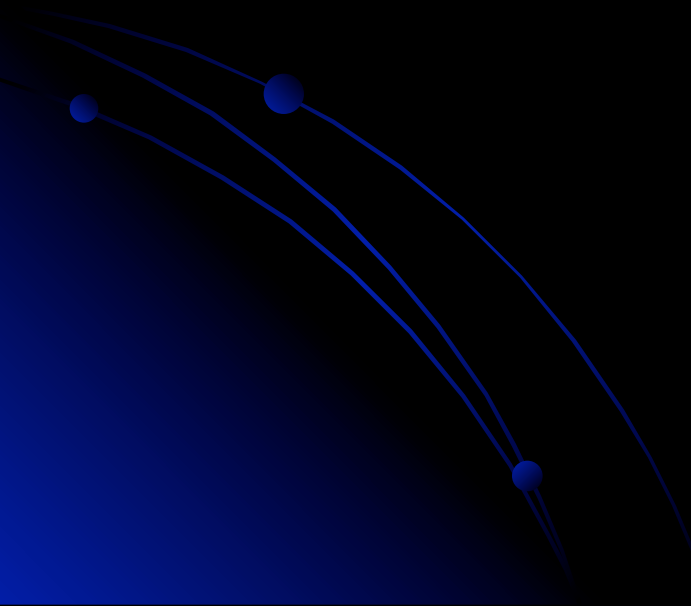


Infection Control

Chapter 15 HST-1



~ Principles of Infection Control

- Microorganism = “microbe”
 - Small, not visible to naked eye
 - Everywhere in environment
- Nonpathogens
 - Part of normal flora of the body
 - Help maintain certain body processes
 - Can become pathogenic in other body systems (i.e. *E. coli*)
- Pathogen
 - Cause infection and disease



Where Bacteria Live



Factors Required for Growth

- Need certain things to grow and reproduce
 - Warm (body temp. = ideal)
 - Dark
 - Source of food & moisture
 - Oxygen needs vary
 - Aerobic vs. anaerobic
- Human body = meets all needs for growth

Classifications of Microorganisms

- **Bacteria**

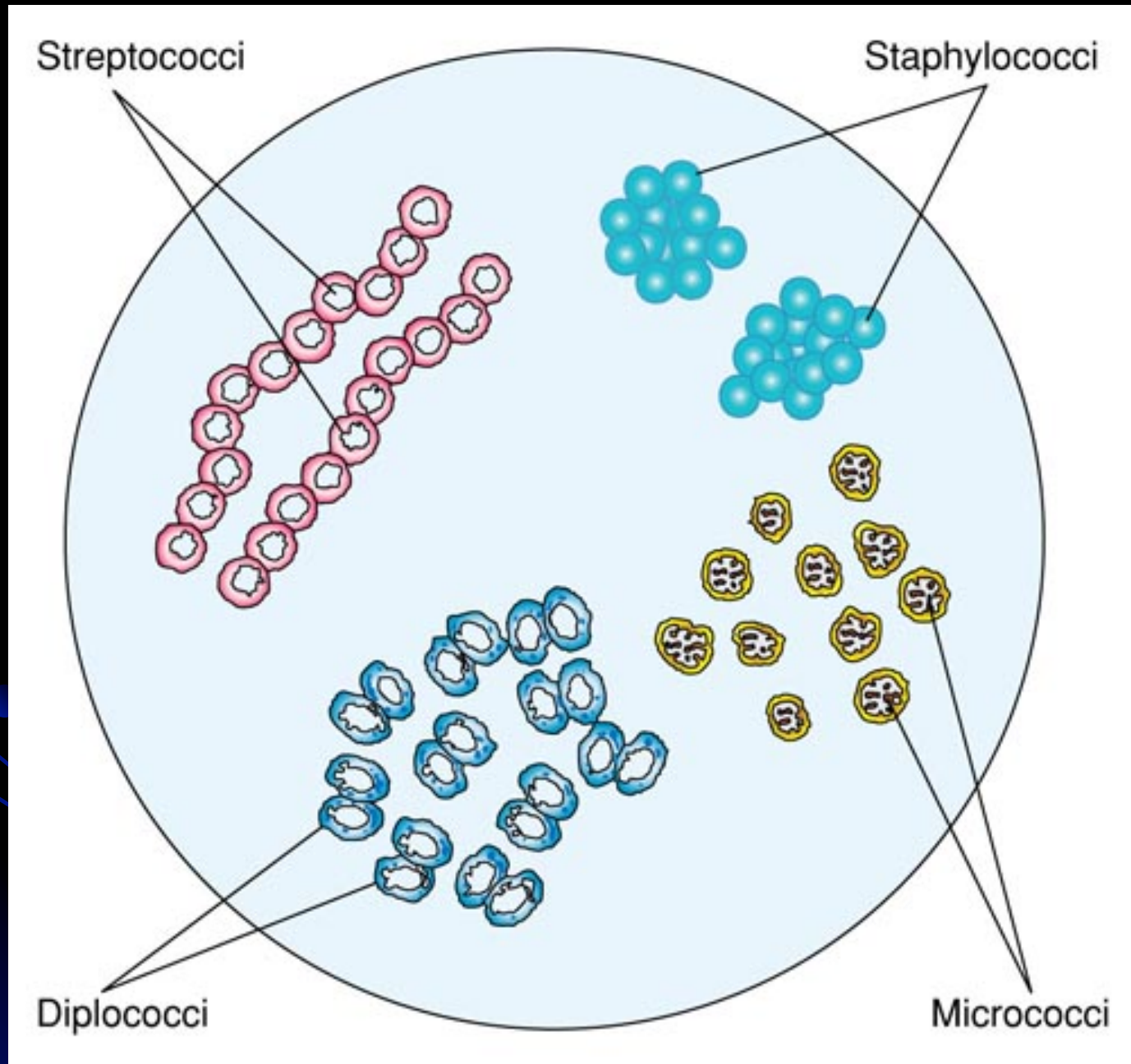
- Simple one-celled plants, multiply rapidly
- Classified by shape & arrangement
 - Cocci = round/spherical
 - Diplococci = pairs
 - Gonorrhea, meningitis, pneumonia
 - Streptococci = chains
 - Severe sore throat, rheumatic fever
 - Staphylococci = clusters/groups
 - Boils, UTI's, wound infections

Streptococci

Staphylococci

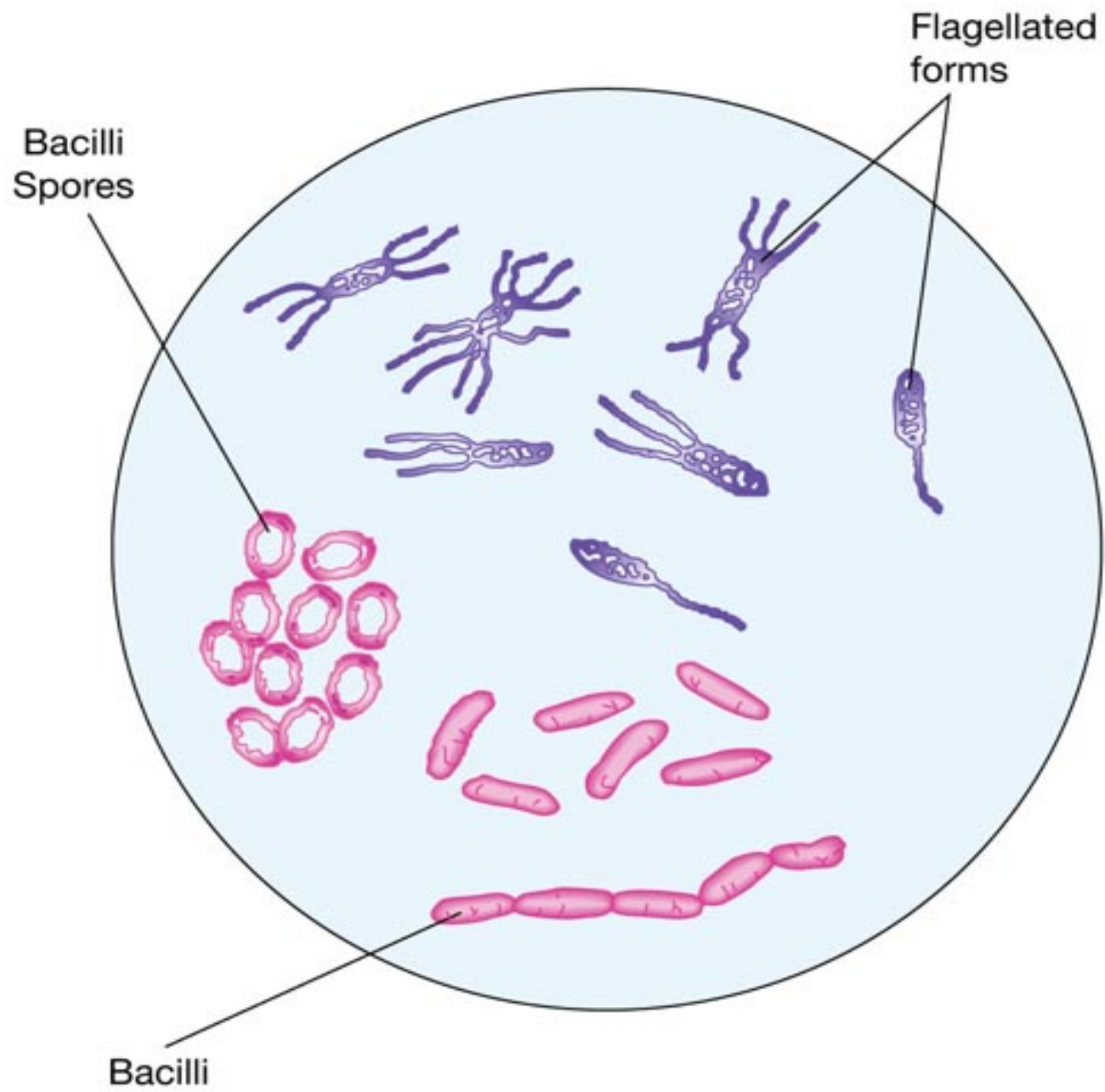
Diplococci

Micrococci

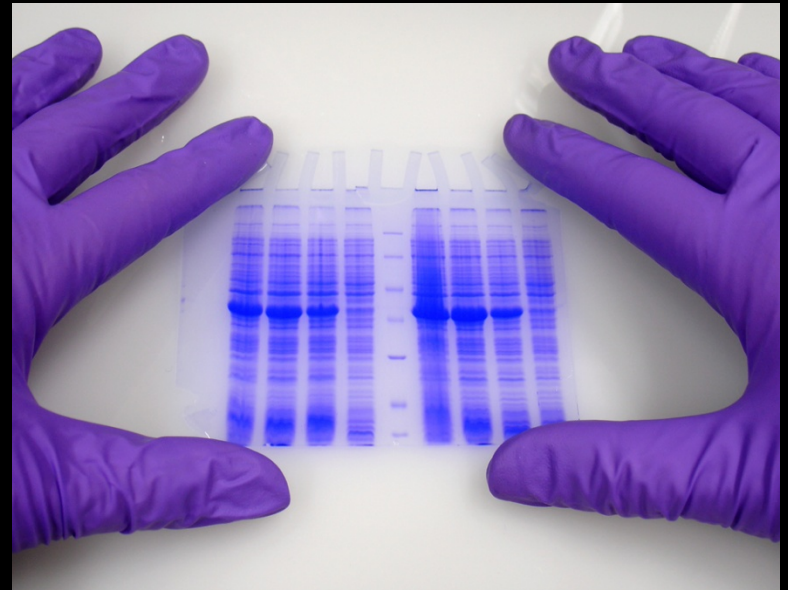


- **Bacteria** (*continued*)

- Bacilli = rod-shaped
 - Single, pairs, chains
 - Flagella = threadlike projections for movement
 - Ability to form spores (thick-walled capsules)
 - TB, tetanus, pertussis (whooping cough), botulism, diphtheria, typhoid
- Spirilla = spiral or corkscrew shape
 - Syphilis, cholera



- Bacteria (*continued*)
 - Antibiotics = kill bacteria
 - Resistance (antibiotic no longer works)
 - MRSA
 - Severe staph infection, difficult to tx



Antibiotic Resistance



● Protozoa

- One-celled, animal-like organism
- Found in decayed material, animal or bird feces, contaminated water
- Flagella
- Malaria, amebic dysentery, trichomonas, African sleeping sickness

Protozoa



- **Fungi**

- Simple, plant-like
- Live on dead organic matter
- Yeasts and molds
- Ringworm, athletes' foot,
histoplasmosis,
yeast vaginitis,
thrush



- **Rickettsiae**

- Parasitic

- Cannot live outside cells of another living organism

- Found on fleas, lice, ticks, mites

- Transmitted by bites

- Typhus fever, Rocky Mountain spotted fever

- Antibiotics usually effective

Rickettsiae



Attachment of rickettsiae to the surface of an endothelial cell is followed by their entry into the cell via rickettsia-induced phagocytosis. Following phagocytosis, the phagosome membrane (arrow) is lost and the rickettsiae escape into the host cell cytoplasm. Bar = 0.5 μ m



● Viruses

- Smallest microorganism
- Must be inside another living cell to reproduce
- Spread through blood and body secretions
- Antibiotics not effective
- Common cold, measles, mumps, chicken pox, herpes, warts, influenza, polio

- **Viruses** (*continued*)

- Constantly mutating and changing genetic information
- Zoonotic Infections: Animals to humans
- Examples
 - SARS: Severe Acute Respiratory Syndrome
 - West Nile Virus (WNV)
 - Monkeypox
 - Ebola & Marburg
 - H5N1 virus (bird flu)

- **Viruses (*continued*)**

- Concern to health care workers

- HBV

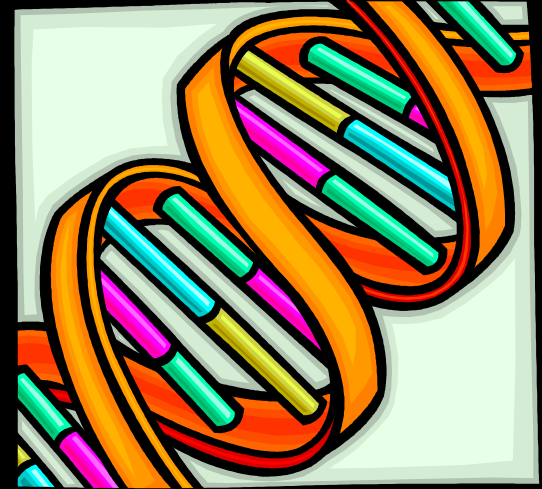
- Federal law – vaccine (3 injections) @ no cost to employees
- Required for those with occupational exposure

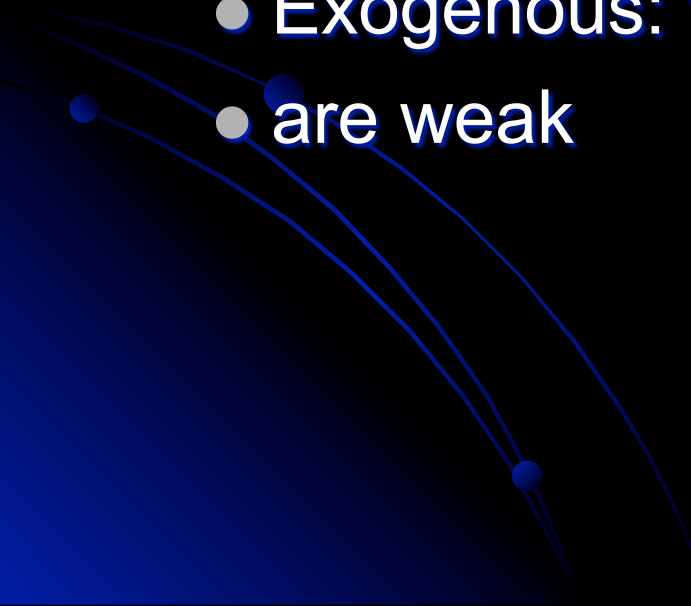
- HCV

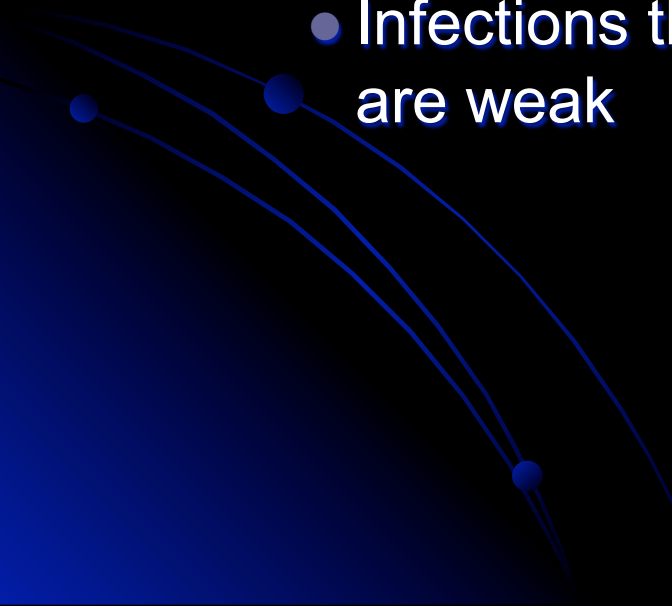
- AIDS (HIV)

- **Helminths**

- Multicellular parasitic organisms
 - AKA = worms or flukes
- Transmitted through eggs / larvae in contaminated food or bites of infected insects
- Examples
 - Hookworms, ascariasis, trichinella, enterobiasis, taenia solium

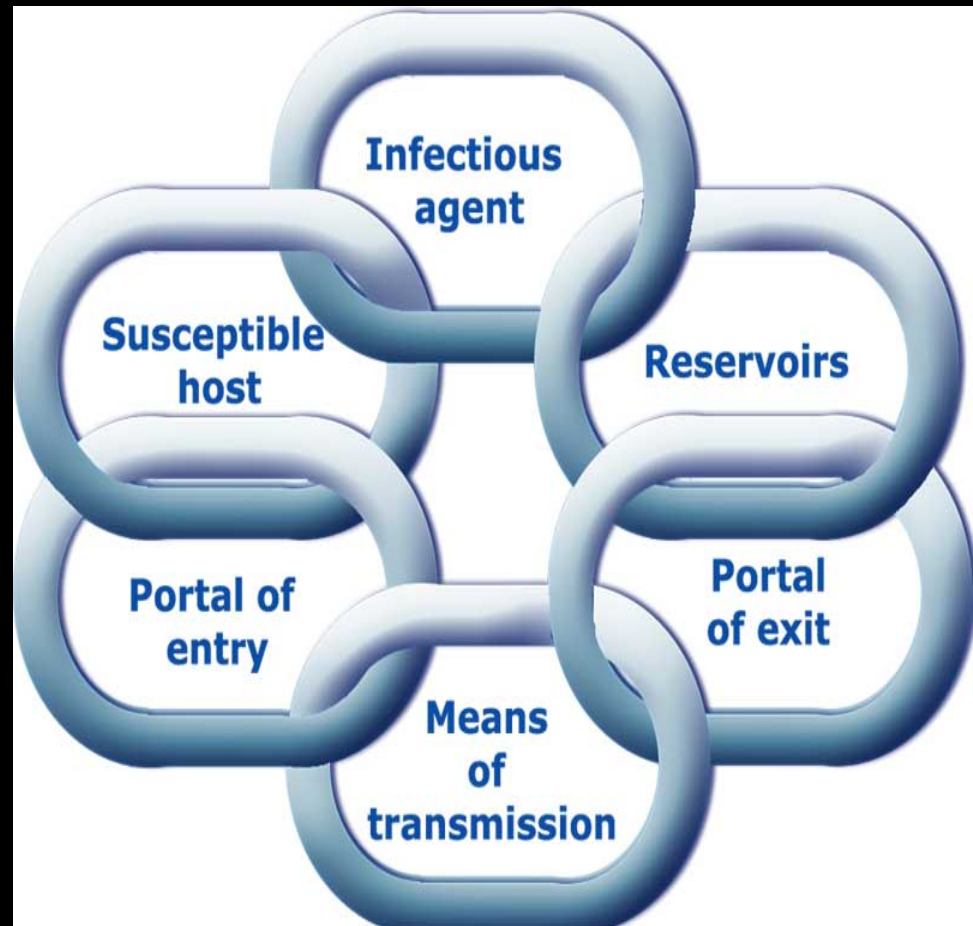


- 3 ways pathogens cause infection
 - Produce poisons, toxins
 - Allergic reactions
 - Invade & destroy living cells
 - Classification
 - Endogenous: originates within the body
 - Exogenous: from outside the body
 - are weak
- 

- Nosocomial: now HAI: Hospital Acquired Infection
 - Infections acquired by an individual in a health care facility
 - Opportunistic
 - Infections that occur when the body's defenses are weak
- 

Chain of Infection

- Factors that must exist for an infection to occur



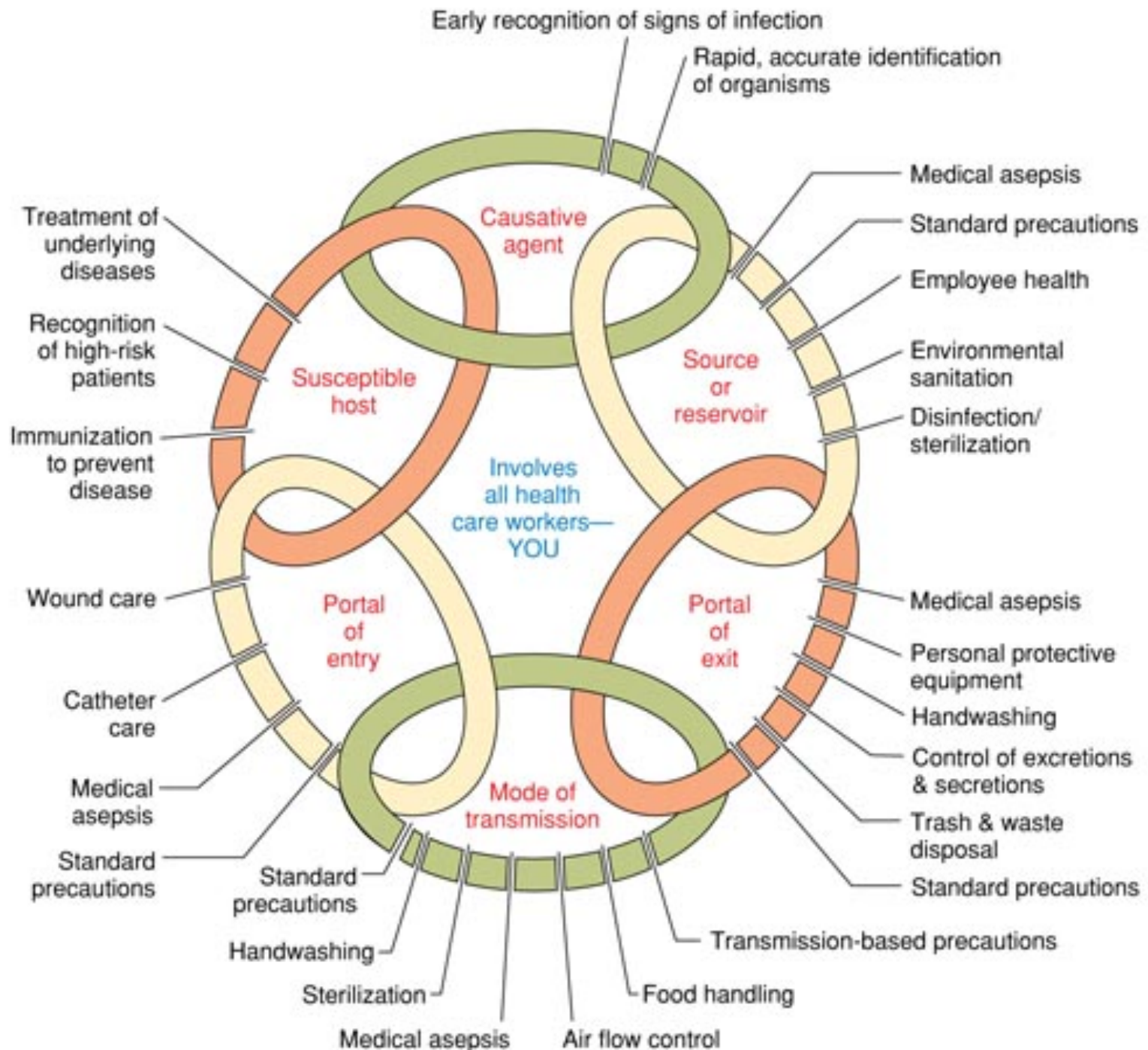
- Causative agent = pathogen
- Reservoir = area where pathogen lives
 - Examples: human body, animals, environment, fomites, contaminated objects
- Portal of exit = way pathogen escapes
 - Examples: urine, feces, saliva, blood, tears, mucous, wound drainage



- Mode of transmission = way pathogen transmitted to another reservoir or host
 - Direct: person to person
 - Indirect:
 - Substances – food, air, soil, insects, feces, clothing, instruments & equipment
 - Airborne
 - Insects, rodents, small animals

- Portal of entry = way pathogen enters new reservoir or host
 - Examples: break in skin, respiratory tract, digestive tract, GU tract, circulatory system
- Susceptible host = person who can contract disease
 - Defenses: mucous membranes, cilia, coughing & sneezing, stomach acid, tears, fever, inflammation,
 - Immune response: antibodies, cells secrete chemicals such as interferon

Breaking the Chain of Infection



Aseptic Techniques

- Ways to break the chain of infection
- Terms:
 - Asepsis = absence of disease-producing pathogen
 - Sterile = free from all organisms
 - Contaminated = pathogens present on object, etc.
- AIM to maintain cleanliness and eliminating or preventing contamination



- Common techniques:
 - Hand washing
 - Personal hygiene
 - PPE's
 - Proper cleaning of instruments / equipment
 - Clean environment

- **Antisepsis**

- Prevent or inhibit growth of pathogens
- Usually not effective against spores / viruses

- **Disinfection**

- Destroys or kills pathogens
- Not always effective against spores / viruses

- **Sterilization**

- Process that destroys ALL microorganisms
- Steam under pressure, gas, radiation, & chemicals
- Autoclave



Discovery
EDUCATION

~ Bioterrorism

- Use of microorganisms, or biologic, agents, as weapons to infect humans, animals, or plants
- Used throughout history
 - 1346 ~ Dead plague victims
 - 1763 ~ Indians and smallpox
 - WWII ~ POW' s exposed to pathogens
- Only a limited number of microorganisms considered ideal

● Characteristics of “Ideal” Microorganisms

- Inexpensive
- Readily available
- Spread through air, food, water
- Survives sunlight, drying, and heat
- Cause death or severe disability
- Easily transmitted
- Difficult to prevent
- No effective treatment

- CDC identified high-priority agents

- **Smallpox**

- Highly contagious
- New vaccine program

- **Anthrax**

- Highly resistant to destruction
- Can live in soil for years
- Cutaneous, GI, Pulmonary

- **Plague**

- **Botulism**

- Paralytic illness caused by nerve toxin

- **Tularemia**

- **Filoviruses**

- Infectious disease, causes severe hemorrhagic fever



Preparing for Bioterrorism

- Epidemic = public health emergency
- Major stress on HC facilities
- Fear / panic = riots, social disorder, disregard for authority
- Bioterrorism Act of 2002
 - June 2002
 - Requirements:
 - US plan against bioterrorism
 - Increased security
 - All levels of gov' t involved

Aspects of Preparation

- Community surveillance
- Notify public of high risk situations
- Strict infection control procedures
- Increased funding for research, vaccine development, prevention
- Restrictions / guidelines for transporting
- Mass immunization
- Increased protection of food / water
- Training HC workers for dx and tx
- Emergency management policies
- Criminal investigations
- Improve HC facilities to deal w/ and communicate in case of / during attack

~ Observing Standard Precautions

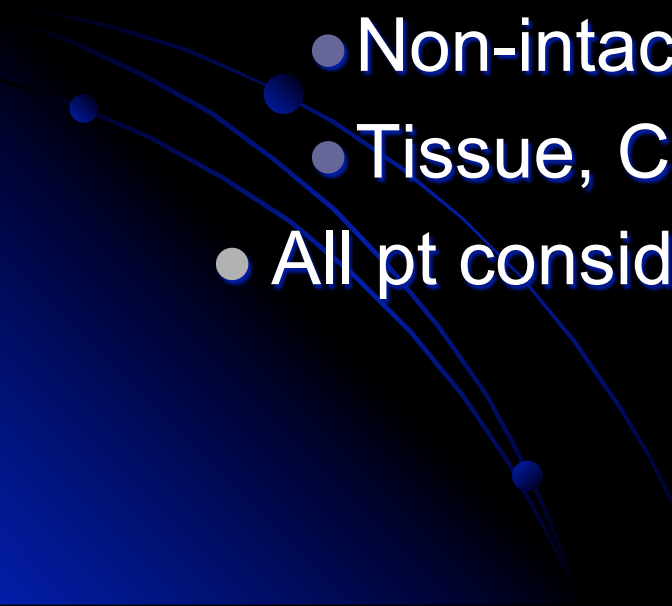


- Pathogens spread through blood and body fluids
- Major concern
 - HBV
 - HCV
 - HIV

- Bloodborne Pathogen Standard
 - Est. 1991 by OSHA
 - Mandatory to follow in all HC facilities
 - Regulations
 - Written exposure plan
 - Id employees with occupational exposure
 - HBV vaccine free to employees
 - PPE & hand washing facilities
 - Immediate decontamination
 - Infectious waste disposal

- No eating, drinking, smoking, application of cosmetics in clinical area
- Provide sharps containers
- Post signs for biohazard area
- Label all biohazardous with biohazard symbols
- Confidential medical evaluation and follow-up for exposure
- Training provided at no cost and during working hours

- Needlestick Safety & Prevention Act
 - Passed by congress, 2000
 - CDC = est. 800,000 sticks/year
 - Requirements
 - Safer devices
 - Needleless systems
 - Update Exposure Plan annually
 - Input from nonmanagerial employees responsible for pt care
 - Maintain sharps injury log

- Standard Precautions
 - Developed by CDC
 - Every body fluid = potential source of infection
 - Blood, blood components
 - Mucus, sputum, saliva, CSF, urine, feces
 - Mucous membranes
 - Non-intact skin
 - Tissue, Cell-specimens
 - All pt considered infectious regardless of dx
- 

STANDARD PRECAUTIONS

FOR INFECTION CONTROL



Wash Hands (Plain soap)

Wash after touching **blood, body fluids, secretions, excretions**, and **contaminated items**. Wash immediately **after gloves are removed** and **between patient contacts**. Avoid transfer of microorganisms to other patients or environments.



Wear Gloves

Wear when touching **blood, body fluids, secretions, excretions**, and **contaminated items**. Put on **clean** gloves just **before touching mucous membranes** and **nonintact skin**. Change gloves between tasks and procedures on the same patient after contact with material that may contain high concentrations of microorganisms. Remove gloves promptly after use, before touching noncontaminated items and environmental surfaces, and before going to another patient, and wash hands immediately to avoid transfer of microorganisms to other patients or environments.



Wear Mask and Eye Protection or Face Shield

Protect mucous membranes of the eyes, nose and mouth during procedures and patient-care activities that are likely to generate **splashes** or **sprays** of **blood, body fluids, secretions**, or **excretions**.



Wear Gown

Protect skin and prevent soiling of clothing during procedures that are likely to generate **splashes** or **sprays** of **blood, body fluids, secretions**, or **excretions**. Remove a soiled gown as promptly as possible and wash hands to avoid transfer of microorganisms to other patients or environments.



Patient-Care Equipment

Handle used patient-care equipment soiled with **blood, body fluids, secretions, or excretions** in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of microorganisms to other patients and environments. Ensure that reusable equipment is not used for the care of another patient until it has been appropriately cleaned and reprocessed and single use items are properly discarded.



Environmental Control

Follow hospital procedures for routine care, cleaning, and disinfection of environmental surfaces, beds, bedrails, bedside equipment and other frequently touched surfaces.



Linen

Handle, transport, and process used linen soiled with **blood, body fluids, secretions, or excretions** in a manner that prevents exposures and contamination of clothing, and avoids transfer of microorganisms to other patients and environments.



Occupational Health and Bloodborne Pathogens

Prevent injuries when using needles, scalpels, and other sharp instruments or devices; when handling sharp instruments after procedures; when cleaning used instruments; and when disposing of used needles.

Never recap used needles using both hands or any other technique that involves directing the point of a needle toward any part of the body; rather, use either a one-handed "scoop" technique or a mechanical device designed for holding the needle sheath.



Do not remove used needles from disposable syringes by hand, and do not bend, break, or otherwise manipulate used needles by hand. Place used disposable syringes and needles, scalpel blades, and other sharp items in puncture-resistant sharps containers located as close as practical to the area in which the items were used, and place reusable syringes and needles in a puncture-resistant container for transport to the reprocessing area.



Use **resuscitation devices** as an alternative to mouth-to-mouth resuscitation.



Patient Placement

Use a **private room** for a patient who contaminates the environment or who does not (or cannot be expected to) assist in maintaining appropriate hygiene or environmental control. Consult Infection Control if a private room is not available.

Handwashing



- MOST important method used to practice aseptic technique
- Purpose:
 - Prevent and control spread of pathogens
 - Protect HC worker from disease / illness
- New CDC guidelines, 2002
 - Plain soap and H₂O
 - Routine cleansing when visibly dirty / soiled

- Antiseptic handwashing

- Antimicrobial soap and water
- Prior to invasive procedures
- Critical care units
- Caring for pt on specific transmission-based precautions
- Facility policy

- Antiseptic handrubs

- Waterless, alcohol-based
- When hands are not visibly dirty / soiled with fluids

Times to Wash Hands

- Arrive @ / before leaving work
- Before and after pt contact
- Any time hands become contaminated
- Before and after removing gloves
- If gloves are torn / punctured
- Before and after handling specimen
- After contact with contaminated object
- After personal use of restroom
- After coughing, sneezing
- Before and after contact with mouth or mucous membranes

Principles of Proper Handwashing

- Soap as cleansing agent
- Warm water
- Friction to help eliminate pathogens from skin surface
- Clean all surfaces
- Point fingertips downward
- Use dry paper towels to turn faucet on / off
- Clean nails

● Nails

- Artificial or long nails prohibited in some HC facilities
- Keep short
- Nails can harbor pathogens, transmit disease, injure pt, or puncture gloves

● Waterless hand cleansing

- Safe during routine pt care
- Rub until dry (approx 15 sec.)
- Wash with soap and water after 6 – 10 cleanings with alcohol-based products

- Gloves

- Times to wear....
- Change after every pt & procedure on same pt if contaminated
- Carefully remove
- Wash hands after removal
- Never wash / reuse

- Gowns

- When to wear...
- Protects clothes
- Dispose properly, wash hands



- Masks

- Prevents exposure to mucous membranes
- Use once, change every 30 min or when moist or soiled

- Face shields & eyewear

- Provide protection from every angle
- If not disposable, must be disinfected before reuse



- Sharp objects
 - Extreme care
 - Safe devices if possible
 - Needles = never bend, break, or recap after use
 - Place in labeled sharps container
 - Never open or empty container
 - Melted, follow facility policy for disposal

- Spills, Cleaning, & Waste
 - Wipe up stat (clean with 10% bleach solution)
 - Wear PPE
 - Large spills = powder
 - Follow agency policy
 - Infectious waste into biohazard bags
 - Soiled linen
 - Laundry bags
 - Linens soiled with blood or body fluids placed in special bags; soaked in special disinfectant prior to wash

- Reporting Procedures for Accidents
 - Required to report immediately (cuts, sticks, splashing of blood or fluids)
 - Follow agency policy to deal with injury / contamination
 - Reporting
 - Follow policy
 - Report any incidents
 - Record care given
 - Note follow-up care
 - Id ways to prevent similar accidents