An Infection Model

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Learning outcomes

- Understand and describe a model of infection. Understand the principles of classifying pathogens and to start to accumulatenames and key characteristics of Some common microbes.
- To understand how to apply the model of infectionto a specificillness

An **infection** :

is the invasion of an organism's body tissues by disease-causing agents(bacteria, viruses, fungi and parasites), their multiplication, and the reaction of host tissues to the infectious agents and the toxins they produce.

An **infectious disease** **(transmissible disease):**

is an illness resulting from an infection.

There are four main types of infections:

1. Viral infection include: encephalitis , meningitis, warts , gastroenteritis, COVID-19, (coronavirus infection), hepatitis and influenza.

2. Bacterial infection Bacteria cause a wide range of infectious diseases, including strep

throat and urinary tract infections, meningitis, cholera, diphtheria, dysentery, typhoid, sexually transmitted infections (STIs) and tuberculosis.

Bacteria are also to blame for many skin rashes.

3. Fungal infection include: histoplasmosis, candidiasis, athlete's foot, ringworm and some eye infections

4. Parasitic infection include: Amebic dysentery,Leishmaniasis,Toxoplasmosis,Hydatid cyst,Schistosomiasis and Pinworm infection .

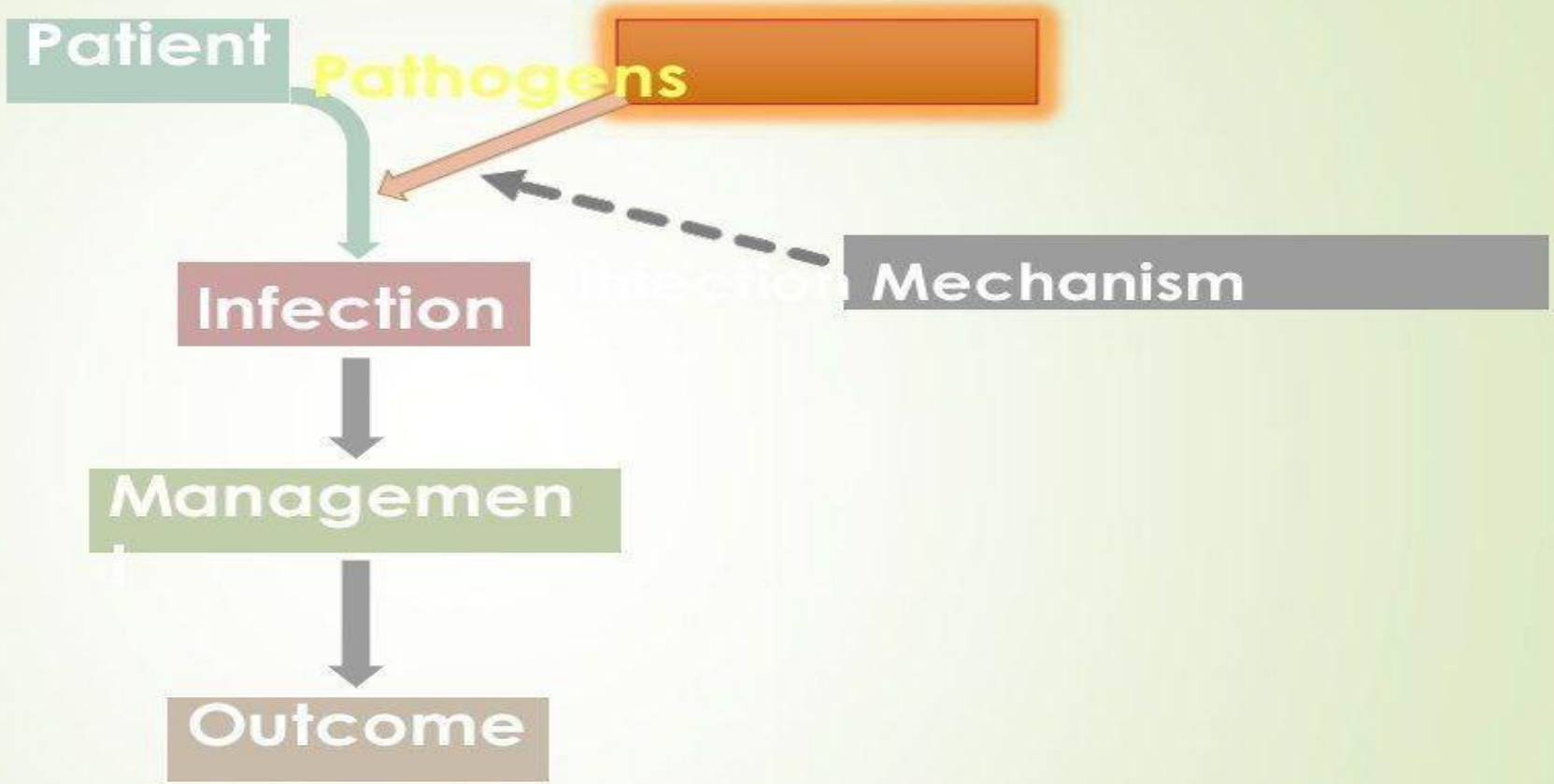
other types of infection

Endogenous infection : Infection that develops within the body due to organisms already present in the body. Example: bacterial vaginosis

Exogenous infection : Infection that starts outside the body, caused by foods, fluids, fomites, etc. Example: food poisoning due to contaminated food

Nosocomial infection : Hospital-acquired infection that is typically resistant to antibiotics Example: sepsis due to methicillin-resistant *Staphylococcus aureus* **(MRSA**)

Opportunistic infection (OI): Infection that occurs when the body's defenses are compromised. An infection that occurs more frequently or is more severe in people with weakened immune systems, such as people with HIV or people receiving chemotherapy and people with diabetes than in people with healthy immune systems. (Cytomegalovirus (CMV) , Tuberculosis (TB) ,Candidiasis and Toxoplasmosis)


Patient
Pathogens
Mechanism
Infection
Managemen
Outcome

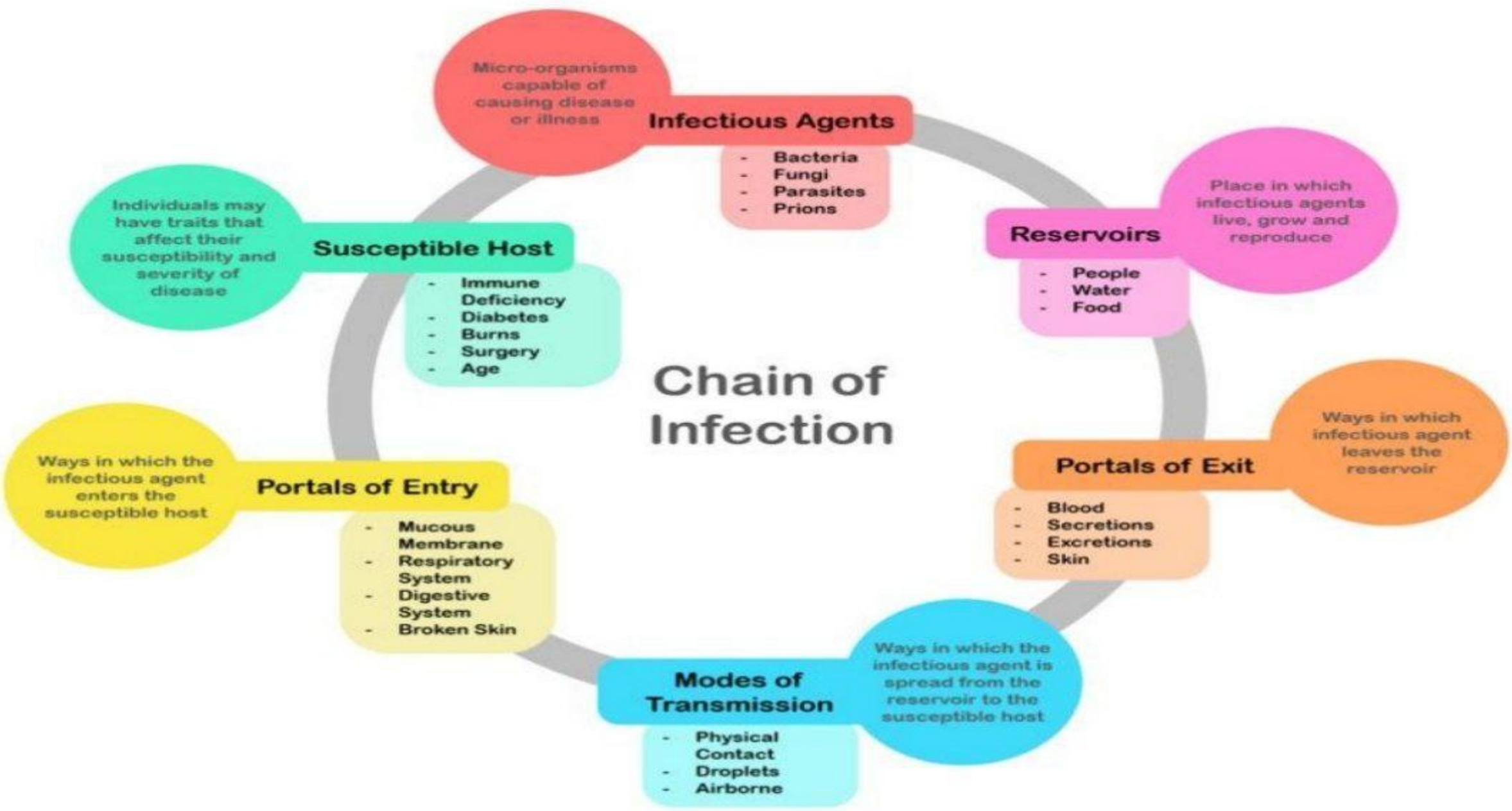
Chain of Infection

Certain conditions must be met in order for a microbe or infectious disease to be spread from person to person. This process, called the chain of infection, can only occur when all

links in the chain are intact. By breaking this chain at any of the links, the spread of infection is stopped.

The chain of infection refers to the series of events that result

in a new person becoming infected with an infectious agent.


Chain of Infection
Infectious Agents
Micro-organisms capable of causing disease or illness
- Bacteria
- Fungi
- Parasites
- Prions
Reservoirs
Place in which infectious agents live, grow and reproduce
- People
- Water
- Food
Portals of Exit
Ways in which infectious agent leaves the reservoir
- Blood
- Secretions
- Excretions
- Skin
Modes of Transmission
Ways in which the infectious agent is spread from the reservoir to the susceptible host
- Physical Contact
- Droplets
- Airborne
Portals of Entry
Ways in which the infectious agent enters the susceptible host
- Mucous Membrane
- Respiratory System
- Digestive System
- Broken Skin
Susceptible Host
Individuals may have traits that affect their susceptibility and severity of disease
- Immune Deficiency
- Diabetes
- Burns
- Surgery
- Age

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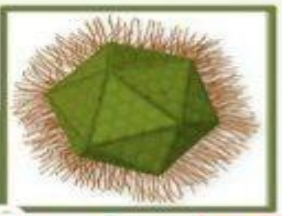
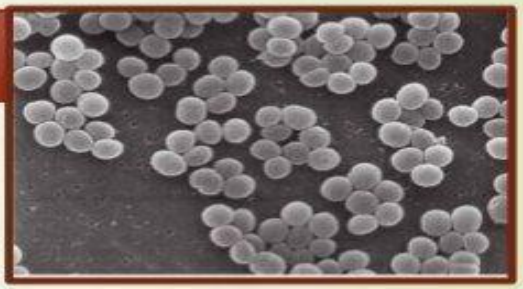
Pathogens

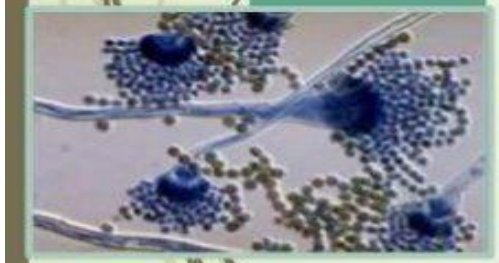
- Virus



- Prokaryote
  - Bacterium



- Eukaryotes
  - Fungus
    - Mold

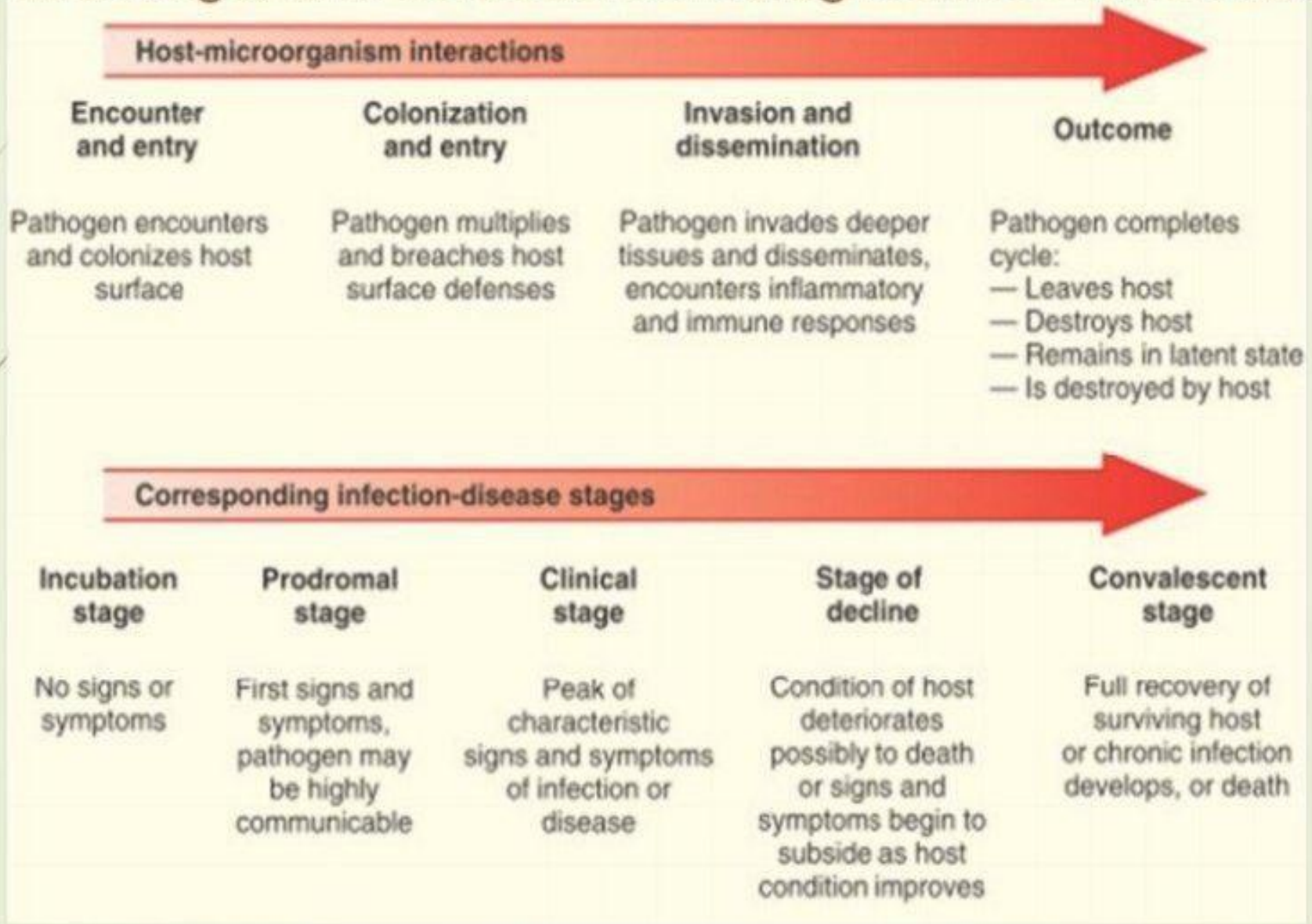


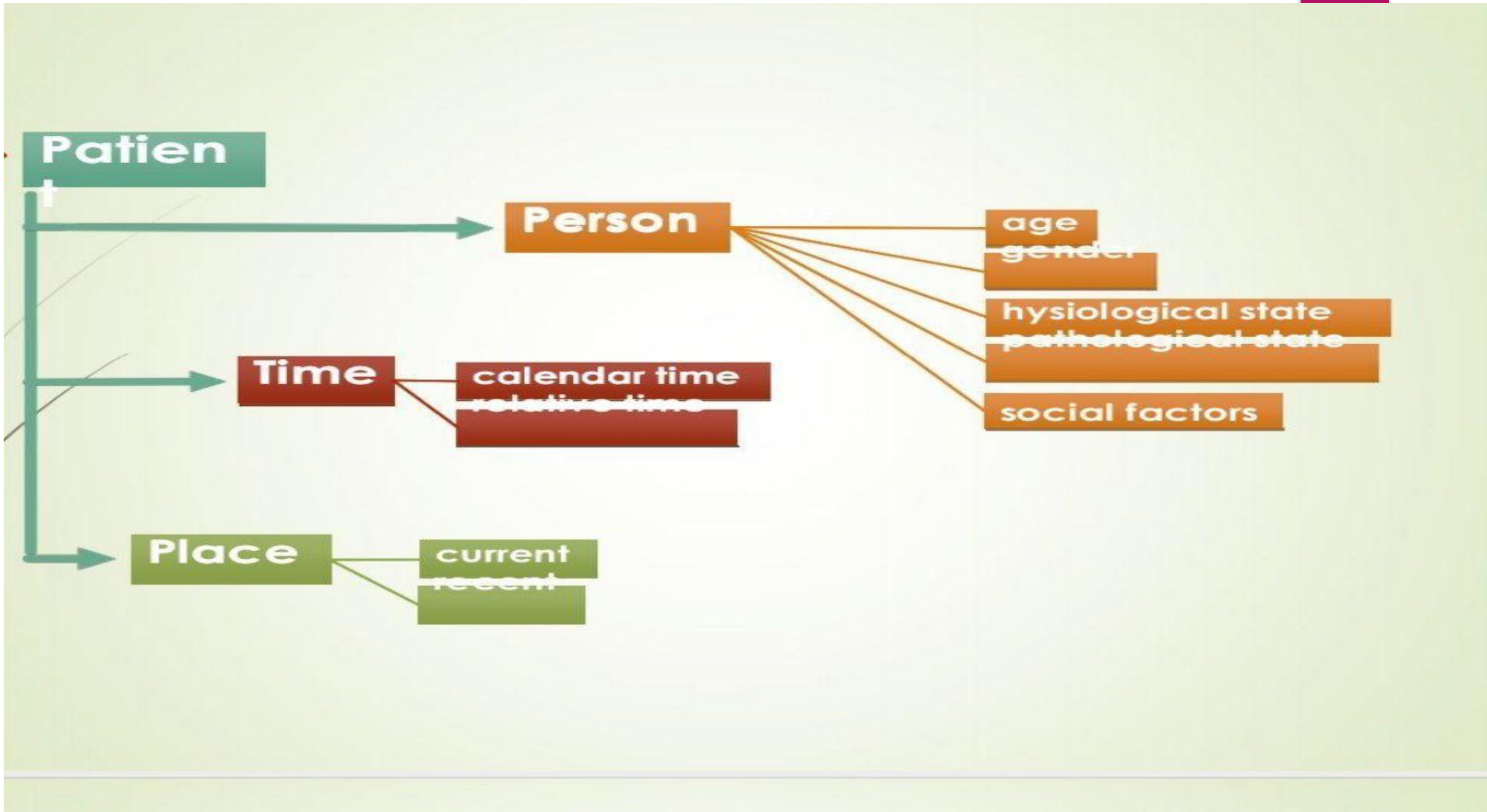
    - Yeast

  - Parasit
    - protozoa

    - helmint

Host-microorganisminteractionsandstagesofinfectionordisease




Patien
t
Person
age
gender
hysiological state
pathological state
social factors
Time
calendar time
relative time
Place
current
recent

Reservoir:

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. This type of person is a carrier and may be referred to as 'colonized'. Examples of reservoirs are standing water, a person with a common cold or syphilis, or a dog with rabies.

Mode of Escape: This refers to the route by which the infectious microorganisms escape or leave the reservoir. For example, pathogens that cause respiratory diseases usually escape through the respiratory tract (coughing and sneezing).

The term **modes of transmission** refer to how an infectious agent, can be transferred from one person, object, or animal, to another.The transmission routes depend on

- The robustness of the microbe in the environment
- Climate
- Temperature
- Virulence factores
- Infectious dose, etc.

The microorganism can spread in several different ways, including through:

- Person to person (skin contact, kissing and sexual intercourse.
- Contact with contaminated soil
- inhaling airborne particles or droplets(sneezing, coughing and speaking
- The transfer of bodily fluids(blood, semen, vaginal fluids, saliva, urine, etc).
- contact with feces
- ingesting contaminated food or water
- touching an object that a person carrying the pathogen has also touched
- Animal to person
- Mother to unborn child via the placenta
- Insect bites

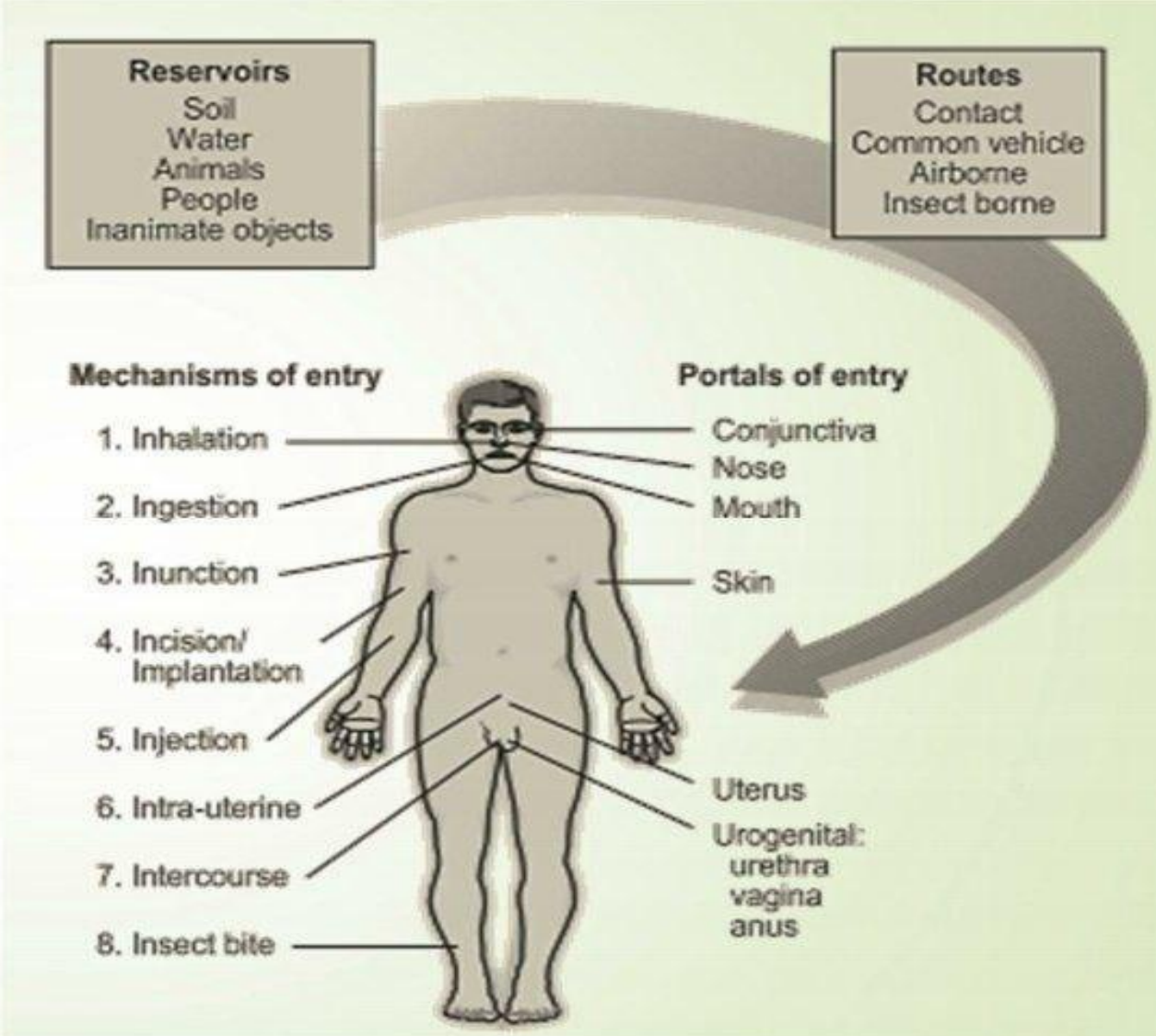
How pathogen interacts with the host to produce

Obligatory steps for infectious microorganisms

Step	Requirement	Phenomenon
Attachment ± entry into body	Evade natural protective and cleansing mechanisms	Entry (infection)
Local or general spread in the body	Evade immediate local defences	Spread
Multiplication	Increase numbers (many will die in the host, or en route to new hosts)	Multiplication
Evasion of host defences	Evade immune and other defences long enough for the full cycle in the host to be completed	Microbial answer to host defences
Shedding from body (exit)	Leave body at a site and on a scale that ensures spread to fresh hosts	Transmission
Cause damage in host	Not strictly necessary but often occurs[a]	Pathology, disease

Infection Mechanism

Infection Mechanism



Damaging the Host

three ways

Direct tissue injury(mechanical orchemical)orby

Subverting the cellular machinery so it becomes nonviable.

Toxicity:exo-and endotoxins damage the hostlocally

And at sites distant to the site of microbial growth.

Immunopathogenic injuries result when the pathogen

Causes the host immune system to damage the host

Diagnosis

Diagnosis of infectious disease is nearly always initiated by **medical history** and physical examination and identification techniques involve

Microbial culture

the culture of infectious agents isolated from a patient. Culture allows identification of infectious organisms by examining their

Microscopic examination

To identifying microscopic features

Biochemical tests

detecting the presence of substances produced by pathogens(Catalase , Coagulase, Oxidase, Urease test)

Serologic tests

used to determine if a person has antibodies against a specific pathogen (ELISA, agglutination, precipitation, complement-fixation, and fluorescent antibodies test)

PCR-based diagnostics

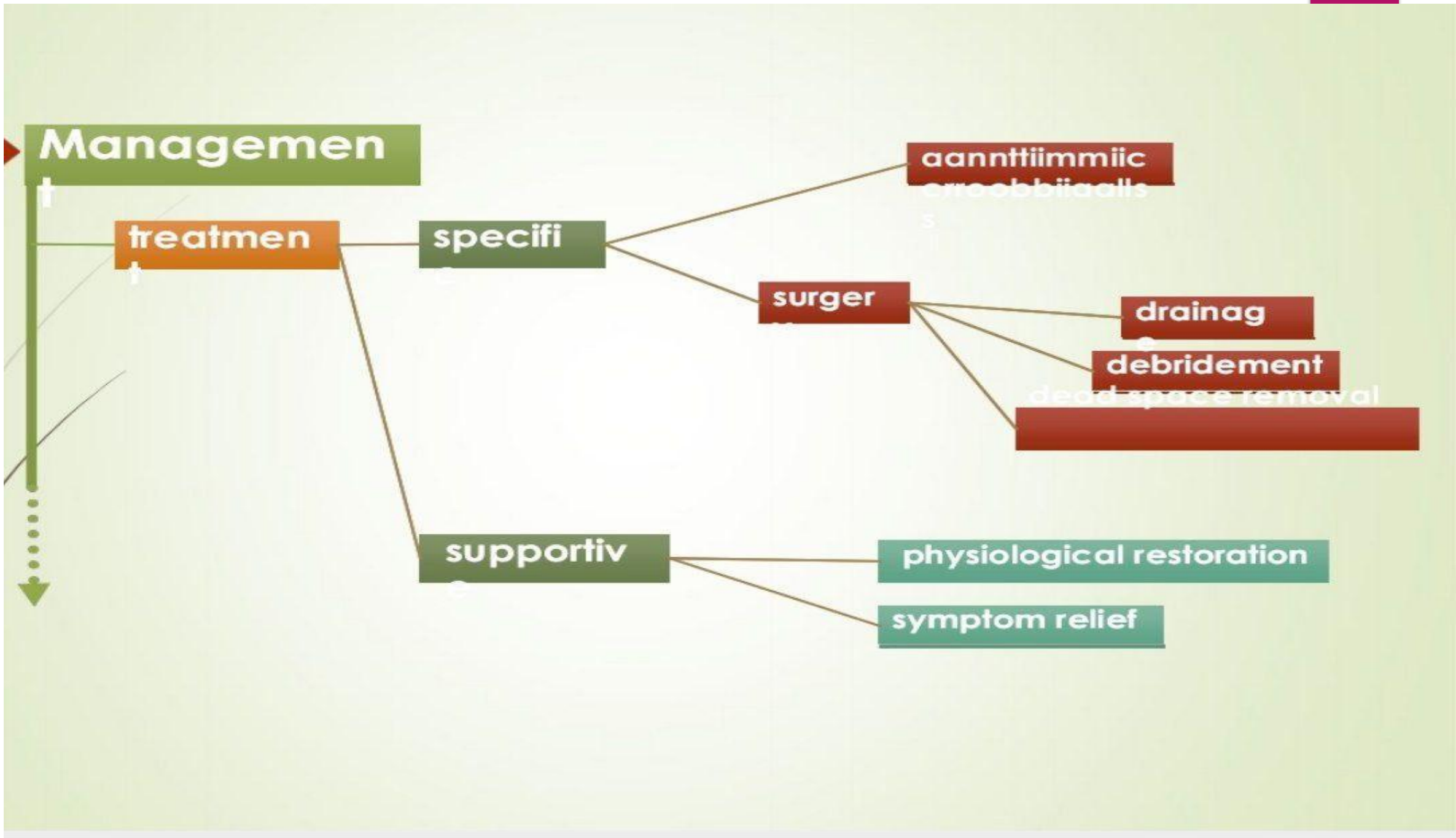
directly identifying an organism by its genotype.

Other techniques (such as X-rays, CAT scans, PET scans or NMR) are used to produce images of internal abnormalities resulting from the growth of an infectious agent. The images are useful in detection of, for example, a bone abscess or a spongiform encephalopathy produced by a prion.

Samples for Testing

A sample is taken from an area of the person's body likely to contain the microorganism suspected of causing the infection. Samples may include

Blood
Sputum
Urine
Stool
Tissue
Cerebrospinal fluid (C.S.F)
Mucus from the nose, throat, or genital area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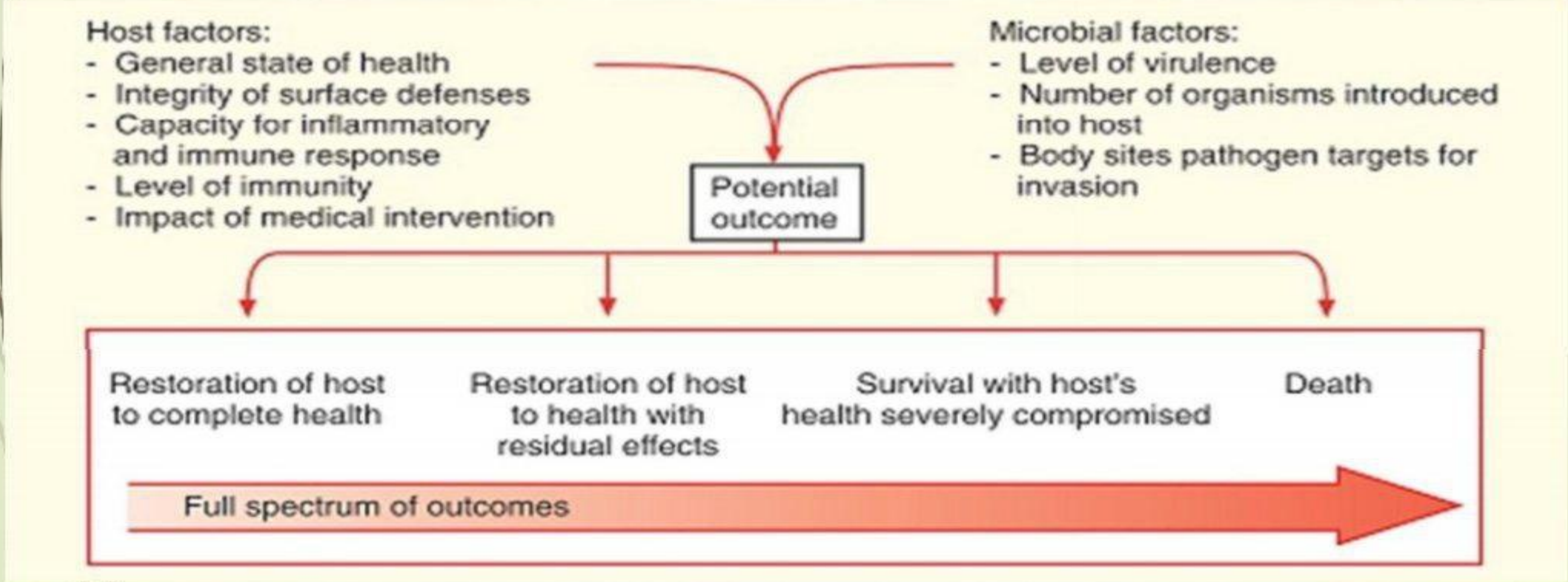
debridement
supportiv
physiological restoration
symptom relief

- When infection attacks the body, *anti-infective* drugs can suppress the infection.
- Several broad types of anti-infective drugs exist, depending on the type of organism targeted; severity and the type of infection they include : antibacterial(antibiotic), antiviral, antifungal and antiparasitic (including antiprotozoal and antihelminthic).
- Not all infections require treatment, and for many self-limiting infections the treatment may cause more side-effects than benefits.

- The most common classes of antibiotics used in medicine include penicillin, cephalosporins, aminoglycosides, macrolides, and tetracyclines.
- vaccines can prevent infections such as the flu, hepatitis A, hepatitis B, human papillomavirus (HPV), and others.

Outcome


Host factors:
- General state of health
- Integrity of surface defenses
- Capacity for inflammatory and immune response
- Level of immunity
- Impact of medical intervention
Microbial factors:
- Level of virulence
- Number of organisms introduced into host
- Body sites pathogen targets for invasion
Potential outcome
Restoration of host to complete health
Restoration of host to health with residual effects
Survival with host's health severely compromised
Death
Full spectrum of outcomes


Thank you