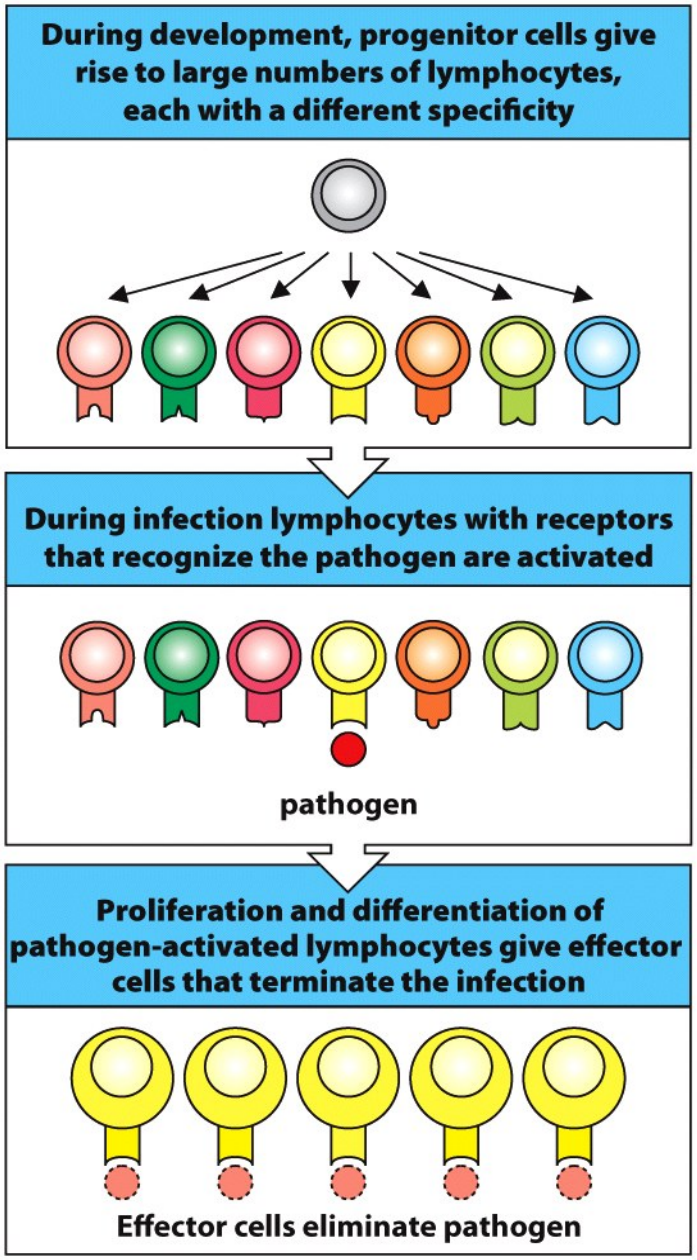

Figure 1.10 The Immune System, 3ed. (© Garland Science 2009)

Development of the adaptive immune response

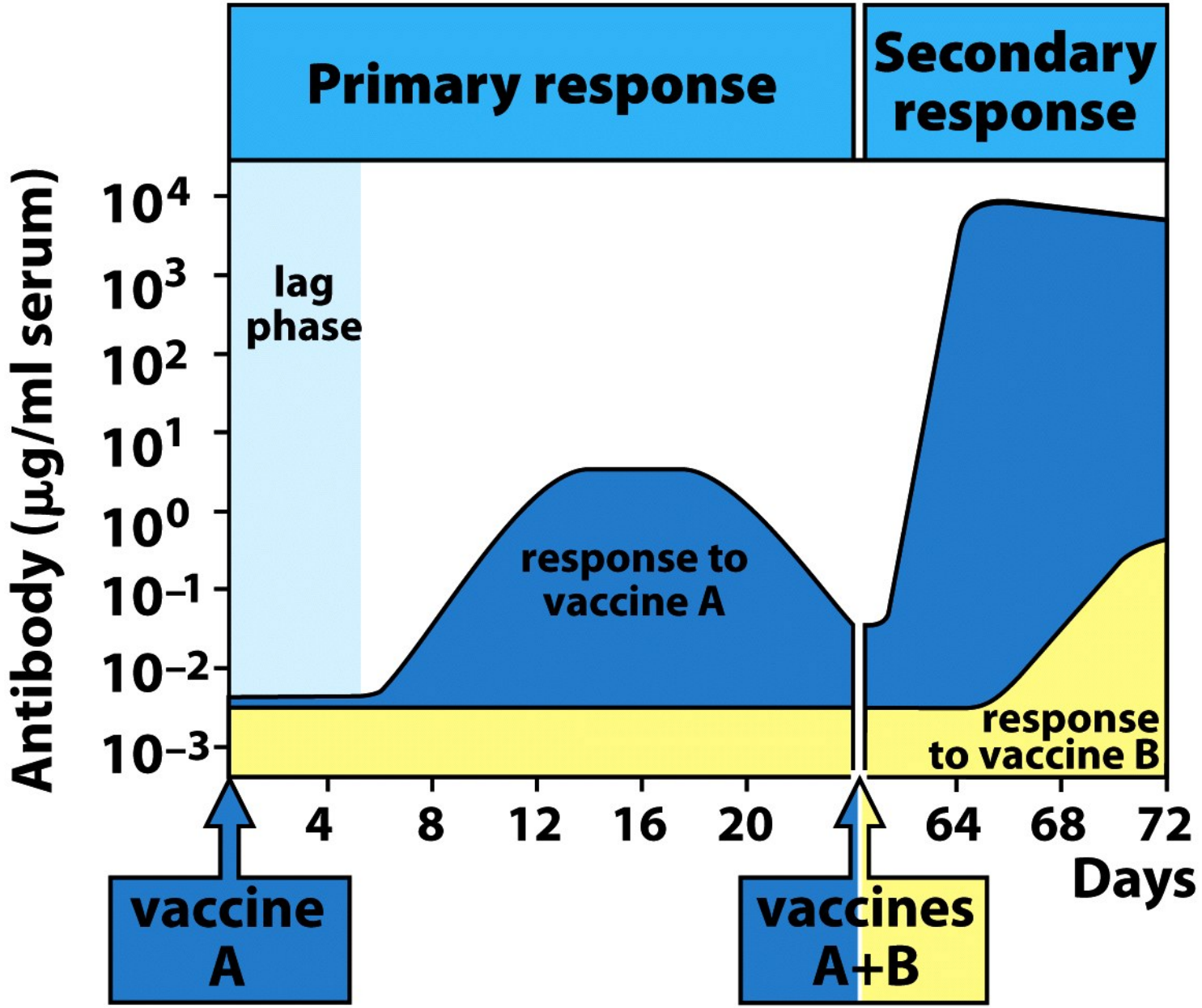

Figure 1.26 The Immune System, 3ed. (© Garland Science 2009)

Vaccination has rid the world of old scourges

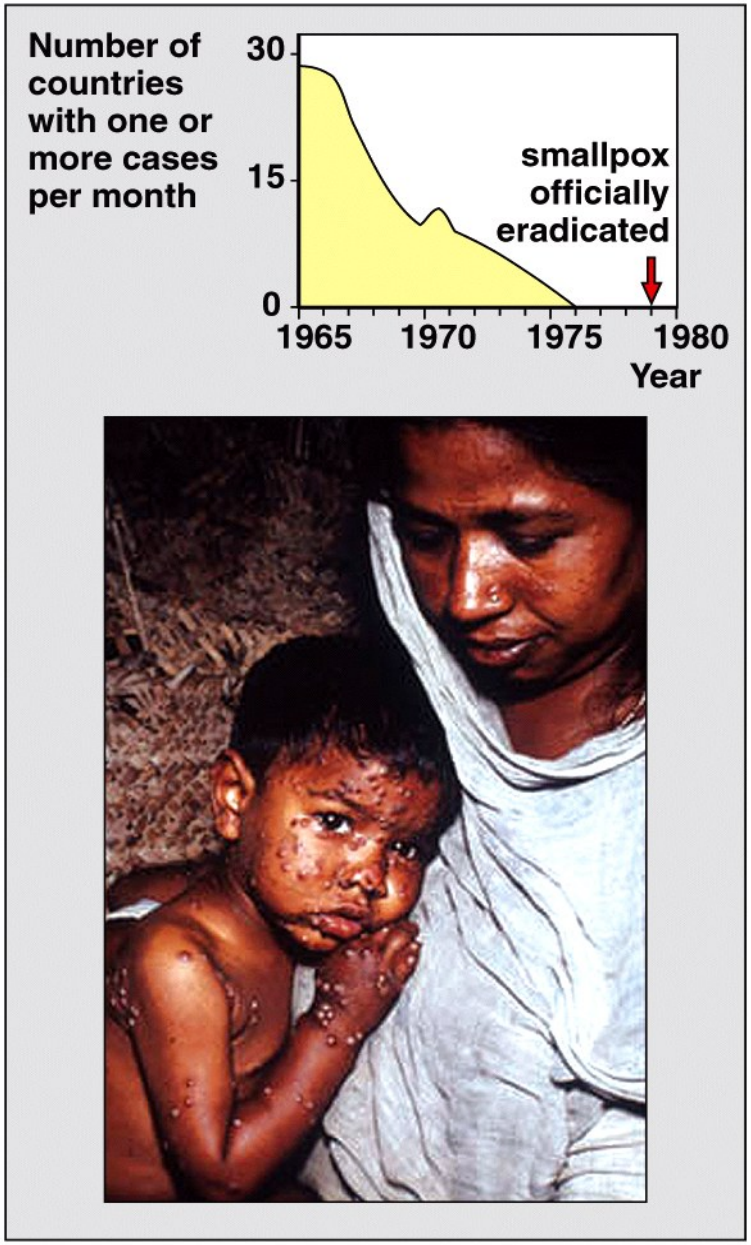

Figure 1.1 The Immune System, 3ed. (© Garland Science 2009)

Just as smallpox was eradicated a new scourge emerged that destroys the immune system and lets the microbes do the rest: HIV/AIDS

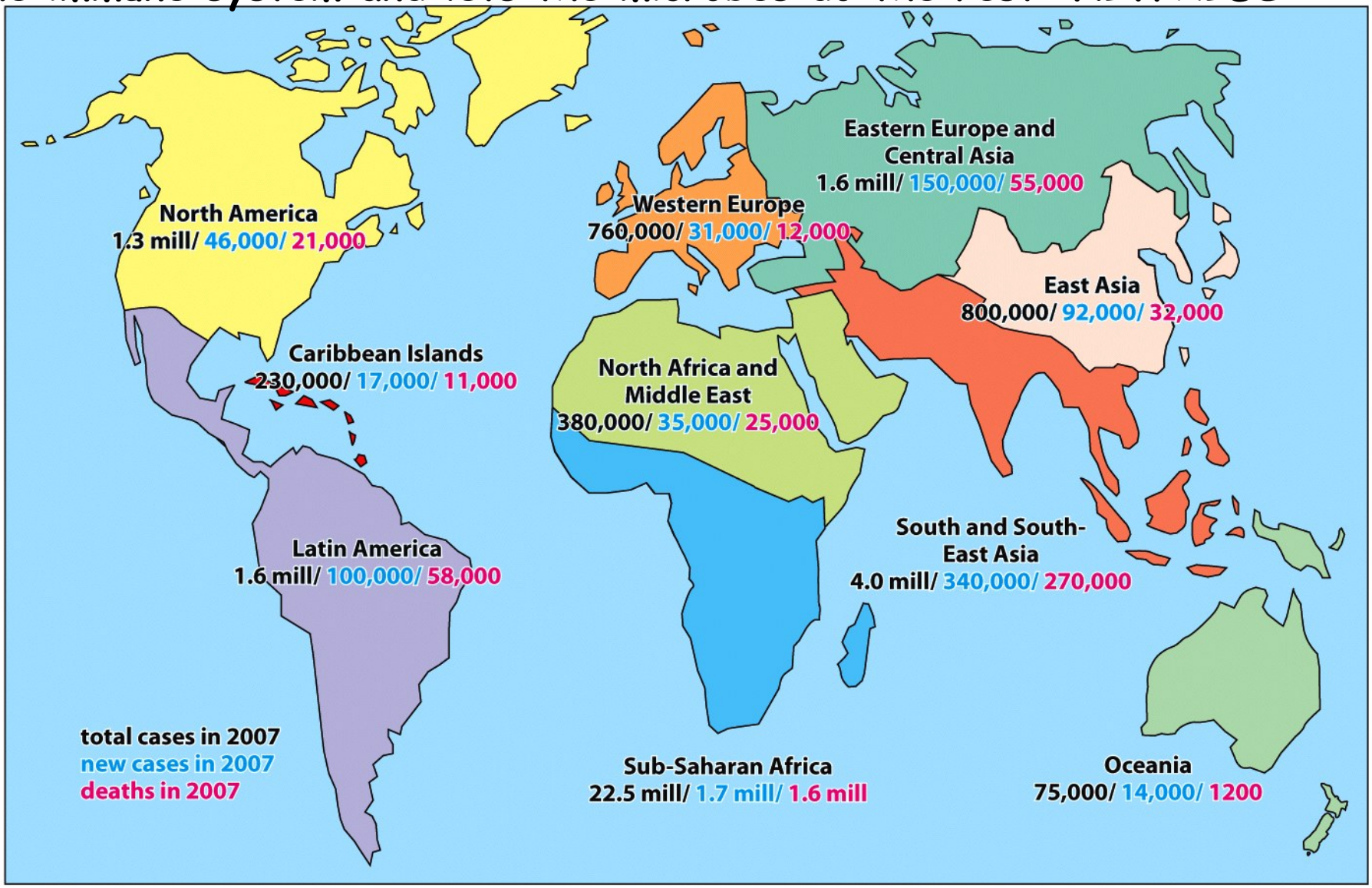

Figure 1.28 The Immune System, 3ed. (© Garland Science 2009)