

IP 101

Class 2: Foundational Infection Prevention

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IP Interviews

- What did you do before IP?
- How long have you been an IP?
- What do you like about IP?
- What is your most valuable/used resource for IP?
- What do you wish someone had told you when you were a new IP?

Syllabus

- Epidemiology
- Vocabulary
- Chain of infection
- Microbiology
- Assignments

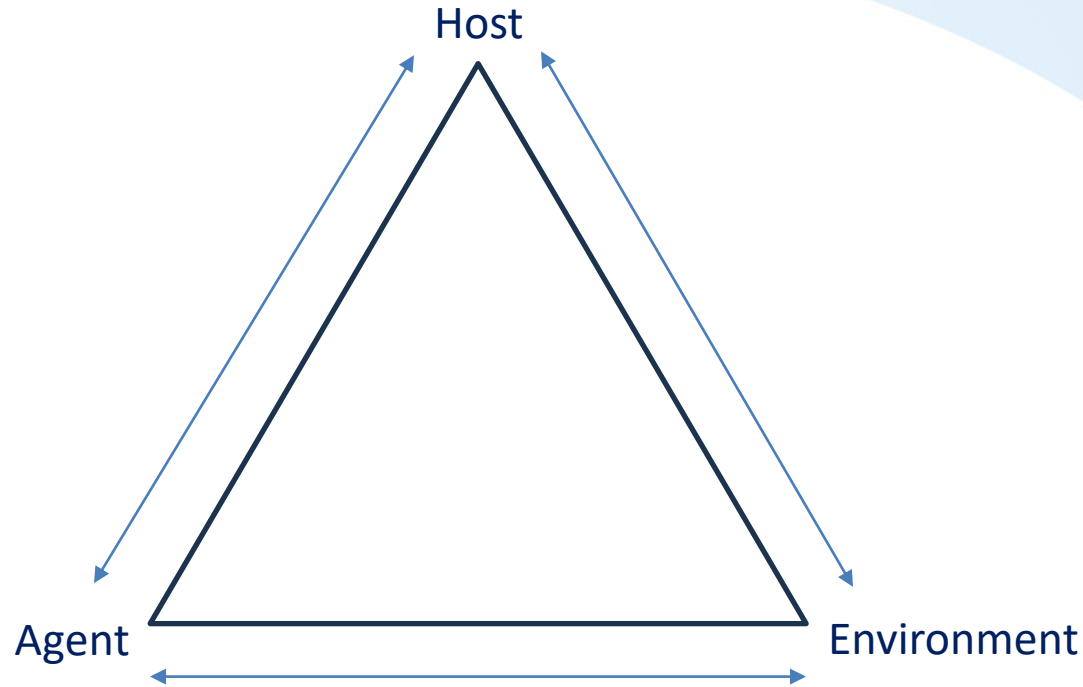
Epidemiology

- Epidemiology
 - study of the frequency, distribution, cause, and control of disease in populations
 - forms the basis of all health-related studies

[Special Episode: On the Origin of Epidemiology – This Podcast Will Kill You](#)

[John Snow: The Father of Epidemiology | Heroes of Progress | Ep. 45 - YouTube](#)

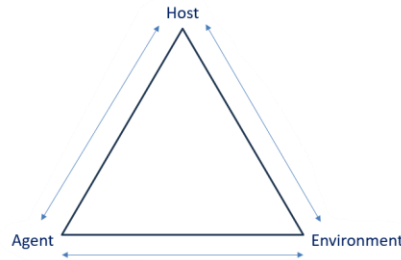
Epidemiology



Tweeten, S. (2023). General Principles of Epidemiology. In *APIC Text*. essay, Association for Professionals in Infection Control and Epidemiology (APIC). Retrieved January 25, 2024, from https://text.apic.org/toc/epidemiology-surveillance-performance-and-patient-safety-measures/general-principles-of-epidemiology#book_section_70916.

Epidemiology

- **Correlation**
- **Association**
 - One variable change causes a change in quality/quantity of another variable
 - Artifactual/spurious, indirect/noncausal, causal
- **Causation**
 - Koch's postulates



Vocabulary

-
- 1) Endemic → E) Usual incidence of a given disease within a geographical area during a specific time period
- 2) Epidemic → B) Excess over expected incidence of disease in a geographical area during a specific time period
- 3) Pandemic → C) Excess over expected incidence of disease in a geographical area during a specific time period, but usually preferred when dealing with the public
- 4) Outbreak → D) Group of people with a certain disease in the same place/time, but are not epidemiologically linked
- 5) Cluster → A) Epidemic spread over a wide geographical area-countries/continents
- A) Epidemic spread over a wide geographical area-countries/continents
 - B) Excess over expected incidence of disease in a geographical area during a specific time period
 - C) Excess over expected incidence of disease in a geographical area during a specific time period, but usually preferred when dealing with the public
 - D) Group of people with a certain disease in the same place/time, but are not epidemiologically linked
 - E) Usual incidence of a given disease within a geographical area during a specific time period

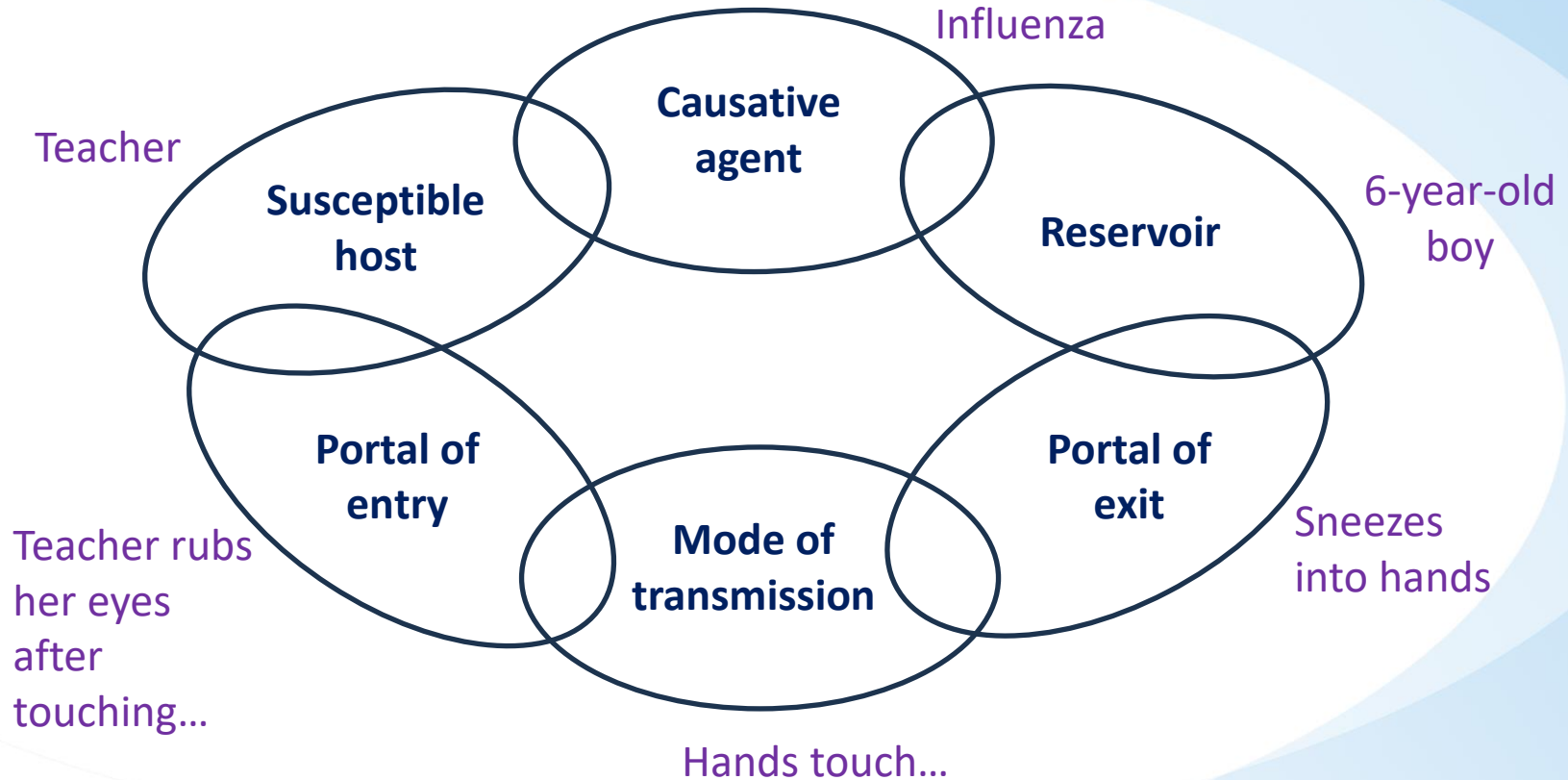
Vocabulary

-
- 1) Incidence
- 2) Prevalence
- 3) Fomite
- 4) Herd immunity
- 5) Infection
- 6) Colonization
- A) Entry/multiplication of an infectious agent in the tissues of a host that results in damage and changes in the host
- B) Inanimate object where organisms may exist for a time
- C) Resistance of a group to invasion/spread of an infectious agent; high proportion of group have immunity
- D) Presence of microorganisms in/on a host, but without tissue damage/change
- E) Number of new cases of disease in a given time period
- F) Number of existing cases of disease at a given time
- The diagram shows the following connections:
1) Incidence → E)
2) Prevalence → F)
3) Fomite → B)
4) Herd immunity → C)
5) Infection → A)
6) Colonization → D)

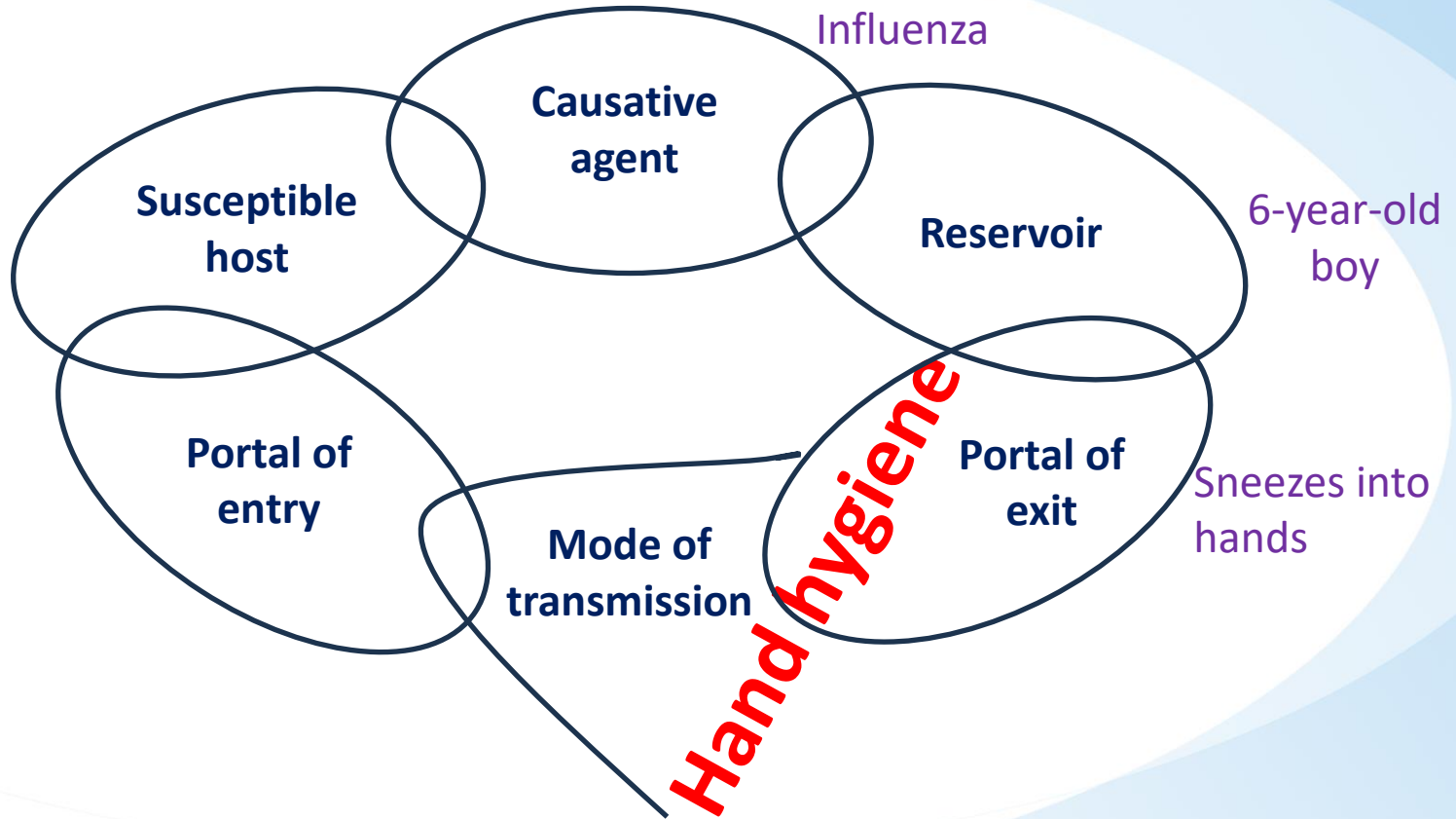
Vocabulary

-
- 1) Contamination → A) Usually caused by the organisms found on the patient's skin or the hub of an indwelling catheter
- 2) Geographic distribution → F) Impacted by climate, environment, and host availability, susceptibility, and number
- 3) Incubation period → D) The time between first contact with an infectious agent and the appearance of the first sign or symptom
- 4) Periods of communicability → C) When the infectious agent can be transferred from an infected reservoir to another
- 5) Signs → B) Observable characteristic of disease (wheezing, fatigue)
- 6) Symptoms → E) Feelings/sensations the person experiences (shortness of breath, temperature of 101)

Chain of Infection



Chain of Infection



Vocabulary

-
- 1) Bacteria
- 2) Viruses
- 3) Fungi
- 4) Protozoa
- 5) Helminths
- 6) Prions
- A) Single or multicellular; most live on land-soil/plants (yeasts/molds)
- B) Abnormal, pathogenic agents that are transmissible and are able to induce abnormal folding of specific normal proteins found mostly in the brain (CJD)
- C) Obligate intracellular parasites (influenza, parvo, corona)
- D) Free-living, single-celled organisms with a defined nucleus (amoeba)
- E) Tiny, single-celled living organisms (*Staphylococcus aureus*, *E. coli*, *Rickettsia rickettsia*)
- F) Parasitic worms (flukes, tapeworms, roundworms)
- The diagram shows the following connections: Bacteria to A, Viruses to C, Fungi to D, Protozoa to E, Helminths to F, and Prions to B.

Mode/Route of Transmission

- **Direct**
 - contact, droplet, infectious agent, bite, transplacental
- **Indirect**
 - biological, mechanical, airborne

Standard Precautions

- First line of defense
- Hand hygiene
- Personal Protective Equipment (PPE)
- Respiratory hygiene/cough etiquette

Wiksten, T. (2014). Standard Precautions. In *APIC Text*. APIC. Retrieved February 16, 2024 from https://text.apic.org/toc/basic-principles-of-infection-prevention-practice/standard-precautions#book_section_568





Contact Precaution

Providers and Staff

- Always wear gown and gloves to enter patient room
- Always perform hand hygiene

Visitors

- Always clean hands and after visiting patient
- See staff at nurses' station before entering room



August 2021



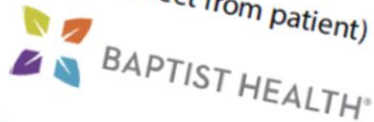
Contact / Droplet Precautions

Providers and Staff

- Always wear gown and gloves to enter patient room
- Always wear mask to enter room
- Always perform hand hygiene

Visitors

- Always clean hands before and after visiting patient
- Wear gown and gloves for contact with patient
- Always wear mask (within 3 feet from patient)



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Droplet Precautions

Providers and Staff

- Always wear mask to enter room
- Always perform hand hygiene

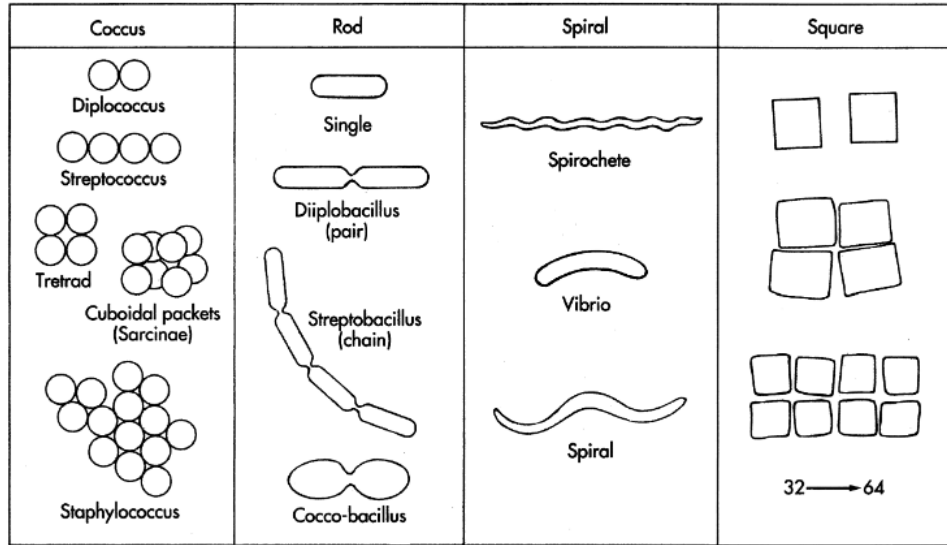
Visitors

- Always clean hands before and after visiting patient
- Always wear mask if within 3 feet of patient



Microbiology

Figure 24-1.



Genus specific epithet

Microbiology

- Polymerase Chain Reaction (PCR)
- Common stains:

Table 24-1 Stains Commonly Used in the Clinical Microbiology Laboratory

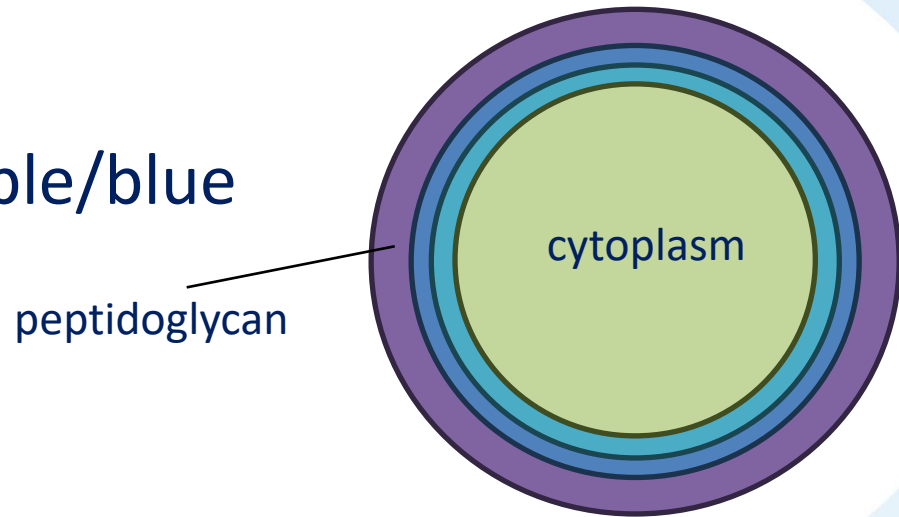
Stain	Application
Gram stain	Most bacterial species; bacteria can be grouped based on their Gram stain reactions; routinely used as the primary microscopic examination
Acid-fast stain Ziehl-Neelsen nonfluorescent	Direct smear for the detection of mycobacteria; identification of acid-fast organisms
Kinyoun nonfluorescent	Direct smear for the detection of mycobacteria, cryptosporidia, and <i>Cyclospora</i> parasites in stool
Fluorochromes (fluorescent stains)	Detection of cell wall-deficient bacteria such as mycoplasmas
Acridine orange	Detection of mycobacteria as well as some sporozoan parasites
Auramine-rhodamine	Direct smear for the differentiation of fungi from background materials; bronchoalveolar fungi and some parasitic cysts
Calcofluor white	Diagnostic antibody or DNA probe-mediated stains directed specifically at an organism
Immunofluorescent	
Modified toluidine blue O stain	Detect <i>Pneumocystis carinii</i> in respiratory tract material as well as other parasites and fungi
Trichrome stain	Differentiates the internal structures of cysts, trophozoites, or other forms of parasites; useful for examination of stool specimens
Wright-Giemsa	Detect parasitic protozoan nuclei in blood (e.g., <i>Plasmodium</i> species, <i>Babesia</i> , <i>Trypanosoma cruzi</i>)

Do it for the Gram-Stain

- 1884 Hans Christian Gram
- Crystal violet applied, washed with alcohol
- Safranin as counterstain

Do it for the Gram-Positive

- Thick peptidoglycan cell wall
- Retains stain
 - Dark violet/purple/blue



Do it for the Gram-Positive

- Streptococci
 - *pneumoniae, viridans, pyogenes, agalactiae*
- Enterococci
 - VRE
- Clostridia
 - *tetani, botulinum, perfringens*
- *Clostridioides difficile*
- *Bacillus anthracis*
- *Corynebacterium diphtheriae*
- *Listeria monocytogenes*

[Episode 95 Tetanus: An inhuman calamity! – This Podcast Will Kill You](#)

[Episode 87 C. diff: Fighting poop with poop – This Podcast Will Kill You](#)

[Episode 82 Anthrax: The Hardcore Spore – This Podcast Will Kill You](#)

[Episode 16 Scratch and Sniff Diphtheria Membrane – This Podcast Will Kill You](#)

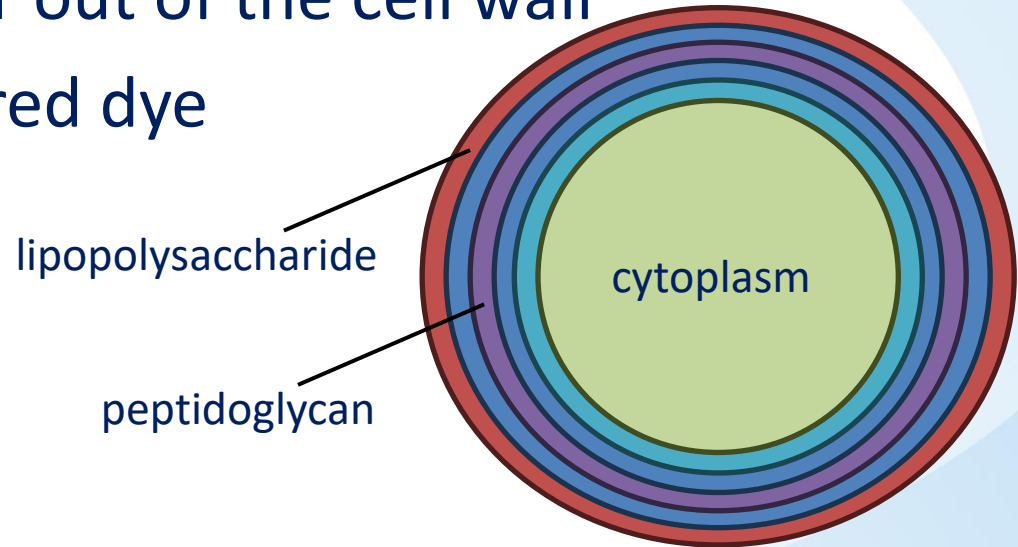
[Episode 114 Listeria: It put dairy on the map – This Podcast Will Kill You](#)

Staphylococcus

- **Gram-positive**, nonmotile, non-spore-forming cocci that tend to form clusters in Gram stains
- Coagulase-positive/negative
 - Coagulase-negative (CoNS)
 - *S. epidermidis*, *S. haemolyticus*, *S. hominis*
 - *Staph. aureus* is coagulase-positive (CoPS)
 - MRSA
- Normal flora
- HAIs

Do it for the Gram-Negative

- Lipopolysaccharide layer as part of cell wall
- Alcohol rinses color out of the cell wall
- Counterstain with red dye
- Pink/red



Do it for the Gram-Negative

- *Pseudomonas aeruginosa*
- *Acinetobacter baumannii*
- Enterobacteriaceae
 - *Escherichia coli*
 - *Proteus, Enterobacter, Klebsiella, Citrobacter, Yersinia, Shigella, Salmonella*
- Chlamydiae
 - *trachomatis, pneumoniae, psittaci*

[Episode 37: E. coli \(unless it's beets\) – This Podcast Will Kill You](#)

[Episode 61 Typhoid: There's Something About Mary – This Podcast Will Kill You](#)

[Episode 94 Chlamydia: Double Trouble – This Podcast Will Kill You](#)

Do it for the Gram-Negative

- Rickettsiae
 - coccobacilli
- Obligate intracellular parasitic bacteria
- Infect humans and arthropods
- *Rickettsia rickettsii*
- *Rickettsia prowazekii*
- *Rickettsia typhi*
- *Coxiella burnetii*

[Episode 55 Rocky Mountain spotted fever: The tick must be destroyed! – This Podcast Will Kill You](#)

Mycoplasma

- Extremely small
- Pleomorphic
- Outer plasma membrane
- Resistant to cell wall-active antibiotics
- *Mycoplasma pneumoniae*, *Mycoplasma hominis*

Mycobacteria

- Bacilli
- Mycolic acid cell wall
 - Acid-fast
- *Mycobacterium tuberculosis* (MTB) complex
 - tuberculosis, bovis, canetti, mungi

[Episode 9 Tuberculosis: A Slow Burn – This Podcast Will Kill You](#)

Viruses

- Super small
- DNA or RNA inside of a capsid
- No cells
 - Influenza viruses
 - Human herpesviruses
 - Coronaviruses
 - Human papillomaviruses
 - Enteroviruses
 - Flaviviruses
 - Orthopoxviruses
 - Hepatitis viruses

[Episode 110 Influenza, Take 2: Fowl Play – This Podcast Will Kill You](#)

[Episode 10 Yellow Fever: Is there a Hamilton Song About This? – This Podcast Will Kill You](#)

[Episode 3 Gnarlypox – This Podcast Will Kill You](#)

[Episode 57 Herpes: Stop the STigma – This Podcast Will Kill You](#)

[Episode 45 Hepatitis C: Hepatiti? – This Podcast Will Kill You](#)

[Episode 43 M-m-m-my Coronaviruses – This Podcast Will Kill You](#)

[Episode 67 HPV: My wart be with you – This Podcast Will Kill You](#)

[Episode 100 Monkeypox: Here we go again? – This Podcast Will Kill You](#)

Parasites

- “...any organism living within or on another living creature and deriving advantage from doing so while causing disadvantage to the host.”

- Scabies
- Lice
- Protozoa
- Larvae (maggots)
- Bed bugs
- Worms

[Episode 23: Opening a can of Hookworms – This Podcast Will Kill You](#)

[Episode 96 Tapeworm: We encyst you listen – This Podcast Will Kill You](#)

[Special Episode: Coprolites! – This Podcast Will Kill You](#)

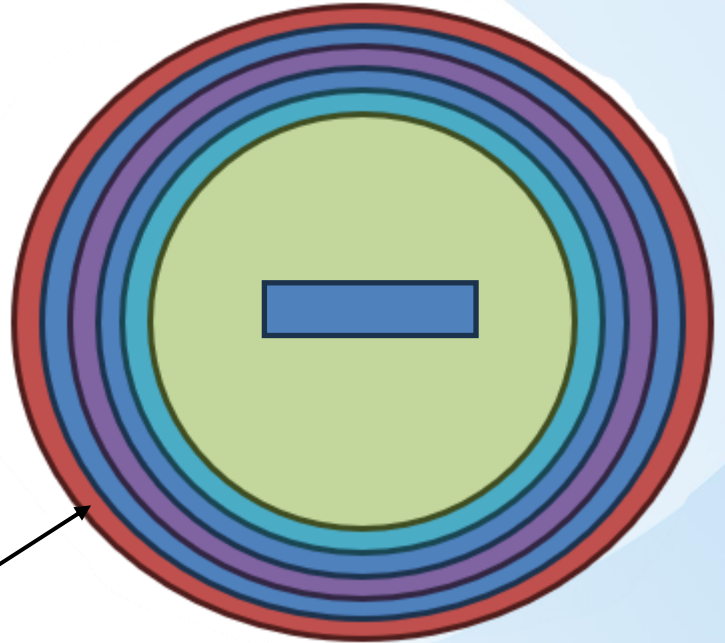
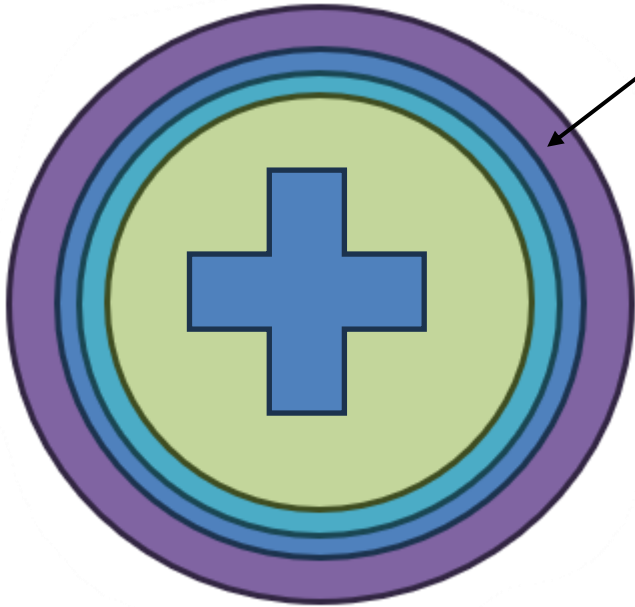
[Episode 31 Giardia: Gerardia – This Podcast Will Kill You](#)

[KHA Quality Webinar: Naegleria Fowleri](#)



Pop Quiz!

peptidoglycan



lipopolysaccharide

Prions

- Proteinaceous infectious particles
 - PrP: PrP^c & PrP^{sc}
- Human disease caused by gene mutation, accidental exposure in medical treatment, or by ingestion of contaminated meat

Creutzfeldt-Jakob Disease

- Prion disease
- Neurological degeneration
- Sporadic or familial
- Transmission
 - Highly infectious: brain, dura mater, pituitary tissue, spinal cord, eye
 - Ingesting contaminated meat

[Episode 20 Prions: Apocalypse Cow – This Podcast Will Kill You](#)

Fungi

- Eukaryotic with cell walls
- Yeasts and molds
- Suspect outbreak if 2+ infections
- *Exserohilum rostratum*
- *Microsporum canis*

Candida

- Yeast or mold?
- Normal commensal of human GI tract and female genital tract
- CLABSIs, BSIs, CAUTIs
- **Risk factors:** broad spectrum antibiotics, neutropenia, immunosuppressed, lines
- *auris, albicans, glabrata, parapsilosis*

Aspergillus

- Yeast or mold?
- Found in decaying organic matter
- Construction
- **Risk factors:** steroids, neutropenia, AIDS...

Assignments

- **Pre-work for session 3:**
 - Make sure you have a working NHSN account
 - [Enrollment Acute Care Hospitals/Facilities | NHSN | CDC](#)
 - Utilize KDPH NHSN webinars for in-depth data entry information