

Infectious Diseases

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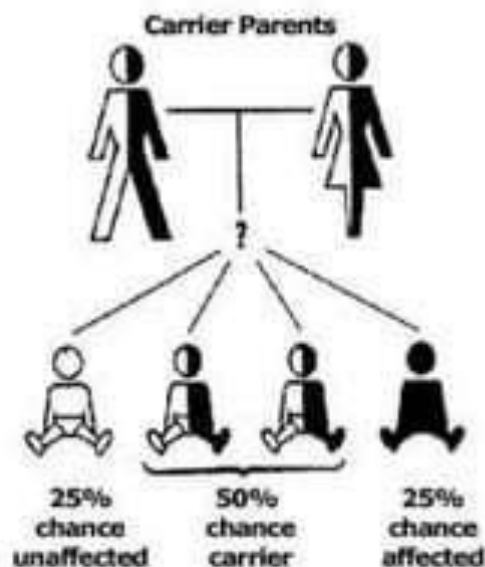
Class: BS-IV

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Department of Zoology

Disease

- ▶ Genetic
- ▶ Biological
- ▶ Physical
- ▶ Chemical



Infectious Diseases - Definitions

- ▶ **Disease** – a pathological condition of body parts or tissues characterized by an identifiable group of signs and symptoms.
- ▶ **Infectious disease** – disease caused by an infectious agent such as a bacterium, virus, protozoan, or fungus that can be passed on to others.
- ▶ **Infection** – occurs when an infectious agent enters the body and begins to reproduce; may or may not lead to disease.
- ▶ **Pathogen** – an infectious agent that causes disease.
- ▶ **Host** – an organism infected by another organism.
- ▶ **Virulence** – the relative ability of an agent to cause rapid and severe disease in a host.

Koch's Postulates



R. Koch

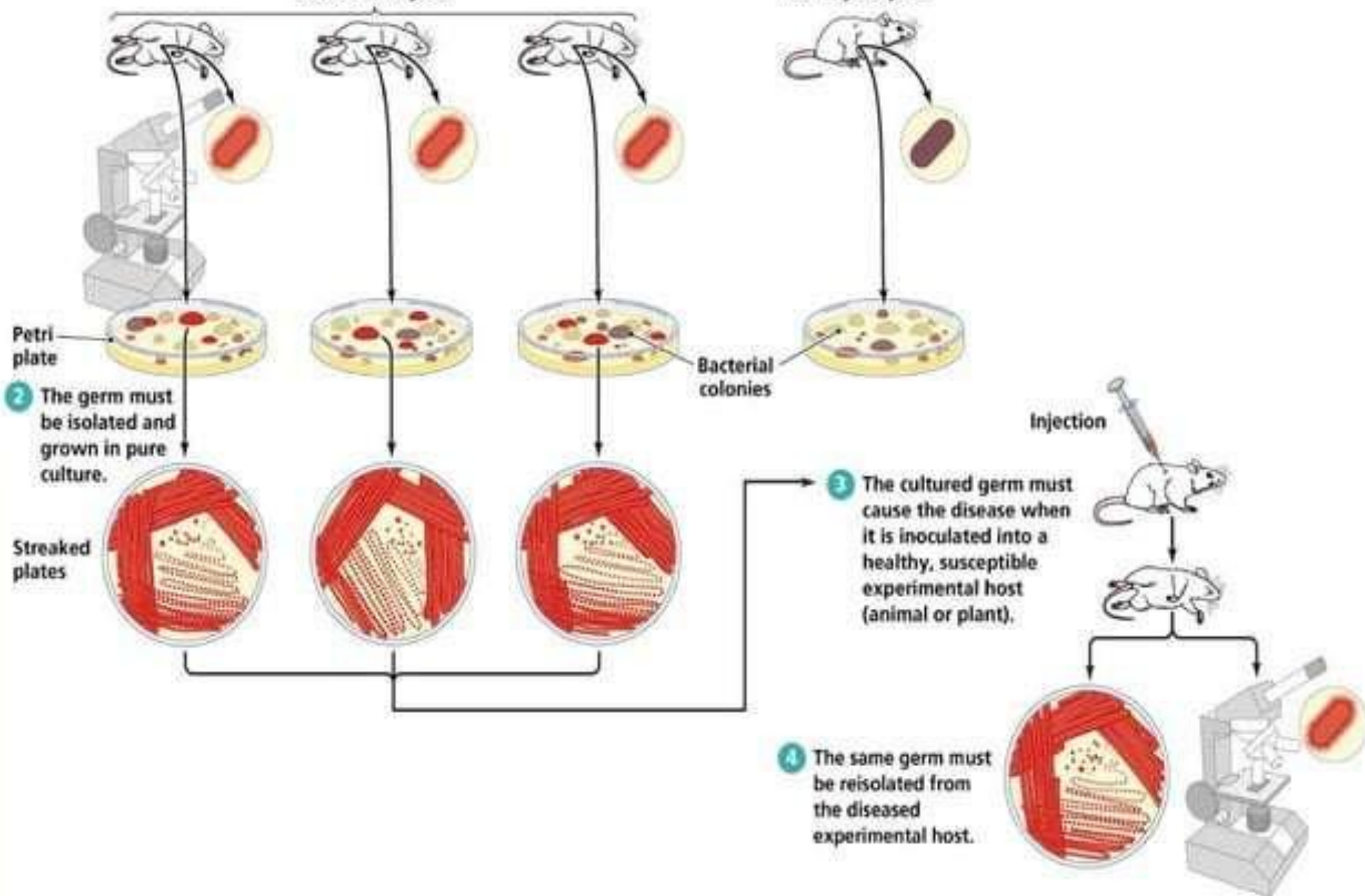
- ▶ Koch developed four criteria to demonstrate that a specific disease is caused by a particular agent.
 1. The specific agent must be associated with every case of the disease.
 2. The agent must be isolated from a diseased host and grown in culture.
 3. When the culture-grown agent is introduced into a healthy susceptible host, the agent must cause the same disease.
 4. The same agent must again be isolated from the infected experimental host.

1 The suspected germ must be present in every case of the disease.

Diseased subjects

Germ not typically found in healthy subjects.

Healthy subjects



2 The germ must be isolated and grown in pure culture.

Streaked plates

Bacterial colonies

Injection

3 The cultured germ must cause the disease when it is inoculated into a healthy, susceptible experimental host (animal or plant).

4 The same germ must be reisolated from the diseased experimental host.

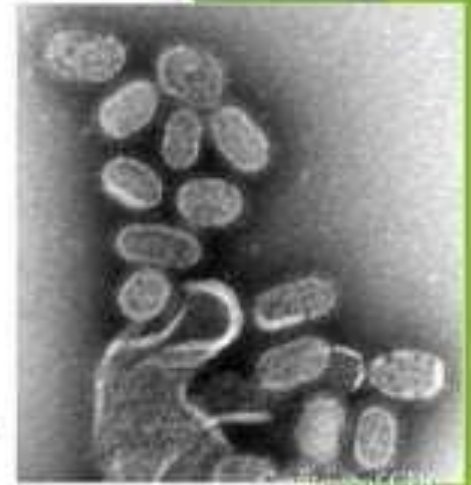
Infectious Disease Agents

- ▶ Most infectious agents that cause disease are microscopic in size and thus, are called microbes or microorganisms.
- ▶ Different groups of agents that cause disease are:
 - ▶ Bacteria
 - ▶ Viruses
 - ▶ Protozoa (Protists)
 - ▶ Fungi
 - ▶ Helminths (Animals)



Infectious Diseases Throughout History

- ▶ Infectious agents have probably always caused disease in humans.
- ▶ Smallpox has been described in ancient Egyptian and Chinese writings and may have been responsible for more deaths than all other infectious diseases combined.
- ▶ There is evidence that malaria and poliomyelitis have existed since ancient times.
- ▶ In the 14th Century, the bubonic plague, or Black Death, killed about 20 million people in Europe alone.
- ▶ In the 20th Century, the 1918 influenza may have killed up to 50 million people worldwide
- ▶ Close to 20 million people have died of AIDS to date.



Recreated 1918 Influenza virions. The 1918 Spanish flu killed more than 500,000 people in the United States and up to 50 million worldwide.

How Infectious Agents Cause Disease

- ▶ Production of poisons, such as toxins and enzymes, that destroy cells and tissues.
- ▶ Direct invasion and destruction of host cells.
- ▶ Triggering responses from the host's immune system leading to disease signs and symptoms.



Courtesy of CDC

Human Immunodeficiency Virus, HIV-1 virions can be seen on surface of lymphocytes.

Phases of Infectious Disease

- ▶ **Incubation period** - time between infection and the appearance of signs and symptoms.
- ▶ **Prodromal phase** - mild, nonspecific symptoms that signal onset of some diseases.
- ▶ **Clinical phase** - a person experiences typical signs and symptoms of disease.
- ▶ **Decline phase** - subsidence of symptoms.
- ▶ **Recovery phase** - symptoms have disappeared, tissues heal, and the body regains strength.

Classification of Infectious Disease

▶ By duration

- ▶ **Acute** - develops and runs its course quickly.
- ▶ **Chronic** - develops more slowly and is usually less severe, but may persist for a long, indefinite period of time.
- ▶ **Latent** - characterized by periods of no symptoms between outbreaks of illness.

▶ By location

- ▶ **Local** - confined to a specific area of the body.
- ▶ **Systemic** - a generalized illness that infects most of the body with pathogens distributed widely in tissues.

▶ By timing

- ▶ **Primary** - initial infection in a previously healthy person.
- ▶ **Secondary** - infection that occurs in a person weakened by a primary infection.

Influenza



JEAN-YVES SGRO, UNIVERSITY OF WISCONSIN-MADISON

Example of an Infectious Disease - Flu

- ▶ Acute contagious disease caused by the influenza virus.
- ▶ Respiratory tract infection, but symptoms felt throughout entire body.
- ▶ Epidemics occur seasonally with low fatality; more deadly pandemics occur several times each century.
- ▶ Highly changeable virus that can infect multiple species, including humans, pigs, and birds.
- ▶ Concern exists that current avian flu will lead to a new pandemic.

Transmission of Infectious Diseases

- ▶ Agents that cause infectious diseases can be transmitted in many ways.
 - ▶ Through the air
 - ▶ Through contaminated food or water
 - ▶ Through body fluids
 - ▶ By direct contact with contaminated objects
 - ▶ By animal vectors such as insects, birds, bats, etc.



Aedes aegypti mosquito
Known to transmit
Dengue fever

Reducing the Spread of Infectious Diseases

- ▶ Vaccines
- ▶ Antimicrobial drugs
- ▶ Good personal hygiene and sanitation
- ▶ Protection against mosquitoes
- ▶ Quarantine



Infectious Diseases as a Cause of Death

- ▶ Infectious diseases are responsible for a quarter to a third of all deaths worldwide.
- ▶ Infectious diseases account for more than half of all deaths in children under the age of 5.
- ▶ Of the top ten causes of death compiled by the World Health Organization, five are due to infectious diseases.
- ▶ The top single agent killers are HIV/AIDS, malaria and tuberculosis. The other top killers are lower respiratory infections and diarrheal diseases, which are caused by a variety of agents.

Emerging Infectious Diseases

- ▶ Emerging diseases are those that have recently appeared within a population, or whose incidence or geographic range is increasing rapidly.
- ▶ Diseases can emerge or re-emerge due to:
 - ▶ appearance of a previously unknown agent.
 - ▶ evolution of a new infectious agent.
 - ▶ spread of an infectious agent to a new host.
 - ▶ spread of an infectious agent to new locations.
 - ▶ acquisition of resistance to anti microbial drugs.

Climate Change

- ▶ A New Factor in Infectious Disease



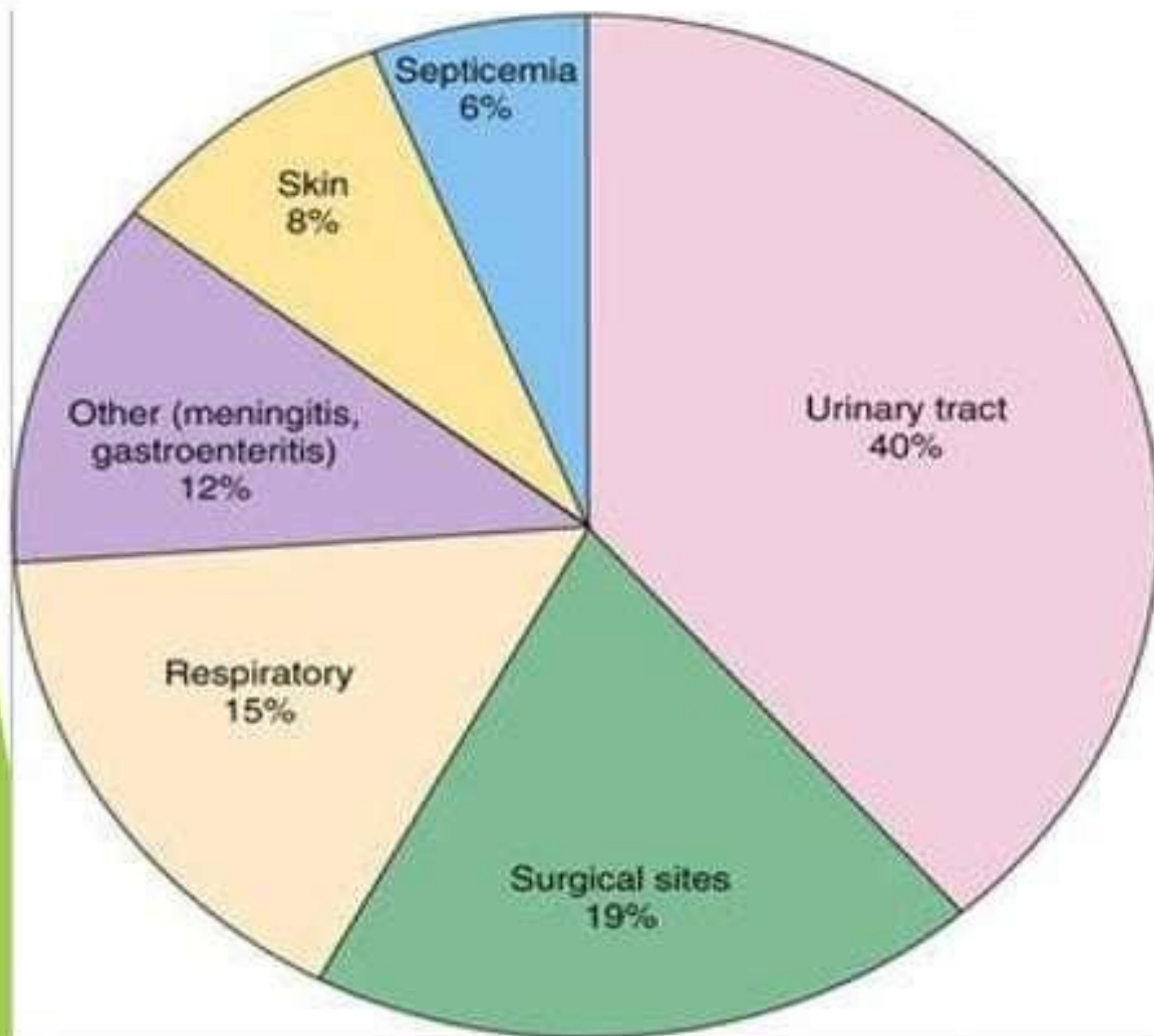
Robin Cochran-Div
PhD)

Modes of Disease Transmission

Table 14.10 Modes of Disease Transmission

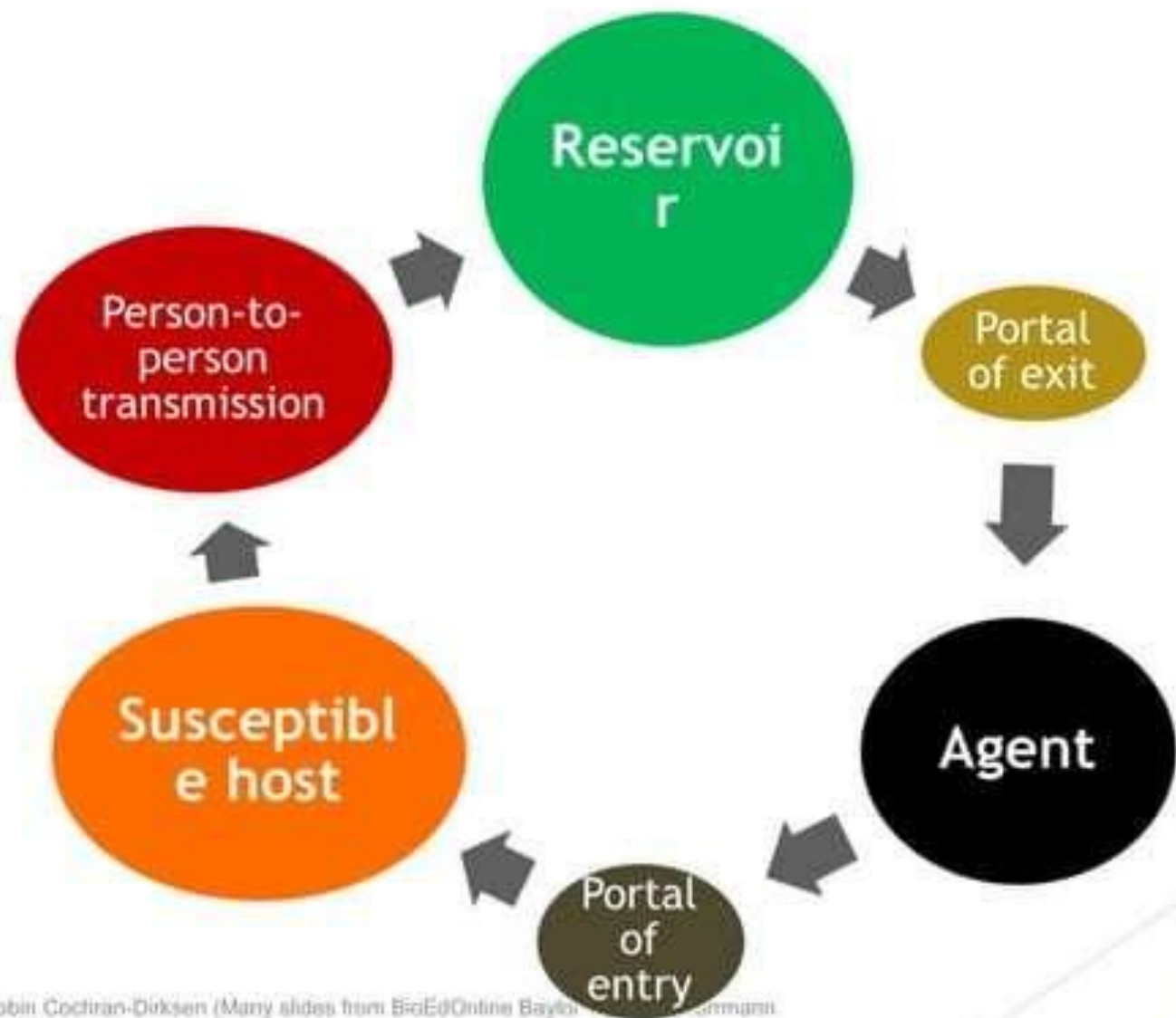
Mode of Transmission	Diseases Spread Include:
Contact Transmission	
Direct Contact: e.g., handshaking, kissing, sexual intercourse, bites	Cutaneous anthrax, genital warts, gonorrhea, herpes, rabies, staphylococcal infections, syphilis
Indirect Contact: e.g., drinking glasses, toothbrushes, toys, punctures	Common cold, enterovirus infections, influenza, measles, Q fever, pneumonia, tetanus
Droplet transmission: e.g., droplets from sneezing (within 1 meter)	Whooping cough, streptococcal pharyngitis (strep throat)
Vehicle Transmission	
Airborne: e.g., dust particles	Chickenpox, coccidiomycosis, histoplasmosis, influenza, measles, pulmonary anthrax, tuberculosis
Waterborne: e.g., streams, swimming pools	<i>Campylobacter</i> infections, cholera, <i>Giardia</i> diarrhea
Foodborne: e.g., poultry, seafood, meat	Food poisoning (botulism, staphylococcal); hepatitis A, listeriosis, tapeworms, toxoplasmosis, typhoid fever
Vector Transmission	
Mechanical: e.g., (on insect bodies) flies, roaches	<i>E. coli</i> diarrhea, salmonellosis, trachoma
Biological: e.g., lice, mites, mosquitoes, ticks	Chagas' disease, Lyme disease, malaria, plague, Rocky Mountain spotted fever, typhus fever, yellow fever

Nosocomial Infections



Disease	Cause	Affected Organ	Transmission
Smallpox	Virus	Skin	Droplet
Influenza	Virus	Respiratory system	Direct contact
HIV/AIDS	Virus	Immune system	Body Fluid
Hepatitis B	Virus	Liver	Body Fluid
Tetanus	Bacteria	Nervous system	Puncture Wound
Strep Throat	Bacteria	Respiratory system	Droplet
Tuberculosis	Bacteria	Respiratory	Droplet

What causes incidence to increase?



Factors influencing disease transmission

