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Diseases carriers , Reservoirs of infection , Disinfection , Communicable Diseases

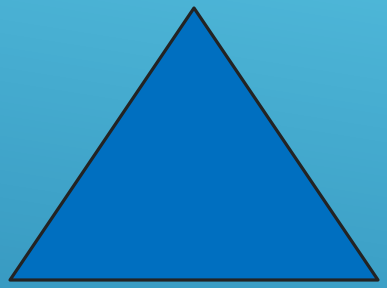
OBJECTIVES:

- At the end of this session the students will be able to;

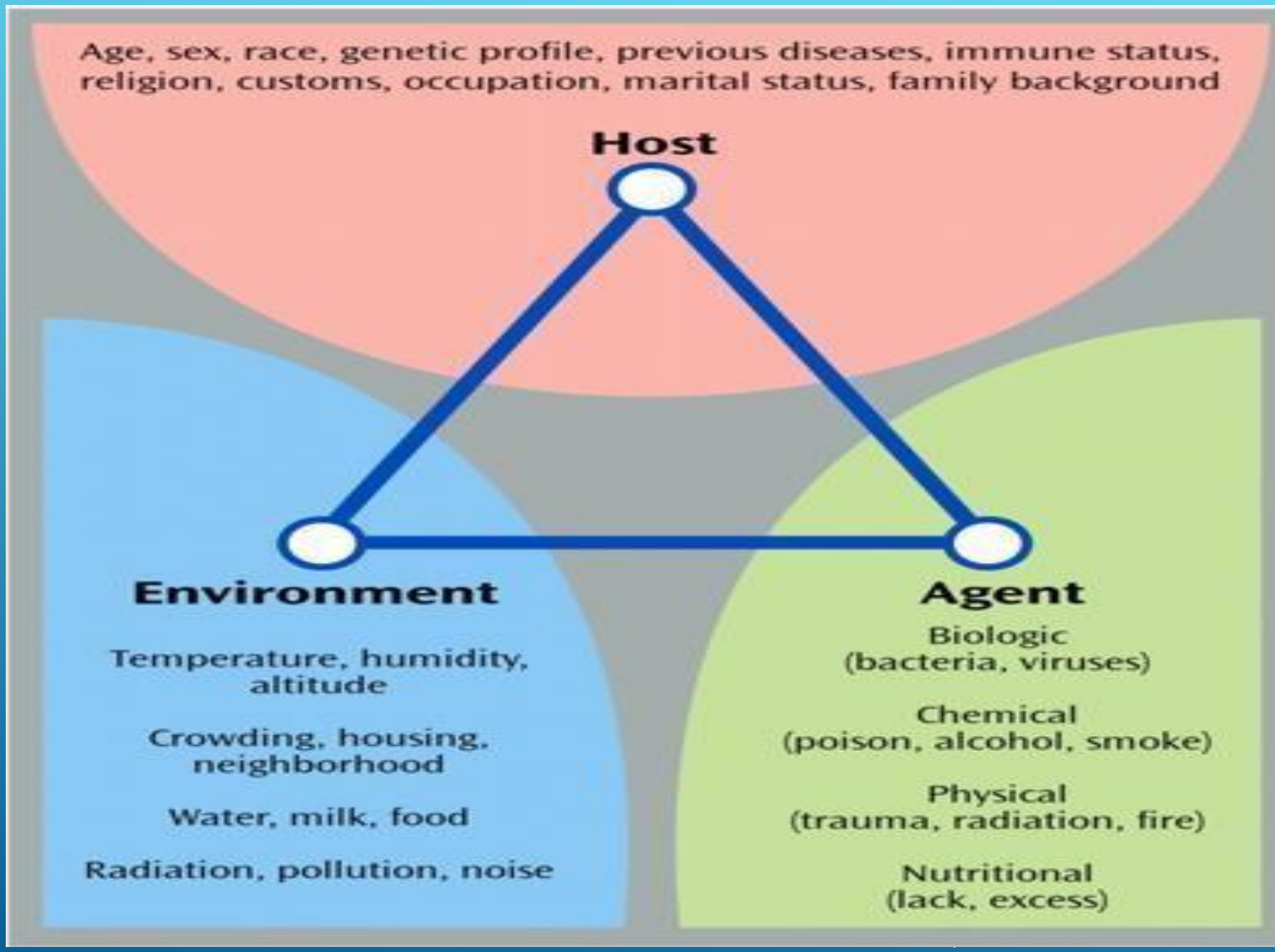
- Describe the diseases carrier
- Explain the reservoir of infection
- Differentiate between disinfection and sterilization
- Explain the types and procedures of disinfection
- Discuss the Communicable diseases control measures (aimed at agent , host , others , administrative measures and vector measures)

EPIDEMIOLOGIC TRIAD

- The standard model of infectious disease causation.
- It has 3 corners (vertices).

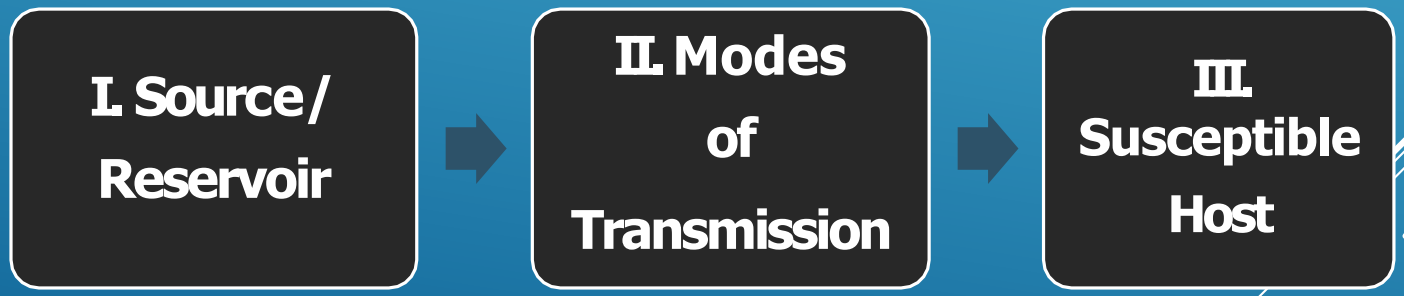


1. ***Agent:*** A microbe that causes disease.
2. ***Host:*** An organism that harbors disease.
3. ***Environment:*** External factors that allows disease transmission.


Age, sex, race, genetic profile, previous diseases, immune status, religion, customs, occupation, marital status, family background
Host
Environment
Temperature, humidity, altitude
Crowding, housing, neighborhood
Water, milk, food
Radiation, pollution, noise
Agent
Biologic (bacteria, viruses)
Chemical (poison, alcohol, smoke)
Physical (trauma, radiation, fire)
Nutritional (lack, excess)

DYNAMICS OF TRANSMISSION

- Communicable diseases are transmitted from the reservoir/source of infection to susceptible host through .



SOURCE/ RESERVOIR OF INFECTION

Any person, animal, plant, soil or substance in which an infectious agent normally lives and multiplies.

The reservoir harbours the infectious agent without injury to itself and serves as a source from which other individuals can be infected.

1. HUMAN RESERVOIRS

Cases

- Primary case
- Index case
- Secondary cases

According to spectrum of disease:

- **Clinical cases**
- (Mild/severe-typical/atypical)
- Sub-clinical cases
- Latent infection cases

Carriers

Type:

- Incubatory
- Convalescent
- healthy

- **Duration:**
- Temporary
- Chronic

- **Portal of exit:**
- Urinary
- Intestinal
- Respiratory
- others

Cases may be:

- PRIMARY CASE: THE FIRST CASE OF AN INFECTIOUS DISEASE INTRODUCED INTO THE POPULATION.
- ***Index case:*** The first case that come to attention of investigators.
- ***Secondary case:*** Case that develops from the primary case.

Cases may be according to spectrum of disease;

1. CLINICAL CASE: MAY BE MILD/SEVERE/TYPICAL OR ATYPICAL DEPENDING UPON THE GRADIENT OF INVOLVEMENT.
2. ***Subclinical cases:*** Asymptomatic or mildly infected that does not alert the patients.
3. ***Latent cases*:** Asymptomatic infection capable of showing symptoms under some circumst ances if activated.

CARRIERS:

- Carriers are infected persons that harbor specific infectious agent in the absence of visible clinical disease and serves as a potential source of infection to others.
- Carriers are less infectious than cases.
- They live a normal life but can infect other individuals.
- Epidemiologically they are more dangerous as these escape recognition.

Carriers may be classified by:

TYPES:

i. ***Incubatory Carrier:*** Person capable of transmitting an infectious agent during incubation period.

ii. ***Convalescent Carrier:*** Person who continue to shed the disease agent during the period of convalescence, e.g. typhoid fever, cholera, whooping cough, in these clinical recovery does not coincide with bacteriological recovery.

iii. ***Healthy Carrier:*** Emerge from subclinical cases.

Cont.

2. TEMPORARY OR CHRONIC:

i. ***Temporary carriers:*** Are those who shed infectious agent for short periods of time. All the three incubatory, convalescent and healthy are included.

ii. ***Chronic carriers:*** A carrier who excretes the infectious agent for indefinite period. E.g. typhoid fever, hepatitis B, dysentery, malaria, etc.

Cont.

3. *Portal of exit:*

- Carriers may be classified according to portal of exit of infectious disease.

1. Urinary

i. Intestinal

ii. Respiratory

iii. Open wounds and

iv. Blood.

2. Animal reservoirs (zoonotic diseases). Infection disease that are transmissible under natural conditions from vertebrate animals to man, e.g. rabies, plague, bovine tuberculosis etc.

3. RESERVOIR IN NON-LIVING THINGS. SOIL AND INANIMATE MATTER CAN ALSO ACT AS RESERVOIR OF INFECTION. E.G. SOIL MAY HARBOR AGENTS THAT CAUSES TETANUS, ANTHRAX ETC.

DIFFERENCE BETWEEN DISINFECTION AND STERILIZATION

BYJU'S The Learning App

DISINFECTION

DISINFECTION IS THE PROCESS OF ELIMINATION OF PATHOGENIC MICROORGANISMS. HOWEVER, THE PROCESS IS NOT EFFECTIVE IN CASE OF VEGETATIVE SPORES

STERILIZATION

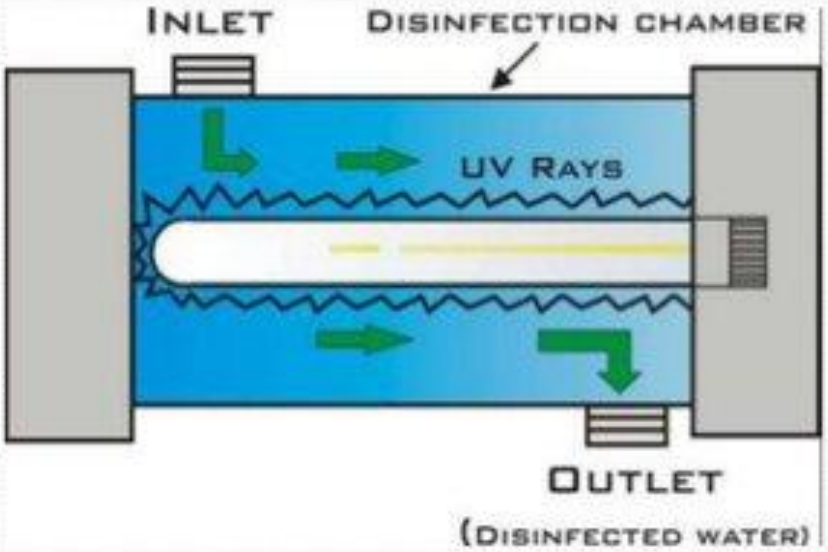
STERILIZATION REFERS TO ANY PROCESS THAT ELIMINATES, REMOVES, KILLS, OR DEACTIVATES ALL FORMS OF LIFE AND OTHER BIOLOGICAL AGENTS PRESENT IN A SPECIFIED REGION

The effects types of disinfectants

Effects level	Disinfectants examples
High level	Ethylene oxide, peracetic acid ,kinds of aldehyde
Normal level	Kinds of alcohol, kinds of iodine, chloric disinfectants
Low level	Chlorhexidine, phenolic disinfectants

Method of disinfection

- Physical method
  - By heat
  - By U.V. rays
- Chemical method
  - Oxidizing chemicals
  - Metal ions
  - Alkalis and acids
- Minor method
  - Boiling of water
  - Treatment with excess lime
  - Treatment with ozone
  - Treatment with iodine and bromine
  - Treatment with ultra-violet rays
  - Treatment with potassium permanganate



MODES OF TRANSMISSION OF DISEASE

COMMUNICABLE DISEASES

A communicable disease is one that spreads from one person or animal to another or from a surface to a person. They include colds and flu. Pathogens such as viruses, bacteria, and fungi cause these diseases.

Communicable diseases can transmit through contact with bodily fluids, insect bites, contaminated surfaces, water, and foods, or through the air.

MODE OF TRANSMISSION

I. Direct transmission

- Direct contact
- Droplet infection
- Contact with soil
- Inoculation into skin or mucosa
- Trans-placental (vertical)

II. Indirect transmission

- Vehicle-borne
- Vector-borne:
  - Mechanical
  - biological
    - propagative
    - Cyclo-prop.
    - Cyclo-develop.
- Air-borne
- Fomite-born

I. DIRECT TRANSMISSION

1. ***Direct contact:*** From source/ reservoir to a susceptible host, e.g. skin to skin contact, STDs AIDS, eye infections etc.
2. ***Droplet infection:*** By saliva & nasopharyngeal

   secretions e.g. flu, diphtheria, whooping cough, tuberculosis, meningococcal meningitis etc.

3. ***Contact with soil:*** The disease agent is in soil e.g. hook worm infection, tetanus, mycosis etc.

4. ***Inoculation into skin or mucosa:*** The disease agent inoculated directly into skin or mucosa e. g. rabies, hepatitis B, etc.

5. ***Trans placental (vertical):*** *e.g*. Toxoplasmosis, others, rubella, cytomegalovirus, herpes simplex (TORCH)

II. INDIRECT TRANSMISSION

1. Vehicle borne transmission:

- The agents multiplies or develops in vehicle & transmits through agencies like water, vegetables, fruits, milk, milk products, ice, blood, serum, tissue or organs transplantation.
- E.g. diarrhea, typhoid, cholera, polio, hepatitis A, brucellosis, etc.

2.VECTOR-BORNE TRANSMISSION:

- Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. It may be:

i. ***Mechanical transmission:*** When a vector simply carries pathogenic microorganisms on their body and transfers them to food. E.g. flies and cockroaches.

II. BIOLOGICAL TRANSMISSION:

a. ***Propagative transmission:*** Multiplication without cyclic change such as DHF, yellow fever, etc.
b. ***Cyclo-development transmission:*** No multiplication but cyclic change such as filariasis, etc.
c. ***Cyclo propagative transmission:*** Multiplication and change in form such as malaria, etc.

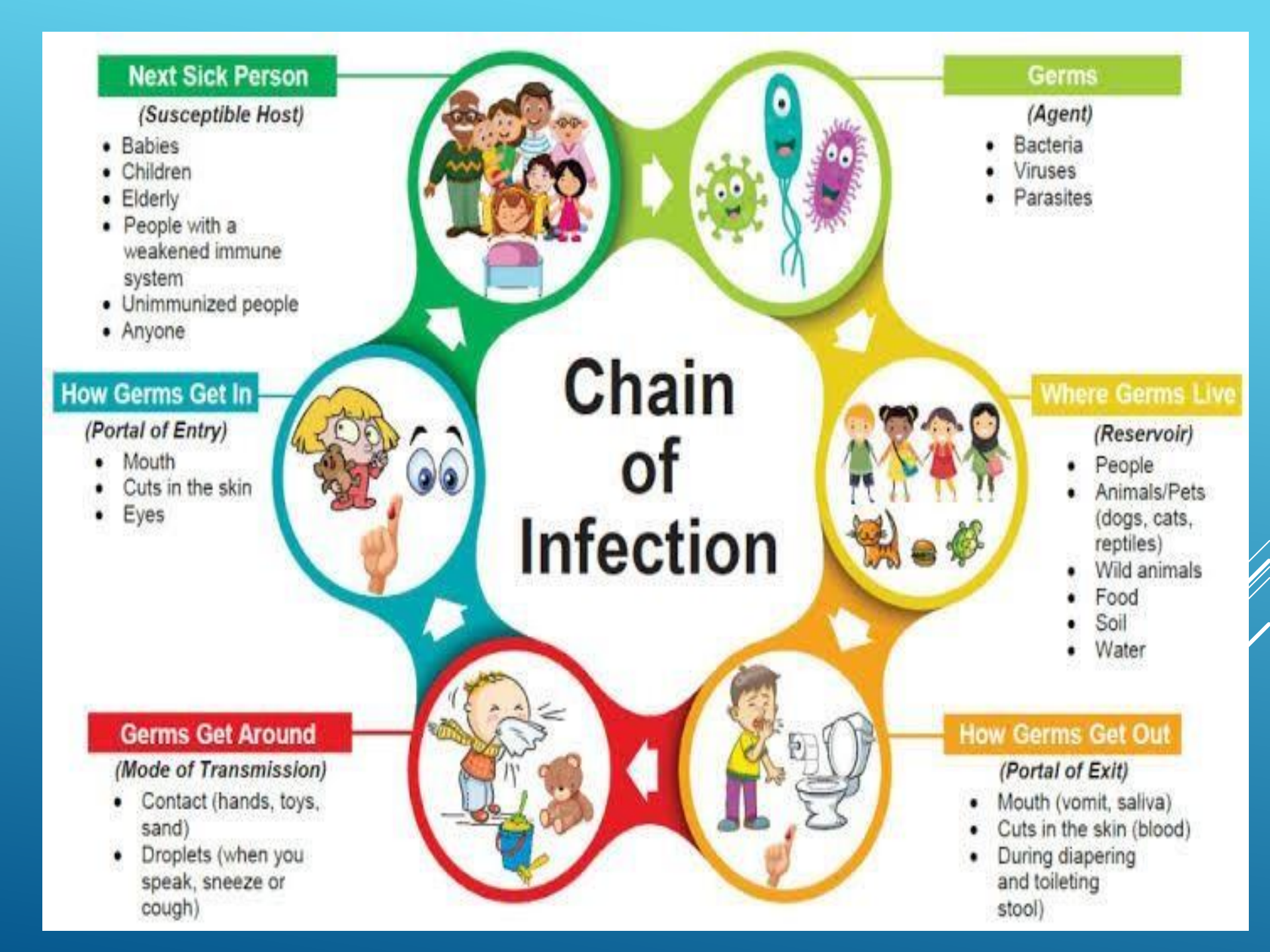
3. AIR BORNE:

- Transmission is carried in air in form of droplets and dust e.g. tuberculosis, influenza, chicken pox, measles, viruses, spores of fungi etc.

4. Fomite borne:

- These are inanimate substances other than water or food contaminated by the infectious discharge, e.g. diphtheria, typhoid bacillary dysentery, hepatitis A, eye and skin infections.

Chain of Infection



Next Sick Person

(Susceptible Host)

- Babies
- Children
- Elderly
- People with a weakened immune system
- Unimmunized people
- Anyone

Germs

(Agent)

- Bacteria
- Viruses
- Parasites

How Germs Get In

(Portal of Entry)

- Mouth
- Cuts in the skin
- Eyes

Where Germs Live

(Reservoir)

- People
- Animals/Pets (dogs, cats, reptiles)
- Wild animals
- Food
- Soil
- Water

Germs Get Around

(Mode of Transmission)

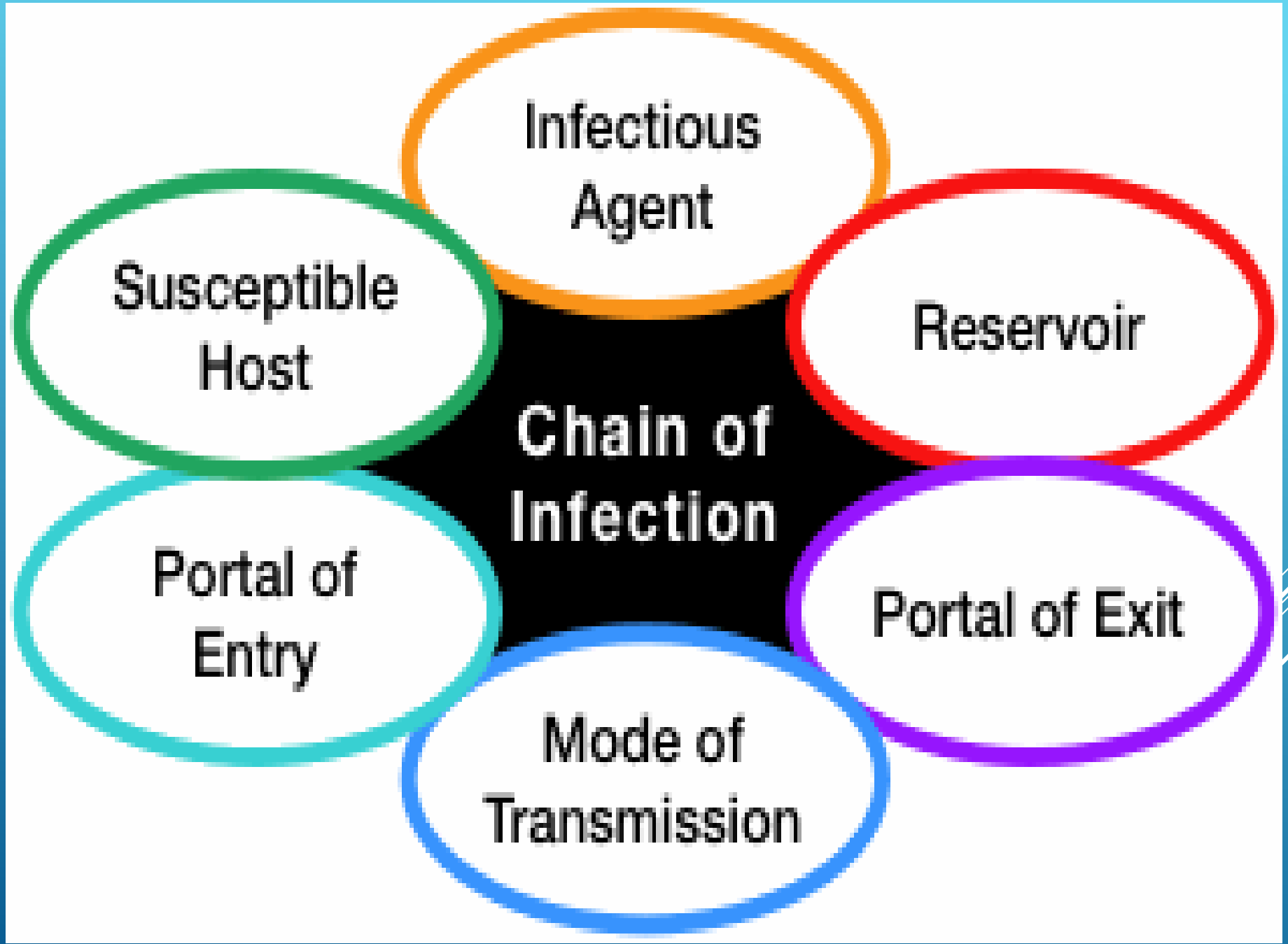
- Contact (hands, toys, sand)
- Droplets (when you speak, sneeze or cough)

How Germs Get Out

(Portal of Exit)

- Mouth (vomit, saliva)
- Cuts in the skin (blood)
- During diapering and toileting stool)

- ***Definition:*** Chain of infection is a model (**a circle of links**) used to understand the infection process.
- Each circle represents a component in the cycle.
- Each link must be present and in the sequential order for an infection to occur.
- Breaking any link in the chain can disrupt the infection.


Infectious Agent
Susceptible Host
Reservoir
Chain of Infection
Portal of Entry
Portal of Exit
Mode of Transmission

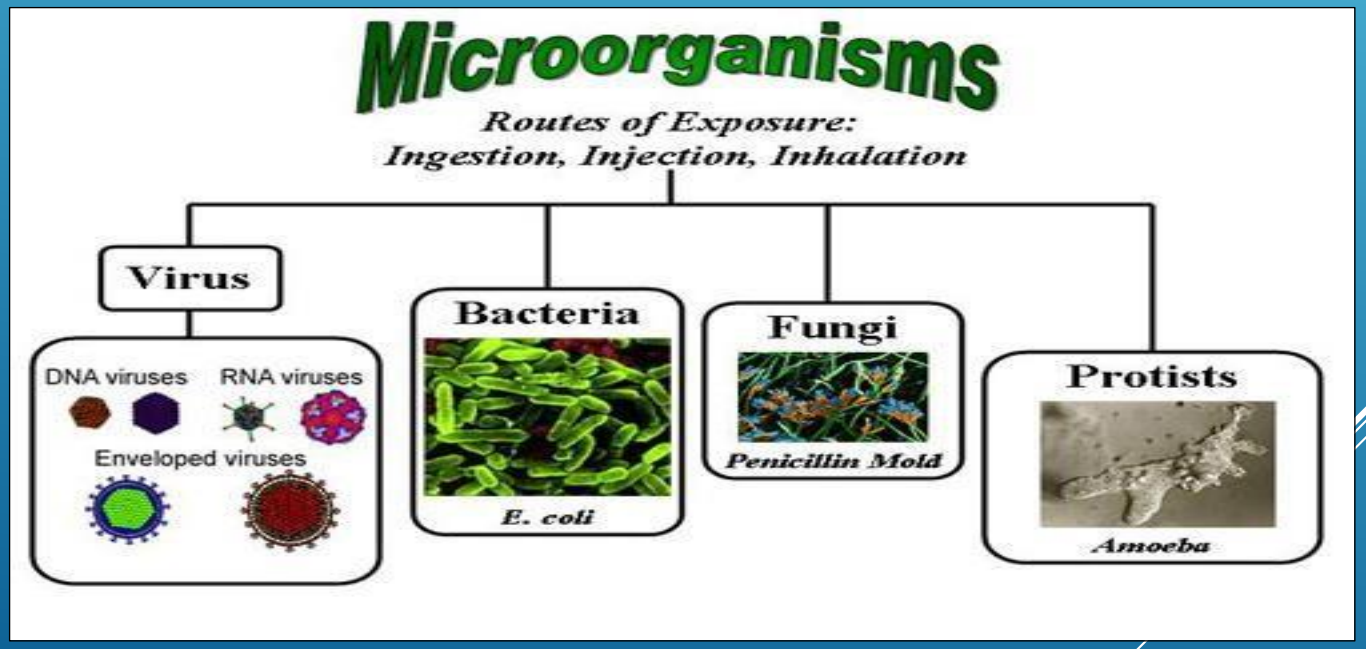
CHAIN OF INFECTION:

- It is the process that begins when,

1. *An infectious agent leaves its*
2. *Reservoir or host through a*
3. *Portal of exit and then*
4. *Is conveyed by some mode of transmission to*
5. *Enter through an appropriate portal of entry to*
6. *Infect a susceptible host*

1. INFECTIOUS AGENT:

THESE ARE THE PATHOGENS THAT CAUSE COMMUNICABLE DISEASES. MOST COMMONLY THESE ARE:



BREAKING THE CHAIN

- ***Infectious agent***
- Early diagnoses and treatment
- Cleaning, disinfection and sterilization
- Infection prevention policies
- Pest control

2. RESERVOIR OR HOST

- The reservoir (source) is a host which allows the pathogen to live, and possibly grow, and multiply.
- Humans, animals and the environment can all be reservoirs for microorganisms.
- Sometimes a person may have a disease but is not symptomatic or ill - carrier.
- E.g. standing water, an infectious person or a dog with rabies.

BREAKING THE CHAIN

2. Reservoir of infection

- Hand hygiene
- Cleaning, disinfection and sterilization
- Infection prevention policies like PPE,
- immunization
- Pest control

3. PORTAL OF EXIT:

- It is the site from where micro-organisms leave the host to enter another host to cause infection. E.g.
- **Upper respiratory tract:** saliva, sneeze, cough
- **Gastrointestinal tract:** feces, vomit
- **Blood:** infected blood
- **Uro - genital tract:** semen, vaginal secretions, urine
- **Skin and mucous membranes:** discharges

BREAKING THE CHAIN

- ***3. Portal of exit***
- Hand hygiene
- Personal protective equipment
- Control of aerosols and splatter (aerosols can transmit respiratory infections like tuberculosis, splashing of mucosa is also a potential risk)
- Respiratory etiquette
- Proper waste disposal

4. MODES OF TRANSMISSION

- The pathogen can be transmitted either by:
- **Direct transmission:** requires close association with the infected host, but not necessarily physical contact.
- **Indirect transmission:** requires a vector, such as an animal or insect.

BREAKING THE CHAIN

4. Mode of transmission

- Hand hygiene
- Personal protective equipment
- Food safety Cleaning, disinfection, sterilization Isolation Safe sex The site through which micro-organisms enter the susceptible host by penetration , inhalation, or ingestion.

5. PORTAL OF ENTRY:

- Inhalation: influenza
- Ingestion: gastro enteritis
- Needle prick: hepatitis B
- Sexual contact: HIV/AIDS,
- Open wound or punctures: tetanus

BREAKING THE CHAIN

5. Portal of entry:

- Hand hygiene
- Personal protective equipment
- Personal hygiene
- First aid
- Safe sex

6. SUSCEPTIBLE HOST:

- A organism that can be infected by pathogens.

- **Vulnerable Populations**:

i. Very young and the very old,

ii. Immune suppressed (due to genetics, transplant drugs, malnutrition, or viral infection like HIV).

iii. Occupational exposure.

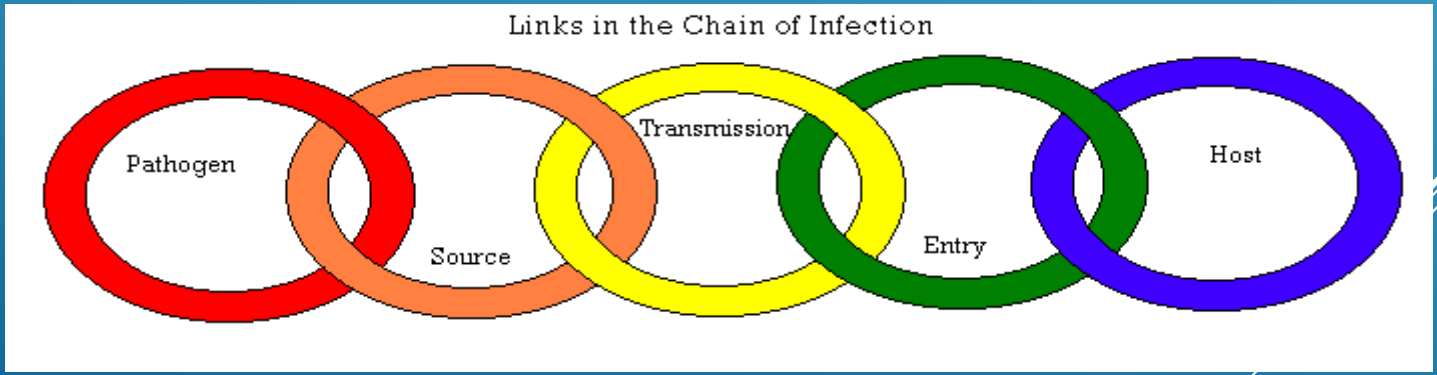
iv. Non-immune.

BREAKING THE CHAIN

- ***6. Susceptible Host:***
- Immunization,
- Health promotion,
- Early diagnosis ant treatment
- Isolation
- Maintain proper sanitation
- Diagnose and treat underlying disease

DIFFERENT WAYS TO BREAK CHAIN

- Diseases have certain weak points
- The basic approach in controlling the disease is to
- Identify these weak points and
- Break the weakest links in chain of transmission



QUIZ
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1. Identify the part(s) of chain of infection that has been eliminated by the following action. Catheter care.

a. Mode of transmission
b. Portal of exit
c. Portal of entry

2. Identify the part(s) of chain of infection that has been eliminated by the following action. Food handling

a. Infectious agent
b. Source /reservoir
c. Mode of transmission

3. Identify the part(s) of chain of infection that has been eliminated by the following action. Hand washing.

a. Susceptible host
b. Mode of transmission
c. Portal of entry

4. Identify the part (s) of chain of infection that has been eliminated by the following action. Identification of organism.

a. Portal of exit
b. Infectious agent
c. Portal of entry

5. Identify the part (s) of chain of infection that has been eliminated by the following action. Personal protective equipment

a. Source/ Reservoir

b. Portal of exit

c. Portal of entry

6. Identify the part (s) of chain of infection that has been eliminated by the following action. Sterilization

- Source or reservoir/mode of transmission
- Portal of entry/Portal of exit
- Mode of transmission / Infectious agent

ANSWERS:

1. c
2. c
3. b
4. b
5. b
6. a

- https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section10.html
- https://professionals.site.apic.org/protect-your-patients/break-the-chain-of-infection/