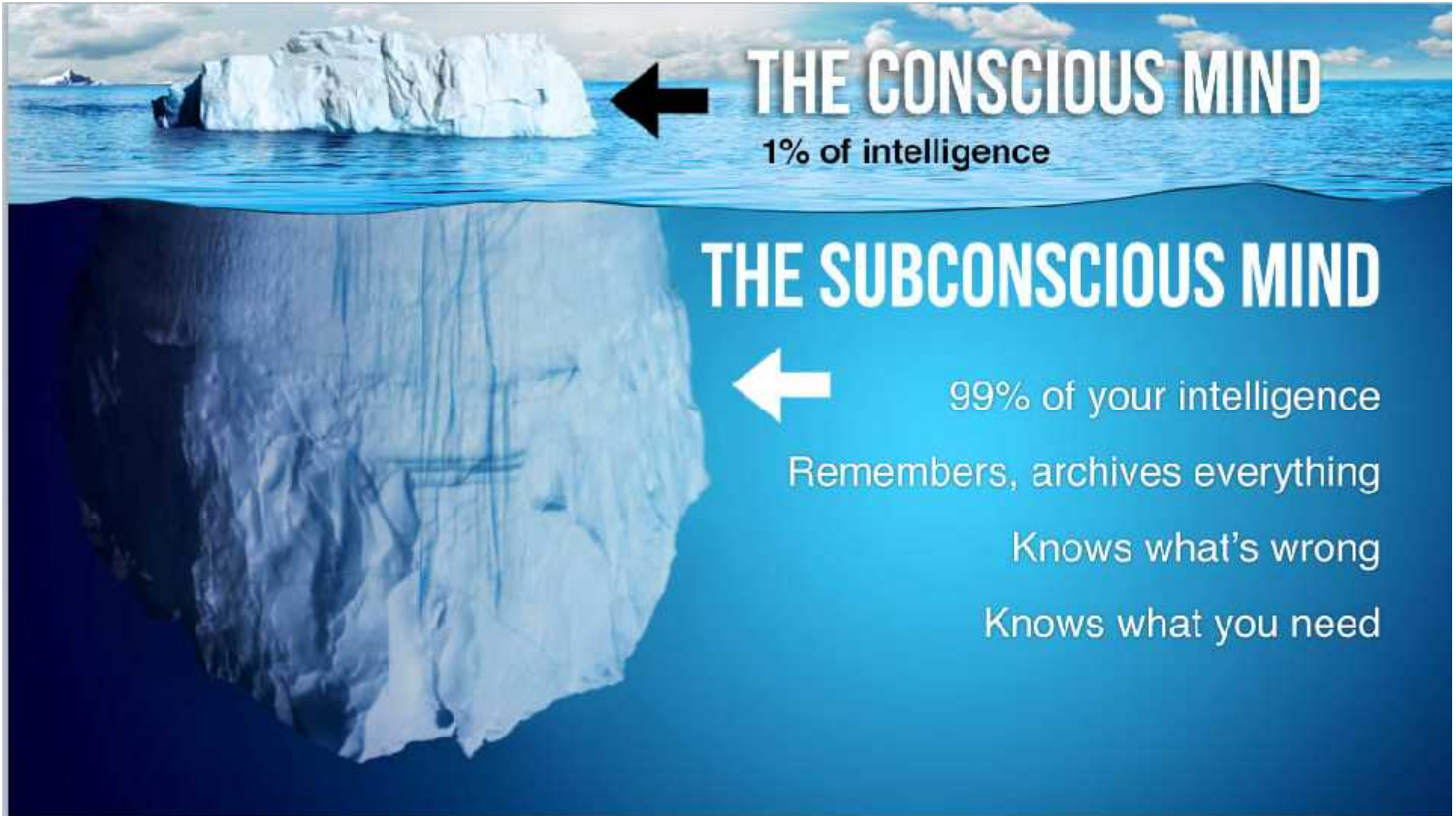


The Outcomes of Infection and Disease

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THE CONSCIOUS MIND

1% of intelligence



THE SUBCONSCIOUS MIND

99% of your intelligence

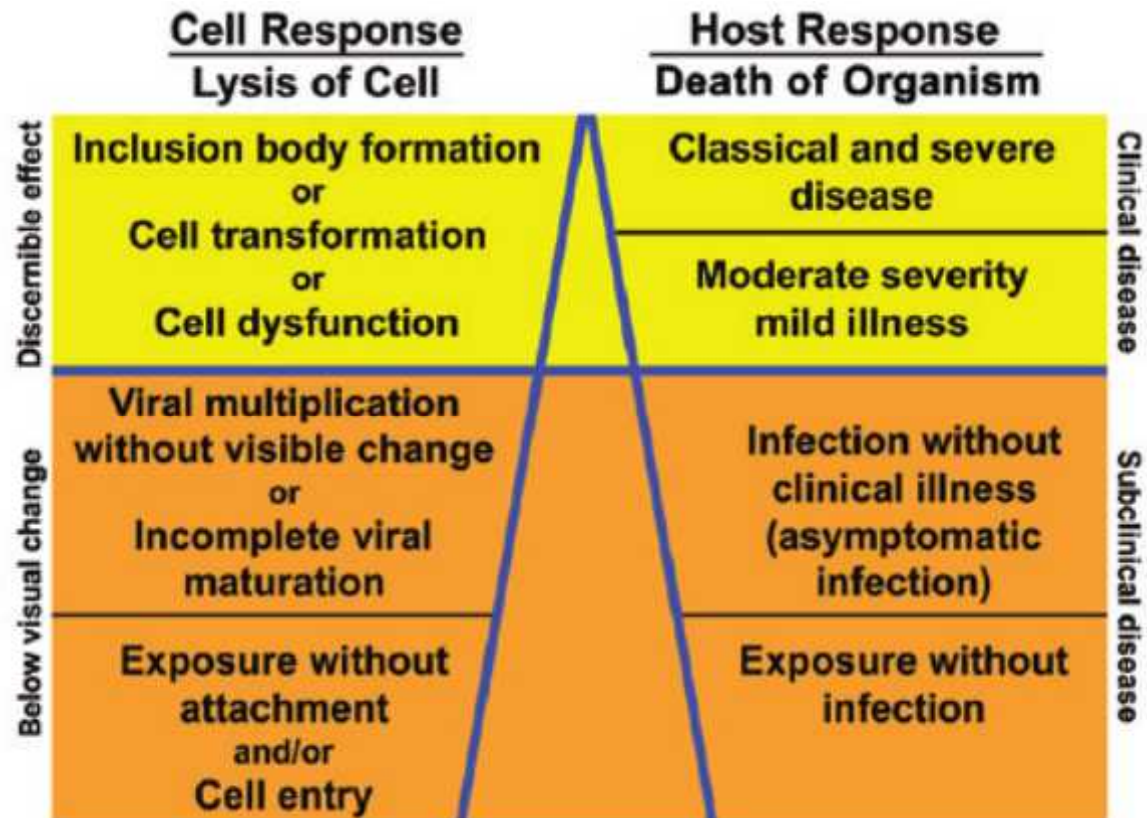
Remembers, archives everything

Knows what's wrong

Knows what you need

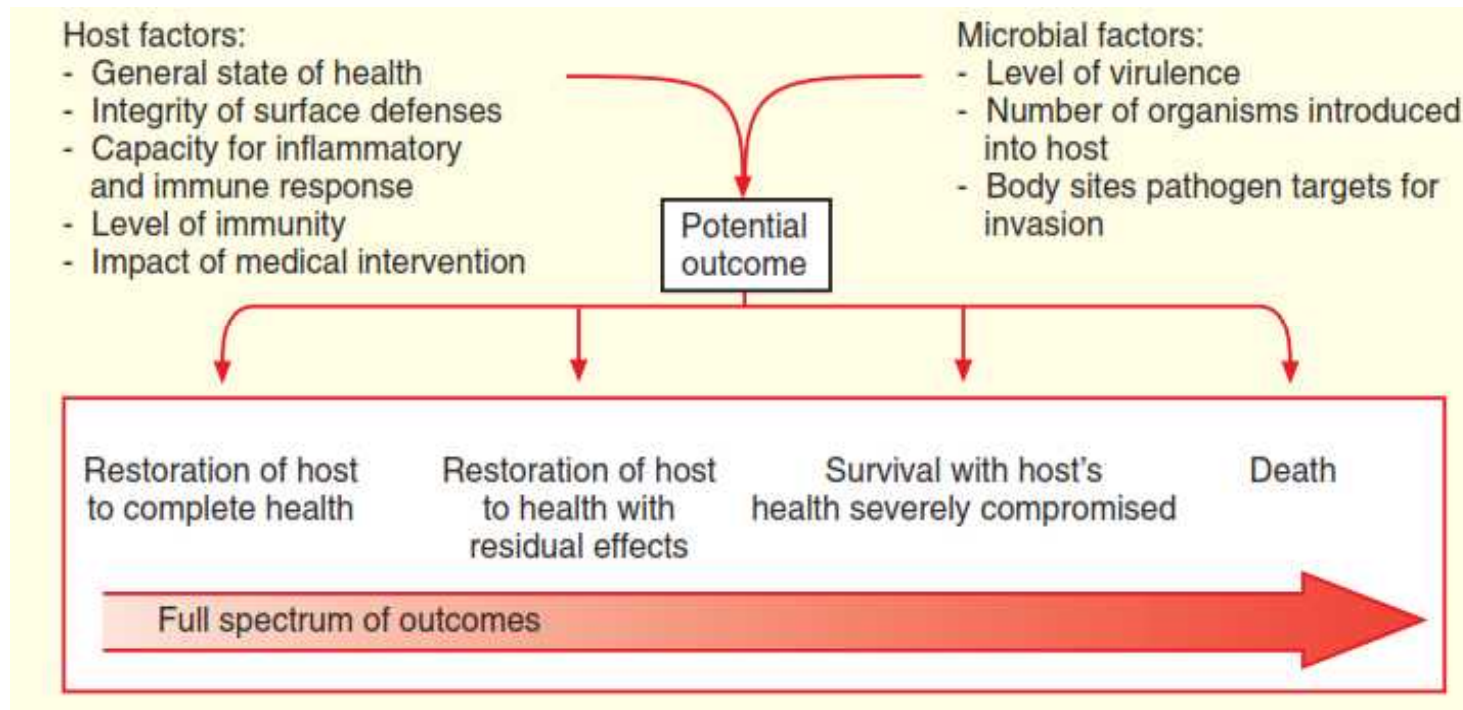


The “Iceberg” Concept of Infectious Diseases at the Level of the Cell and of the Host

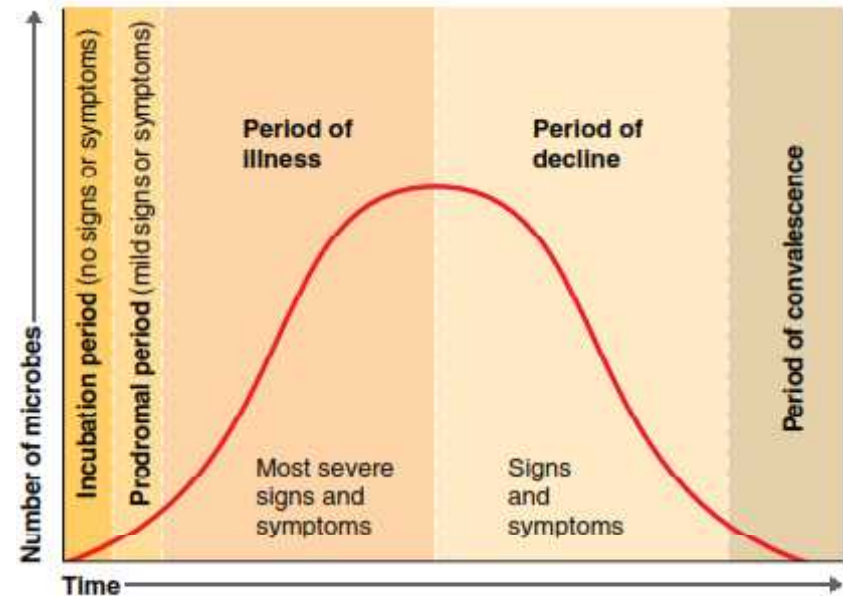




Possible Outcomes of Infections & Infectious Diseases



Stages of Infection or Disease



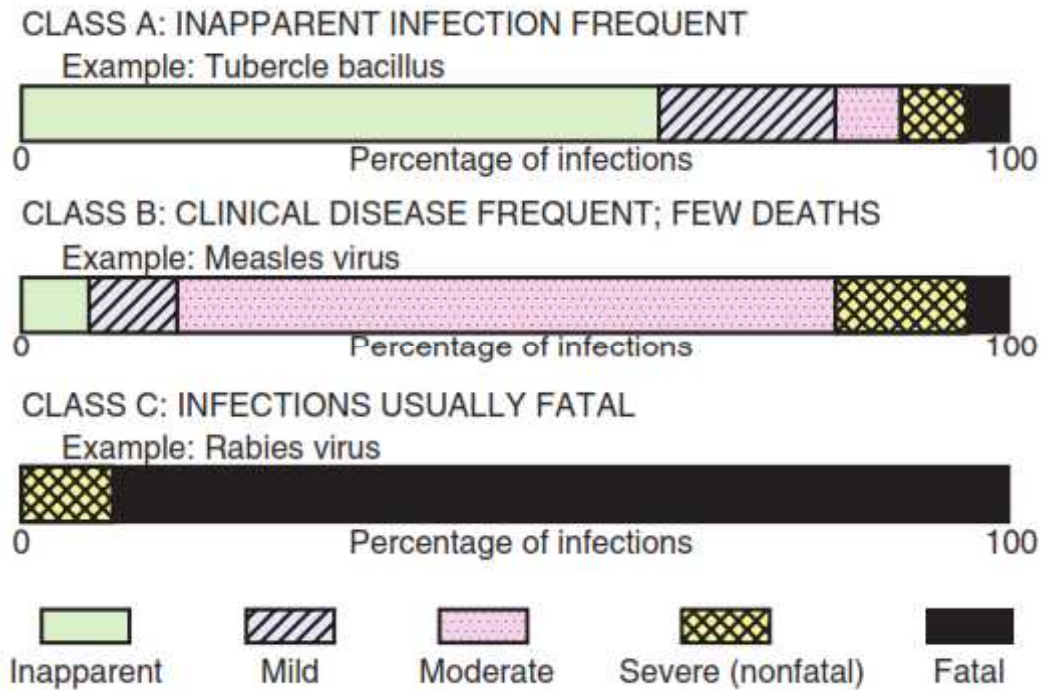
Corresponding infection-disease stages

Incubation stage	Prodromal stage	Clinical stage	Stage of decline	Convalescent stage
No signs or symptoms	First signs and symptoms, pathogen may be highly communicable	Peak of characteristic signs and symptoms of infection or disease	Condition of host deteriorates possibly to death or signs and symptoms begin to subside as host condition improves	Full recovery of surviving host or chronic infection develops, or death

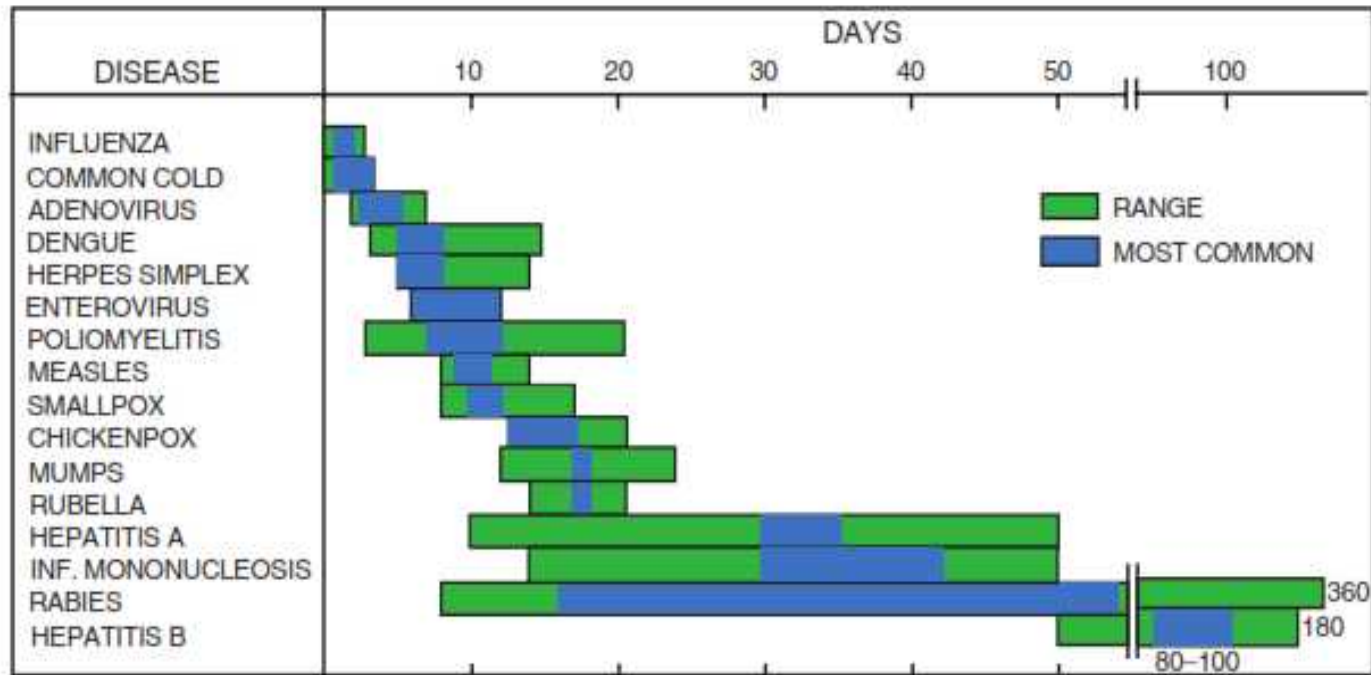
Nonclinical (Inapparent) Disease

- ✓ **Preclinical disease:** Disease that is not yet clinically apparent but is destined to progress to clinical disease.
- ✓ **Subclinical disease:** Disease that is not clinically apparent and is not destined to become clinically apparent. This type of disease is often diagnosed by serologic (antibody) response or culture of the organism.
- ✓ **Persistent (chronic) disease:** A person fails to “shake off” the infection, and it persists for years, at times for life. In recent years, an interesting phenomenon has been the manifestation of symptoms many years after an infection was thought to have been resolved. Some adults who recovered from poliomyelitis in childhood report severe chronic fatigue and weakness; this has been called postpolio syndrome in adult life. These have thus become cases of clinical disease, albeit somewhat different from the initial illness.
- ✓ **Latent disease:** An infection with no active multiplication of the agent, as when viral nucleic acid is incorporated into the nucleus of a cell as a provirus. In contrast to persistent infection, only the genetic message is present in the host, not the viable organism.

Distribution of Clinical Severity for Three Classes of Infections

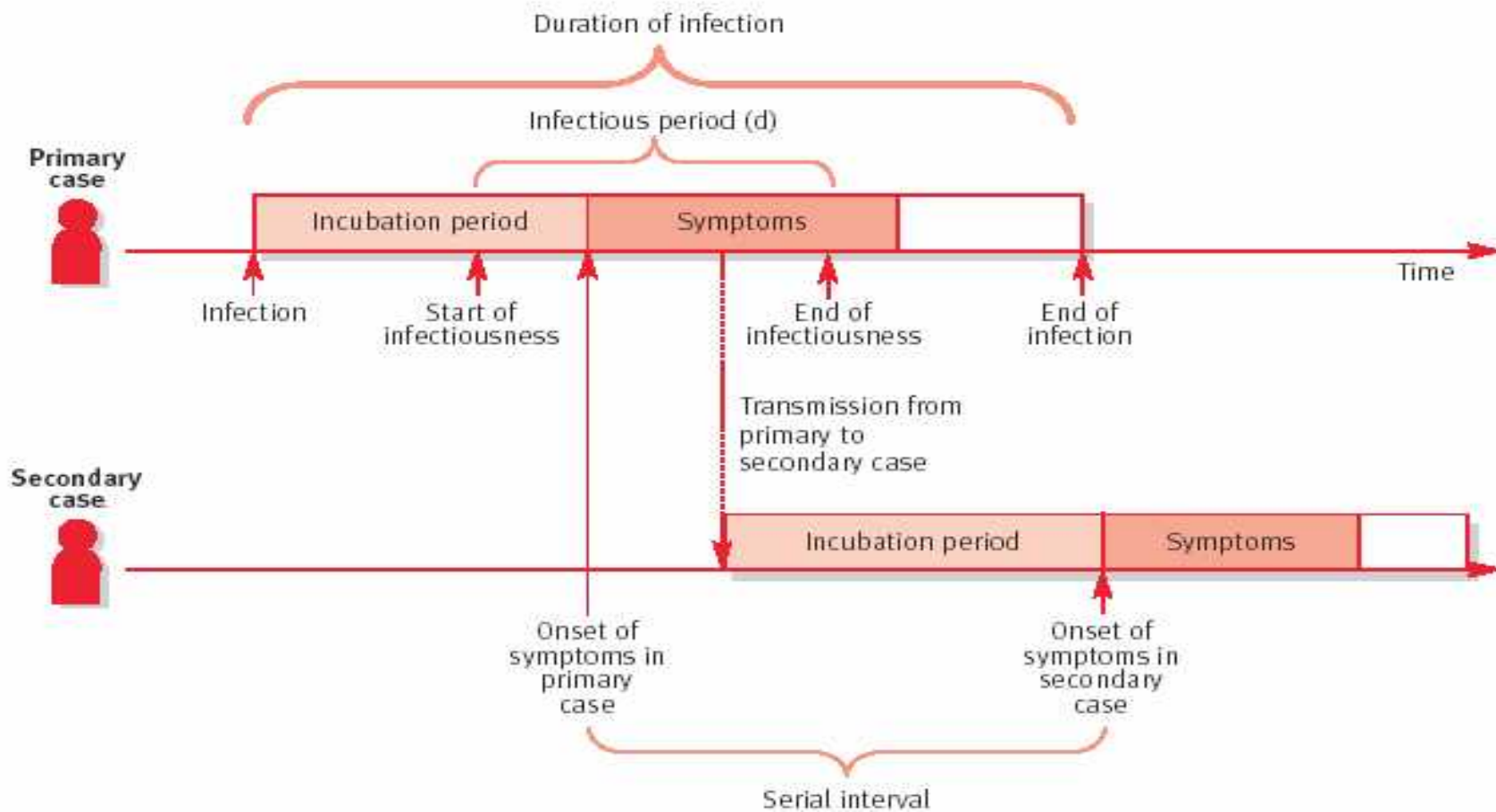


Incubation Periods of Viral Diseases

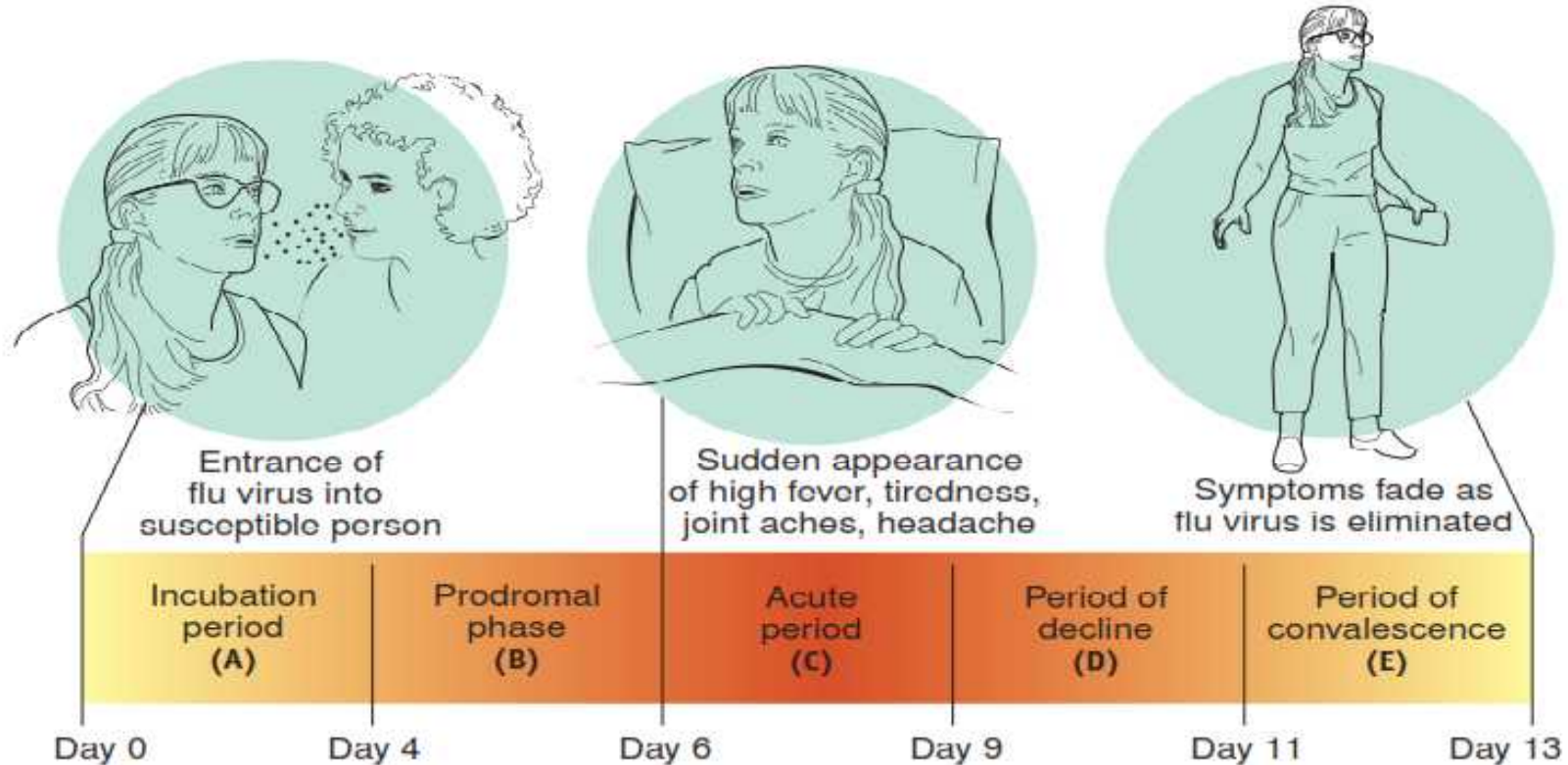


From Evans AS, Kaslow RA, eds. *Viral Infections of Humans: Epidemiology and Control*. 4th ed. New York: Plenum; 1997

Illustration of incubation period, duration of infection and serial interval

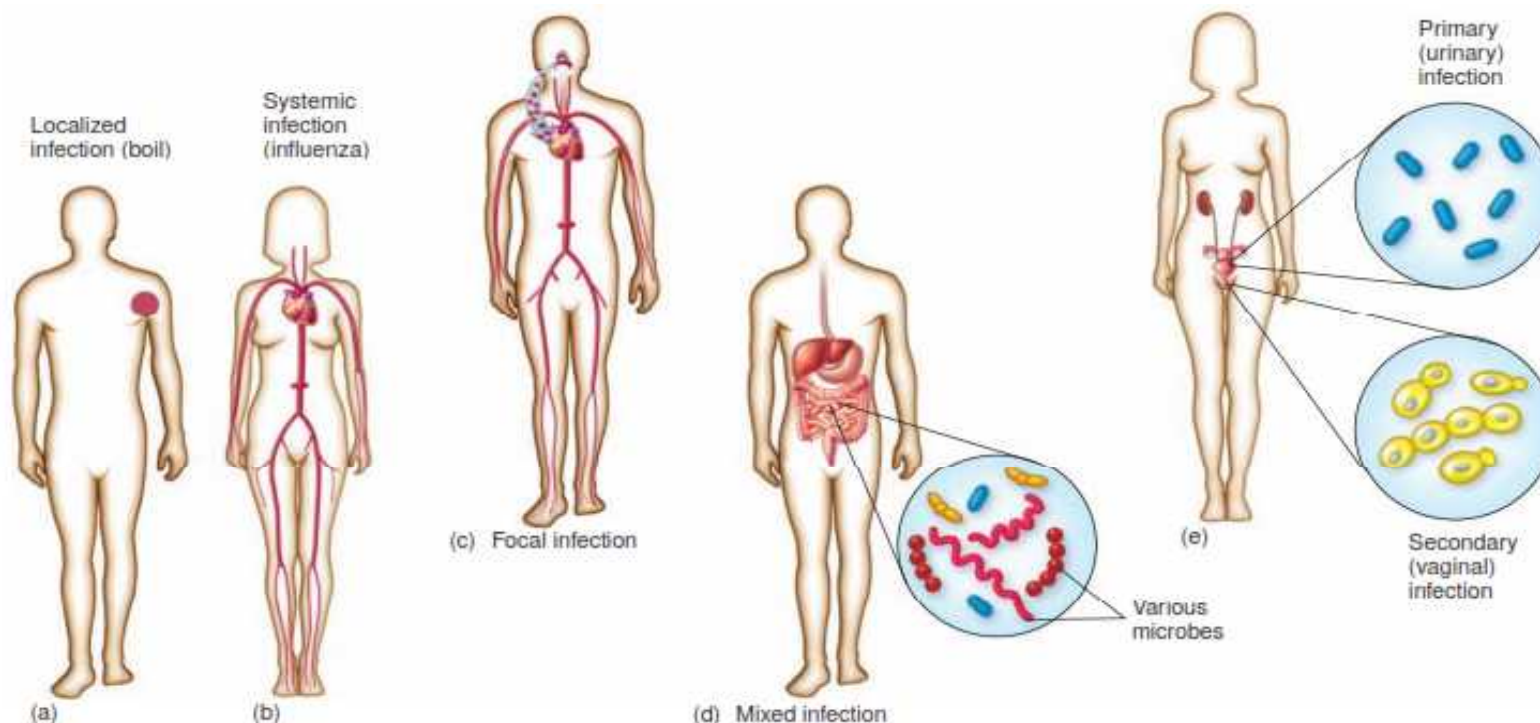


The Stages of an Clinical Infections, as Typified by the Flu



- (A) A susceptible person could be exposed to flu viruses in respiratory droplets at which time the **incubation period** begins.
- (B) The **prodromal phase** is characterized by mild signs and symptoms, such as a headache and fever.
- (C) The **acute period** is characterized by sudden symptoms of high fever with chills, cough, tired muscles and joint pain, and loss of appetite.
- (D) As the virus is eliminated from the body, the fever breaks and appetite returns as **recovery** begins.
- (E) With the period of **convalescence**, the body returns to normal.

Patterns of Infection



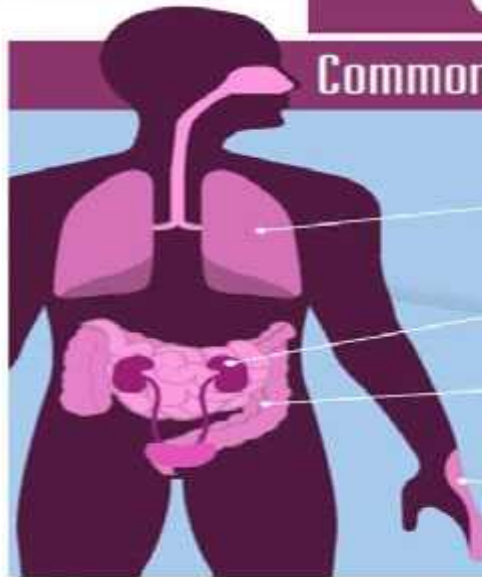
- (a) **Localized infection**, in which the pathogen is restricted to one specific site.
- (b) **Systemic infection**, in which the pathogen spreads through circulation to many sites.
- (c) **Focal infection** occurs initially as a local infection, but circumstances cause the microbe to be carried to other sites systemically.
- (d) **Mixed infection**, in which the same site is infected with several microbes at the same time.
- (e) In a **primary-secondary infection**, an initial infection is complicated by a second one in the same or a different location and caused by a different microbe.



S	E	P	S	I	S
S hivering, fever, or very cold	E xtrême pain or general discomfort ("worst ever")	P ale or discolored skin	S leepy, difficult to wake up, confused	"I feel like I might die"	S hort of breath

Symptoms of Sepsis

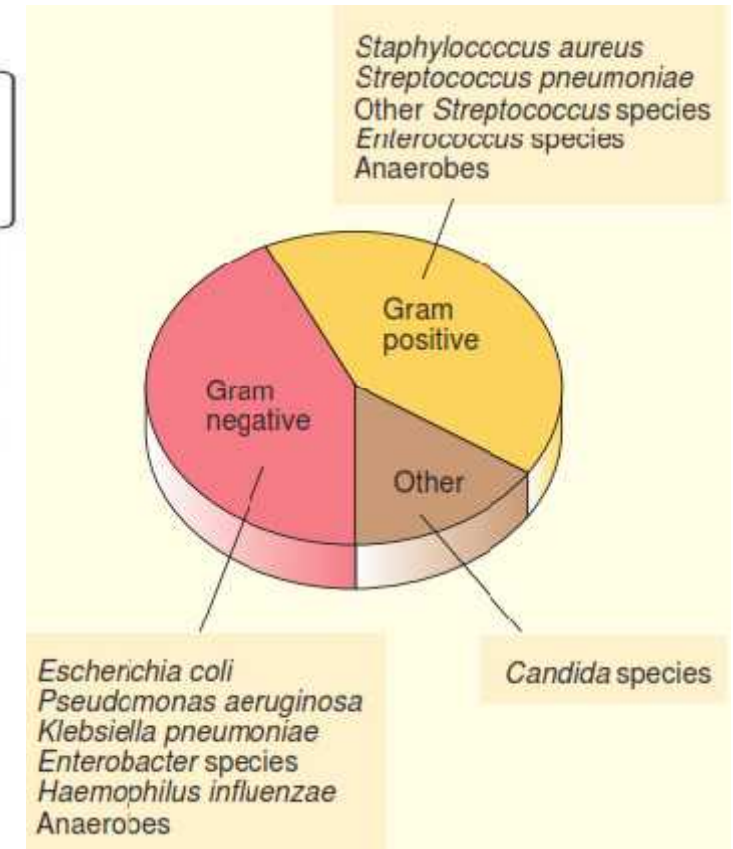
Common infections can lead to sepsis.



Among adults with sepsis:

- 35% had a lung infection (e.g., pneumonia)
- 25% had a urinary tract infection (e.g., kidney infection)
- 11% had a type of gut infection
- 11% had a skin infection

Microbes Causing Septicemia



SEPSIS

BY THE NUMBERS

30

MILLION

people worldwide are affected by sepsis¹

1.6

MILLION

diagnoses each year in the U.S.¹

3rd

LEADING CAUSE OF DEATH

claiming over 258,000 lives in the U.S. every year¹

25-30% **MORTALITY RATE**

Sepsis kills more individuals than prostate cancer, breast cancer, and HIV/AIDS combined^{2,3}

2/3 **OF SEPTIC PATIENTS**

enter the health system via the Emergency Department⁴

#1 **CAUSE** of hospital readmission in U.S.⁵

>\$24 in annual costs in the U.S.⁶
BILLION

#1 **COST** of hospitalization in the U.S.⁶

1.5%

increase in incidence of sepsis

EACH YEAR⁷

19%

of sepsis patients are rehospitalized within

30 DAYS⁸

19%

INCREASE

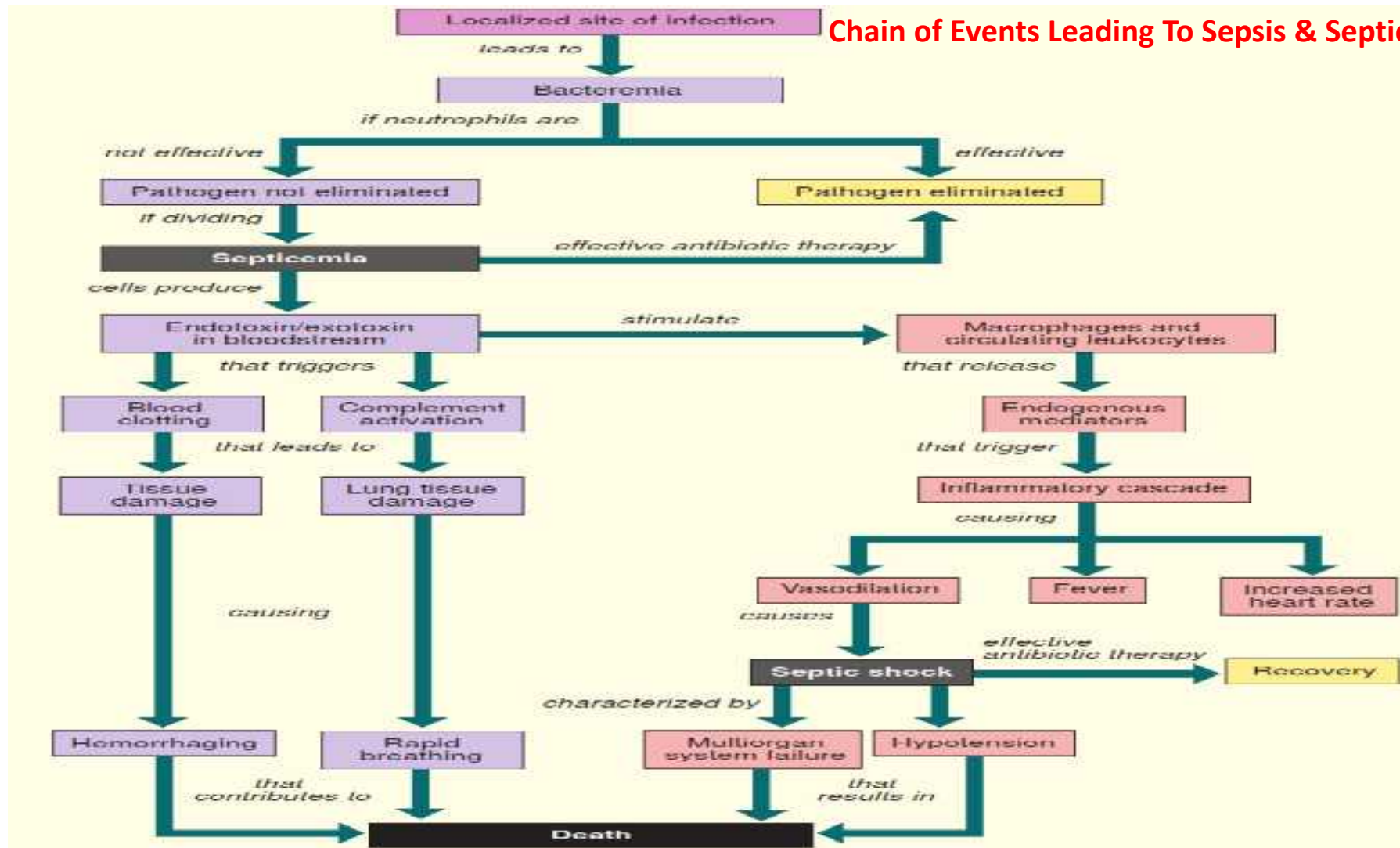
in spending from 2011-2019⁹

ANTIBIOTIC ADMINISTRATION

decreases the likelihood of death by

7.6% **PER HOUR**¹⁰

Chain of Events Leading To Sepsis & Septic Shock



Common Signs & Symptoms of Infectious Diseases

Signs	Symptoms
Fever	Chills
Septicemia	Pain, irritation
Microbes in tissue fluids	Nausea
Abnormal chest sounds	Malaise, fatigue
Skin eruptions	Chest tightness
Leukocytosis	Itching
Leukopenia	Headache
Swollen lymph nodes	Weakness
Abscesses	Abdominal cramps
Tachycardia (increased heart rate)	Anorexia (lack of appetite)
Antibodies in serum	Sore throat

TAKE NOTE: A GUIDE TO THE TERMINOLOGY OF INFECTION AND DISEASE

Words in medicine have great power and economy. A single technical term can often replace a whole phrase or sentence, thereby saving time and space in patient charting. The beginning student may feel overwhelmed by what seems like a mountain of new words. However, having a grasp of a few root words and a fair amount of anatomy can help you learn many of these words and even deduce the meaning of unfamiliar ones. Some examples of medical shorthand follow.

The suffix *-itis* means an inflammation and, when affixed to the end of an anatomical term, indicates an inflammatory condition in that location. Thus, meningitis is an inflammation of the meninges surrounding the brain; encephalitis is an inflammation of the brain itself; hepatitis involves the liver; gastroenteritis, the intestine; and otitis media, the middle ear. Although not all inflammatory conditions are caused by infections, many infectious diseases inflame their target organs.

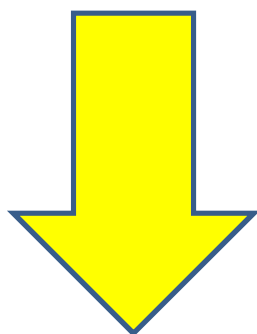
The suffix *-emia* is derived from the Greek word *haima*, meaning blood. When added to a word, it means "associated with the blood." Thus, septicemia means sepsis (infection) of the blood; bacteremia, bacteria in the blood; viremia, viruses in the blood; and fungemia, fungi in the blood. It is also applicable to specific conditions such as toxemia, gonococcemia, and spirochetemia.

The suffix *-osis* means "a disease or morbid process." It is frequently added to the names of pathogens to indicate the disease they cause; for example, listeriosis, histoplasmosis, toxoplasmosis, shigellosis, salmonellosis, and borreliosis. A variation of this suffix is *-iasis*, as in trichomoniasis and candidiasis.

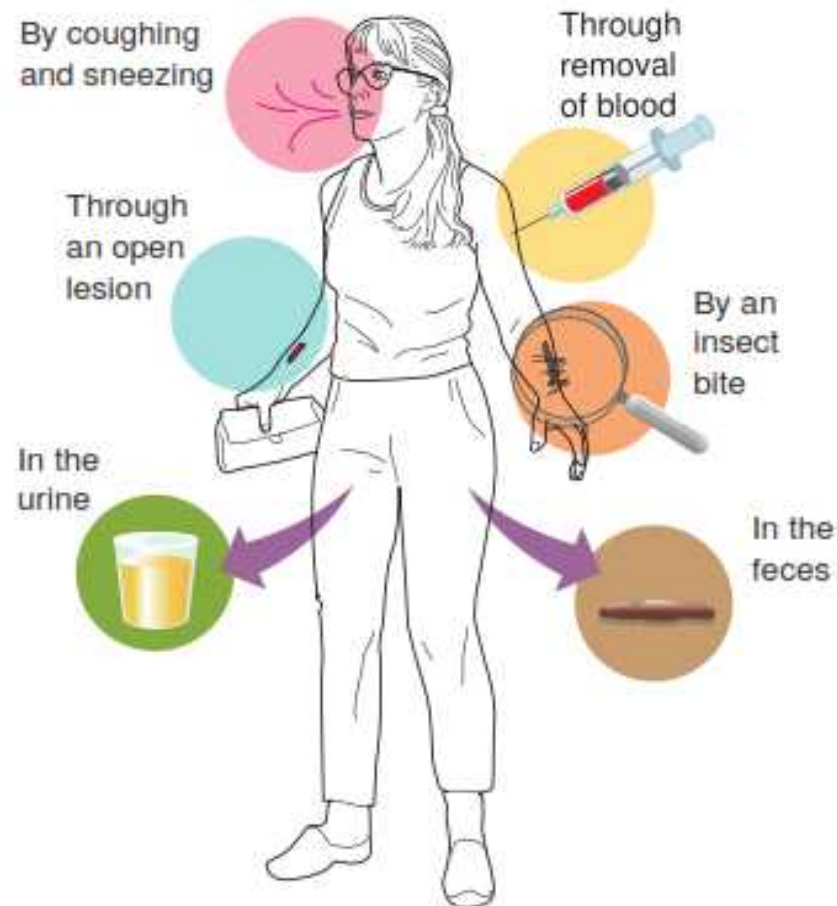
The suffix *-oma* comes from the Greek word *onkomas* (swelling) and means tumor. Although the root is often used to describe cancers (sarcoma, melanoma), it is also applied in some infectious diseases that cause masses or swellings (tuberculoma, leproma).

Incubation Periods of Selected Exposures & Diseases

Exposure	Clinical Effect	Incubation/Latency Period
Saxitoxin and similar toxins from shellfish	Paralytic shellfish poisoning (tingling, numbness around lips and fingertips, giddiness, incoherent speech, respiratory paralysis, sometimes death)	few minutes–30 minutes
Organophosphorus ingestion	Nausea, vomiting, cramps, headache, nervousness, blurred vision, chest pain, confusion, twitching, convulsions	few minutes–few hours
<i>Salmonella</i>	Diarrhea, often with fever and cramps	usually 6–48 hours
SARS-associated corona virus	Severe Acute Respiratory Syndrome (SARS)	3–10 days, usually 4–6 days
Varicella-zoster virus	Chickenpox	10–21 days, usually 14–16 days
<i>Treponema pallidum</i>	Syphilis	10–90 days, usually 3 weeks
Hepatitis A virus	Hepatitis	14–50 days, average 4 weeks
Hepatitis B virus	Hepatitis	50–180 days, usually 2–3 months
Human immunodeficiency virus	AIDS	<1 to 15+ years
Atomic bomb radiation (Japan)	Leukemia	2–12 years
Radiation (Japan, Chernobyl)	Thyroid cancer	3–20+ years
Radium (watch dial painters)	Bone cancer	8–40 years



Pathogens Must Be Able to Leave the Host to Spread Disease: Six portals of exit



Various Types of Infections Associated with Parasitic Organisms

Type	Definition
Abscess	A localized infection with a collection of pus surrounded by an inflamed area
Acute	Short but severe course
Bacteremia	Presence of viable bacteria in the blood
Chronic	Persists over a long time
Covert	Subclinical, no symptoms
Cross	Transmitted between hosts infected with different organisms
Focal	Exists in circumscribed areas
Fulminating	Infectious agent multiplies with great intensity
Introgenic	Caused as a result of health care
Latent	Persists in tissues for long periods, during most of which there are no symptoms
Localized	Restricted to a limited region or to one or more anatomical areas
Mixed	More than one organism present simultaneously
Nosocomial	Develops during a stay at a hospital or other clinical care facility
Opportunistic	Due to an agent that does not harm a healthy host but takes advantage of an unhealthy one
Overt	Symptomatic
Phylogenetic	Caused by plant pathogens
Primary	First infection that often allows other organisms to appear on the scene
Pyogenic	Results in pus formation
Secondary	Caused by an organism following an initial or primary infection
Sepsis	(1) The condition resulting from the presence of bacteria or their toxins in blood or tissues; the presence of pathogens or their toxins in the blood or other tissues (2) Systemic response to infection; this systemic response is manifested by two or more of the following conditions as a result of infection: temperature, >38 or $<36^{\circ}\text{C}$; heart rate, >90 beats per min; respiratory rate, >20 breaths per min, or pCO_2 , <32 mm Hg; leukocyte count, $>12,000$ cells per ml^3 , or $>10\%$ immature (band) forms
Septicemia	Blood poisoning associated with persistence of pathogenic organisms or their toxins in the blood
Septic shock	Sepsis with hypotension despite adequate fluid resuscitation, along with the presence of perfusion abnormalities that may include, but are not limited to, lactic acidosis, oliguria, or an acute alteration in mental status
Severe sepsis	Sepsis associated with organ dysfunction, hypoperfusion, or hypotension; hypoperfusion and perfusion abnormalities may include, but are not limited to, lactic acidosis, oliguria, or an acute alteration in mental status
Sporadic	Occurs only occasionally
Subclinical (inapparent or covert)	No detectable symptoms or manifestations
Systemic	Spread throughout the body
Toxemia	Condition arising from toxins in the blood
Zoonosis	Caused by a parasitic organism that is normally found in animals other than humans