

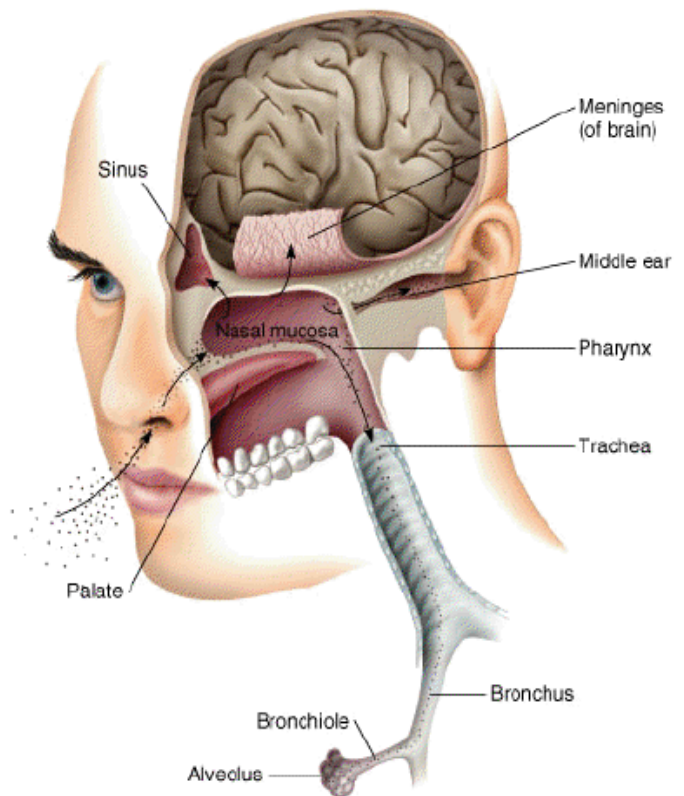
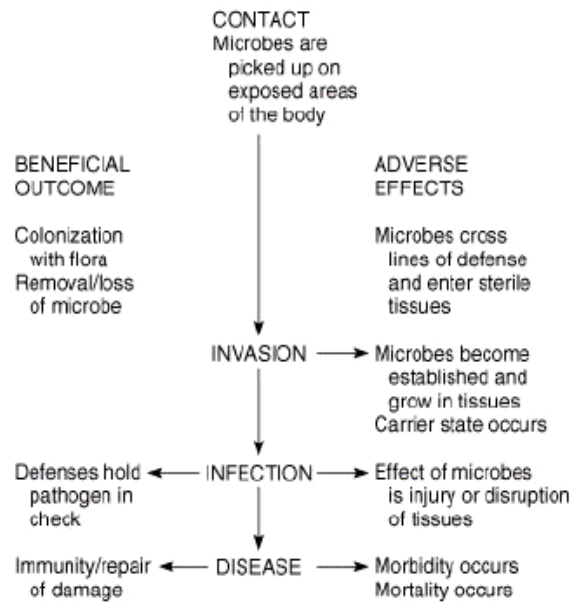
Principles of Infectious Disease

Lecture #13 – Dr. Gary Mumaugh

Terminology

- Pathology – study of disease
- Etiology – cause of disease
- Pathogenesis – disease process
- Infection – colonization by microbes
- Disease – illness

Microbe – Host Interactions



Normal Microbota / Flora

- Compete for living space and nutrients with pathogens
- Mutualism
 - They get space and food, we get vitamins and protection from pathogens
- Biofilms
 - Microbes cooperate in attachment

Sites That Harbor a Normal Flora

- Skin and its contiguous mucous membranes
- Upper respiratory tract
- Gastrointestinal tract
- External urethra
- External genitalia
- Vagina
- External ear canal
- External eye (lids, conjunctiva)

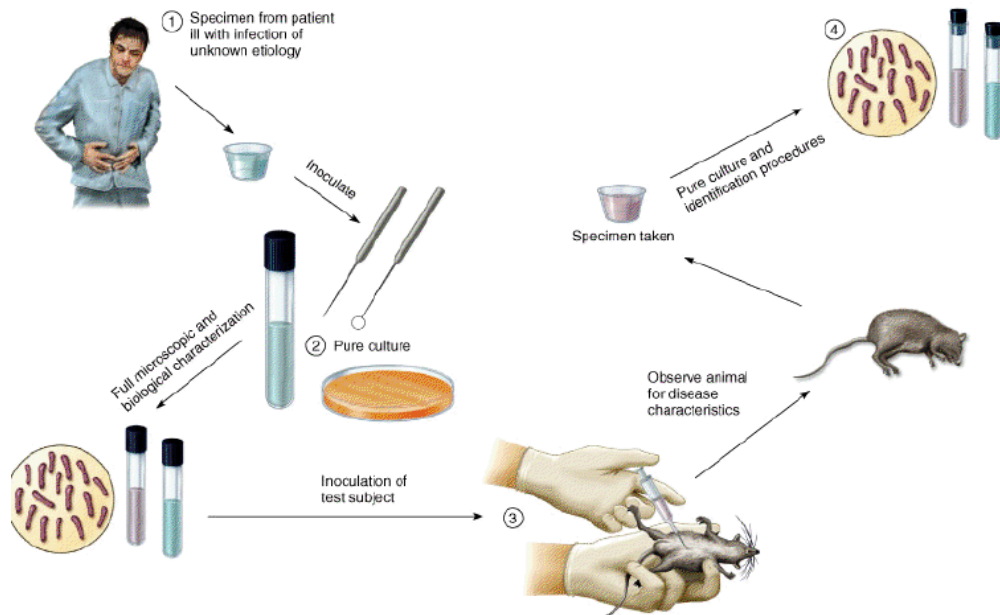
Sterile (Microbe-Free) Anatomical Sites & Fluids

- All internal tissues and organs
 - Heart and circulatory system
 - Liver
 - Kidneys and bladder
 - Lungs
 - Brain and spinal cord
 - Muscles
 - Bones
 - Gonads
 - Glands
 - Sinuses
 - Middle and inner ear
 - Internal eye
- Fluid within an organ or tissue
 - Blood
 - Urine in kidneys, ureters, bladder
 - Cerebrospinal fluid
 - Saliva prior to entering the urethra
 - Amniotic fluid surrounding the embryo and fetus

Opportunistic Pathogens

- Organisms that cause disease when they enter a different environment
 - *Staphylococcus aureus* enters with breaks in the skin
 - *Escherichia coli* enters peritoneal cavity from a burst appendix
 - *Clostridium difficile* colonizes intestines when the normal flora have been killed by antibiotics

Disease Etiology – Koch’s Postulates

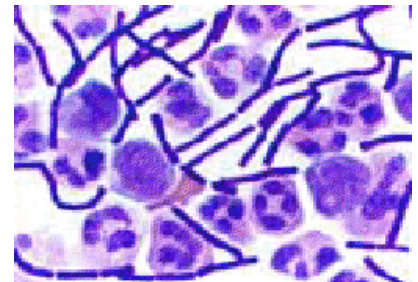


Exceptions to Koch’s Postulates

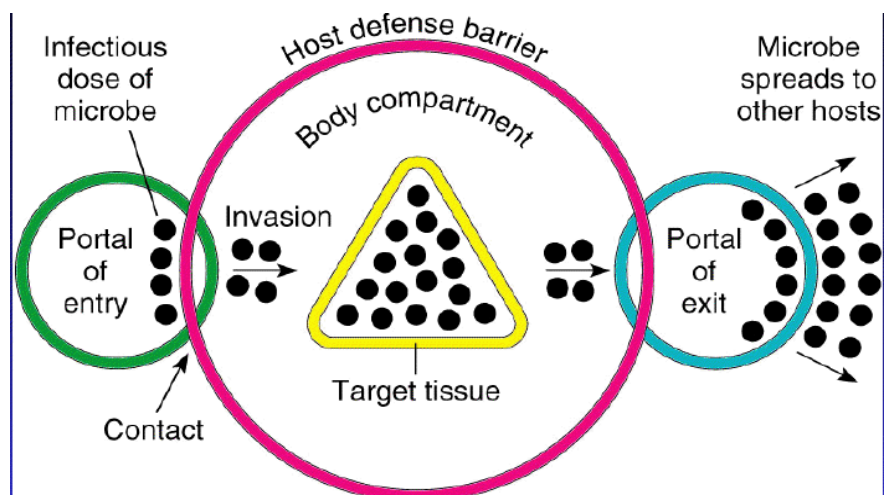
- Some bacteria and viruses cannot be cultivated in pure culture
- Some pathologies are caused by several organisms
 - Nephritis, pneumonia, meningitis, peritonitis
 - “itis” = inflammation
- Some organisms cause several diseases
 - *Staphylococcus aureus*
- Ethical considerations

Microbe of the Day

- Bacillus anthracis
- Gram positive rod
- Survives in the soil as spores
- Infects hoofed animals
- First bacterium proven to cause a specific disease



Infection



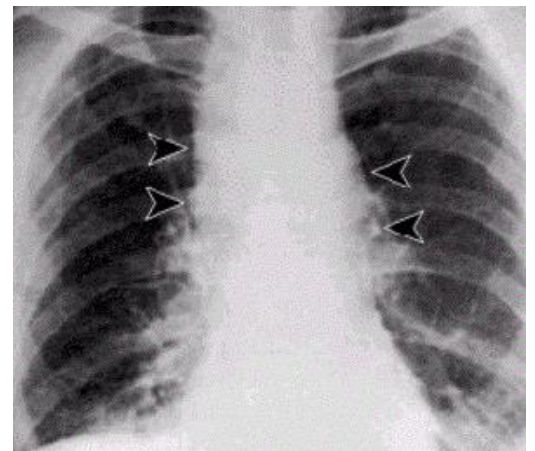
Anthrax in Herbivores

- May be listless or without appetite
- After death, bleeding from body cavities
- In US, incidence higher along old cattle drive routes



Human Anthrax Infections

- Cutaneous
- Respiratory
- Gastrointestinal
- Not spread per-to-person (not contagious)
- Most common in countries without veterinary public health programs
- NOW – a germ warfare threat

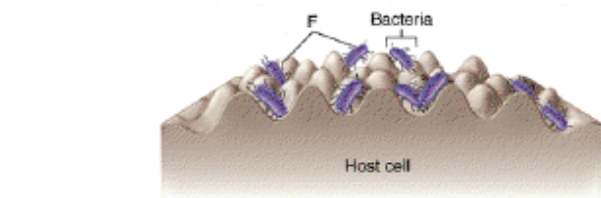


Portal of Entry

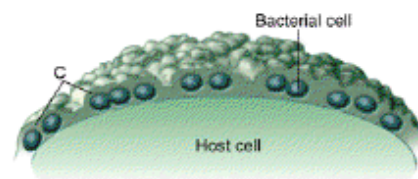
- Skin
- Gastrointestinal Tract
- Respiratory
- Urogenital
- Placenta
- Parenteral (injection, bite)

Attachment

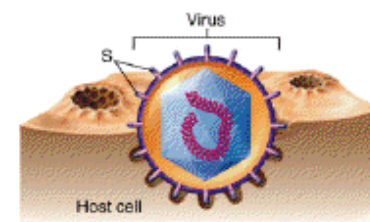
- Fimbriae
- Glyocalyx
- Hooks
- Suction discs
- Viral spike



(a) Fimbriae

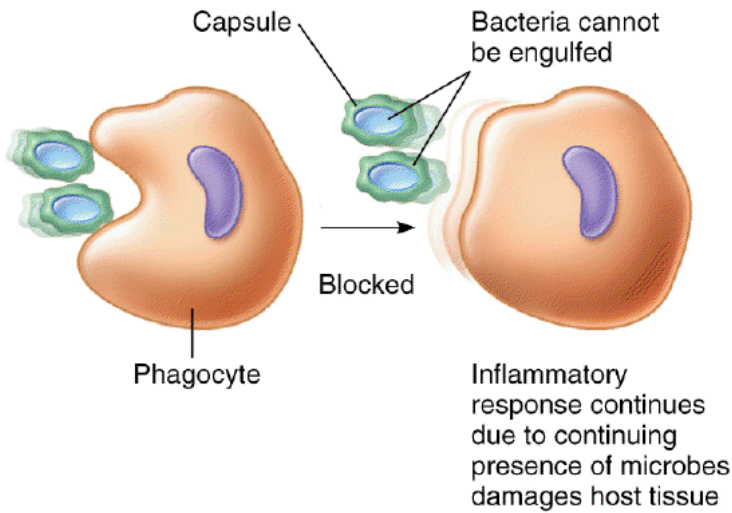


(b) Capsules



(c) Spikes

Surviving Hosts Defenses



Additional Virulence Factors

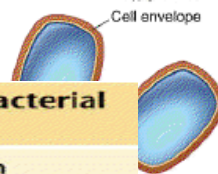
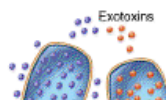
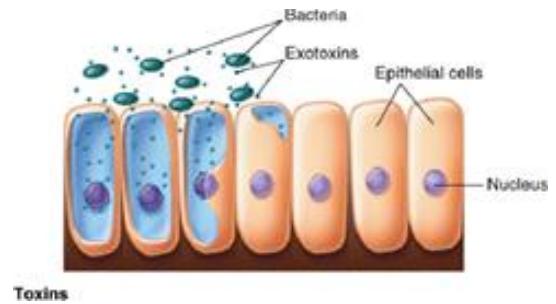
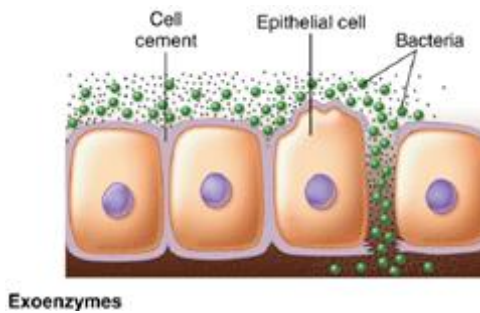
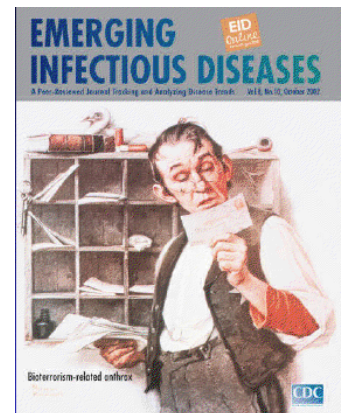


TABLE 13.7 Differential Characteristics of Bacterial Exotoxins and Endotoxin

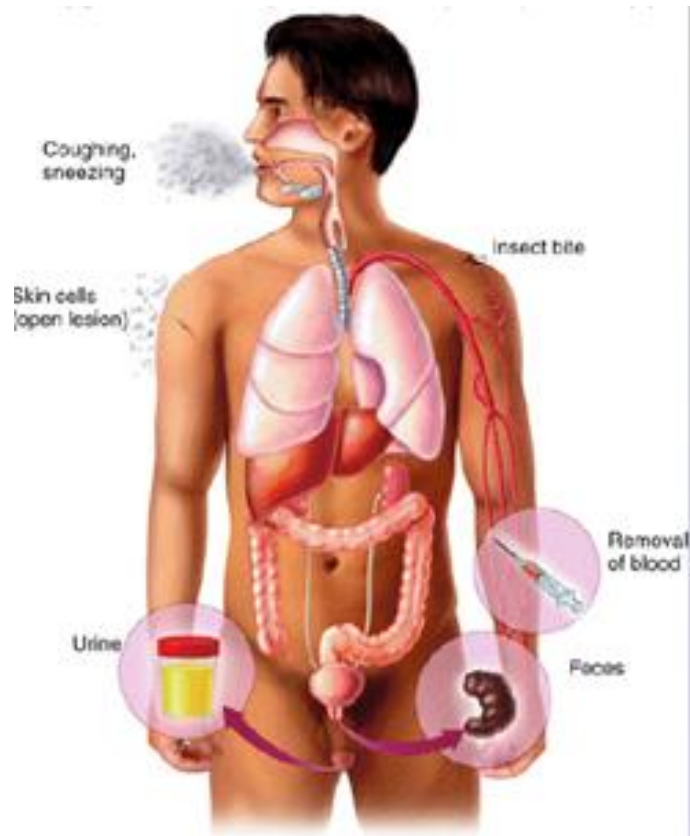
Characteristic	Exotoxins	Endotoxin
Toxicity	Toxic in minute amounts	Toxic in high doses
Effects on the Body	Specific to a cell type (blood, liver, nerve)	Systemic: fever, inflammation
Chemical Composition	Small proteins	Lipopolysaccharide of cell wall
Heat Denaturation at 60°C	Unstable	Stable
Toxoid Formation	Can be converted to toxoid*	Cannot be converted to toxoid
Immune Response	Stimulate antitoxins**	Does not stimulate antitoxins
Fever Stimulation	Usually not	Yes
Manner of Release	Secreted from live cell	Released by cell during lysis
Typical Sources	A few gram-positive and gram-negative	All gram-negative bacteria

More Terminology

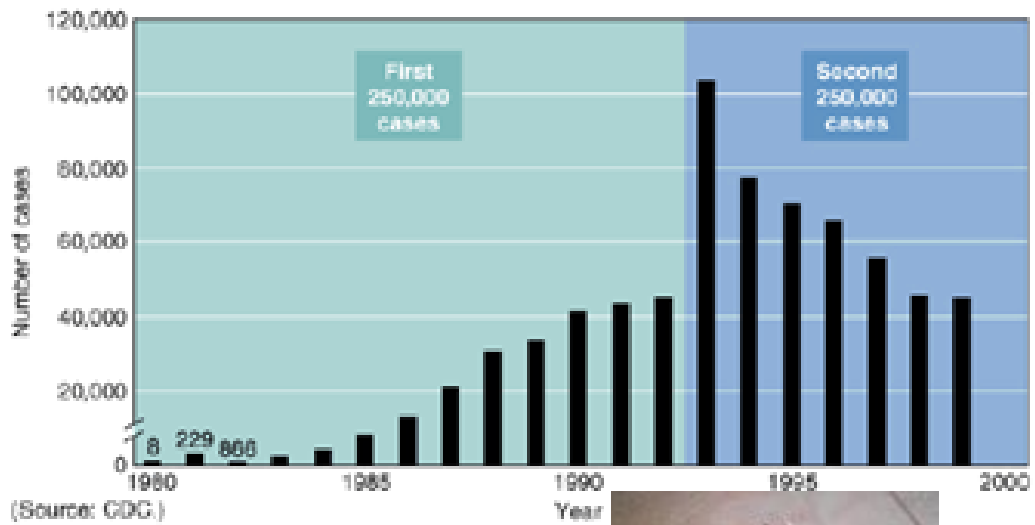
- Signs – measurable changes
- Symptoms – patient complaint
- Communicable disease – transmitted from one host to another
- Contagious disease – easily transmitted
- Acute disease
- Chronic disease
- Latent disease
- Secondary infections
- Bacteremia, septicemia, toxemia, viremia
- Sporadic – occasional cases
- Endemic – constantly present
- Epidemic – outbreaks
- Pandemic – worldwide outbreaks
- Incidence – number of infected people during a particular period of time
- Prevalence – number of disease people at any given time



Portals of Exit



Reported US AIDS Cases



Spread of Disease



- Reservoir
 - Humans
 - Animals (zoonoses)
 - Environment
- Contact
 - Direct
 - Indirect (fomite)
- Droplet
- Vehicle
- Vector



Nosocomial Infections

- Hospital acquired
- 5-15% of patients acquire infection
- Control of nosocomial infections
 - Handwashing
 - Disinfection of surfaces
 - Single-use materials
 - Appropriate antibiotic use
 - Surveillance – infection control officer

