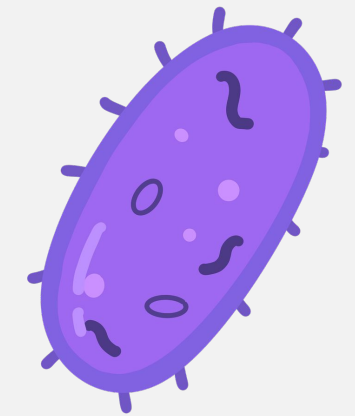
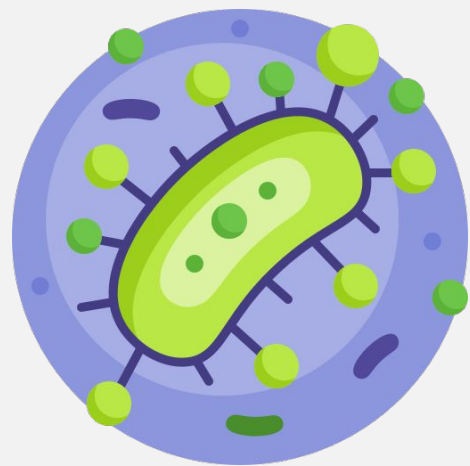


Editing File

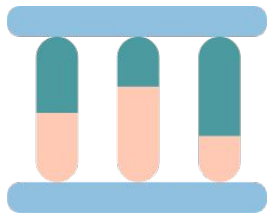
# Host Parasite Relationship



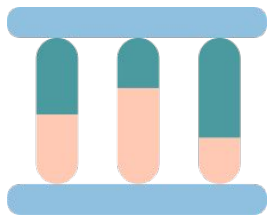
index:

- Main text.
- **Important.**
- In boys slides only.
- In girls slides only.
- Doctors notes.
- Extra info.

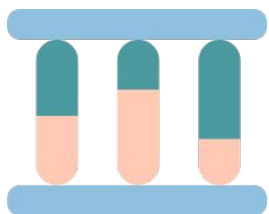
# OBJECTIVES



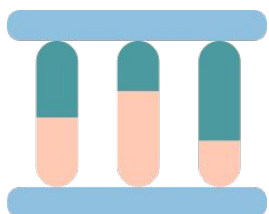
Define core terms related to host-parasite relationship.



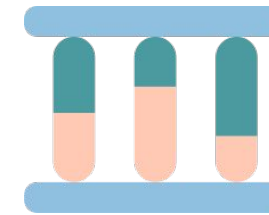
Recall host response to parasite invasion (specific and non-specific responses).



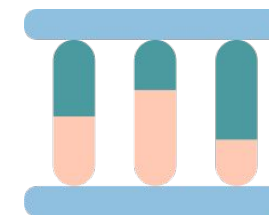
Know important examples of primary and secondary pathogens.



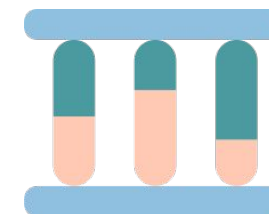
Recognize the differences between virulence and pathogenicity and how virulence is measured.



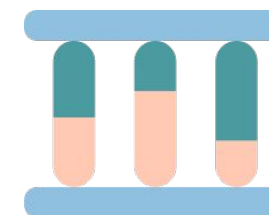
Recall the transmissibility of pathogenicity



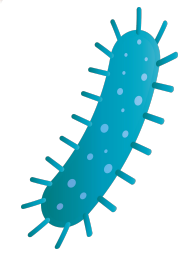
Describe the attributes of pathogenicity and recall examples.



Know the infection chain and infectious disease process



Know Koch's Postulates

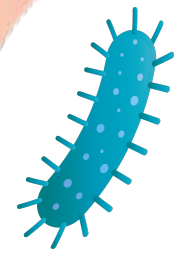


# Host-Parasite Relationship :

**Host:** human, animal or, other organisms that support the growth and survival and protection of the parasite.

**Parasite:** A bacteria, viruses, fungi or parasites which live in or within the host, may cause disease or live mutually with the host.

- Human host is normally in contact with many microorganisms (**normal flora**)  
which are all bacteria and organisms in our body that cause no harm and disease and may be beneficial
- Only a small number of these microorganism (primary and opportunistic pathogens) can cause disease.
- Host-parasite relationships (interaction) is characterized by fighting the organism trying to invade the body and the body defending itself by protective measures. All defense lines in our body ex: WBC, tonsils, Stomach PH ....
- Host-parasite relationship is discussed under : **pathogenicity & microbiota**



# DEFINITIONS:

**Pathogenicity:** the ability of the microorganism to cause diseases

**Infection:** invasion of cells and multiplication by microorganisms **without** tissue destruction. Shows no symptoms

**Infectious Disease:** is the end product of an infectious process **with** tissue destruction depends on both host immunity and pathogen virulence (signs & symptoms of infection)

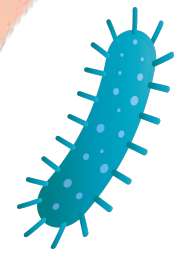
**Resistance:** The ability of the host to prevent establishment of infection by using its defense mechanisms.

**Susceptibility:** Lack of resistance to an organism and establishment of disease. عرضة للعدوى

**Transmissibility:** The ability to spread from one host to another. This enables the microorganism to **maintain continuity** of its species in the event of death of original host.

Modes of transmission :airborne cough), contact (water, food), vehicle or vector (fly/mosquitos)

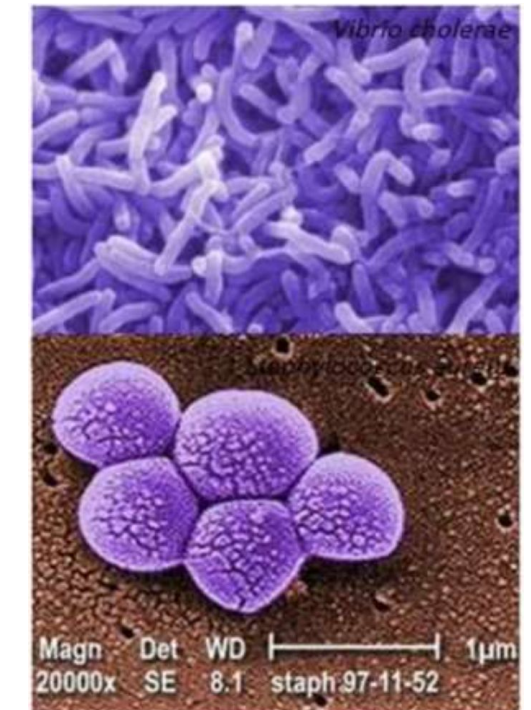




# Pathogen:

**Pathogen** (infectious agent): is a microorganism having the capacity to cause a disease in a particular host.

- A pathogen may infect one body organ or multiple organs.
- Some pathogens enter into latent state (infection but no symptoms) eg :  
Mycobacterium tuberculosis (bacteria that cause TB), [Herpes virus](#)



**Pathogen**  
(divided according to the degree of pathogenicity)

**Primary (true) pathogens** (full-time bad guys)

**opportunistic (secondary) pathogens** (Part-time bad guys)

An organism that is able to cause disease in an apparently **healthy individual** who is non-immune to that organism.

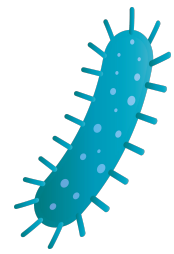
**Example:**  
1-Bordetella species, 2-Mycobacterium Tuberculosis

- Causes disease in healthy individuals
- Associated with a specific & recognizable disease

Having low pathogenicity and infects people with **low Immunity**

**Example:**  
1-Pseudomona 2-S. epidermidis (staphylococcus epidermidis)

- Causes disease in immune compromised host.
- Gain access (injury) to sterile regions

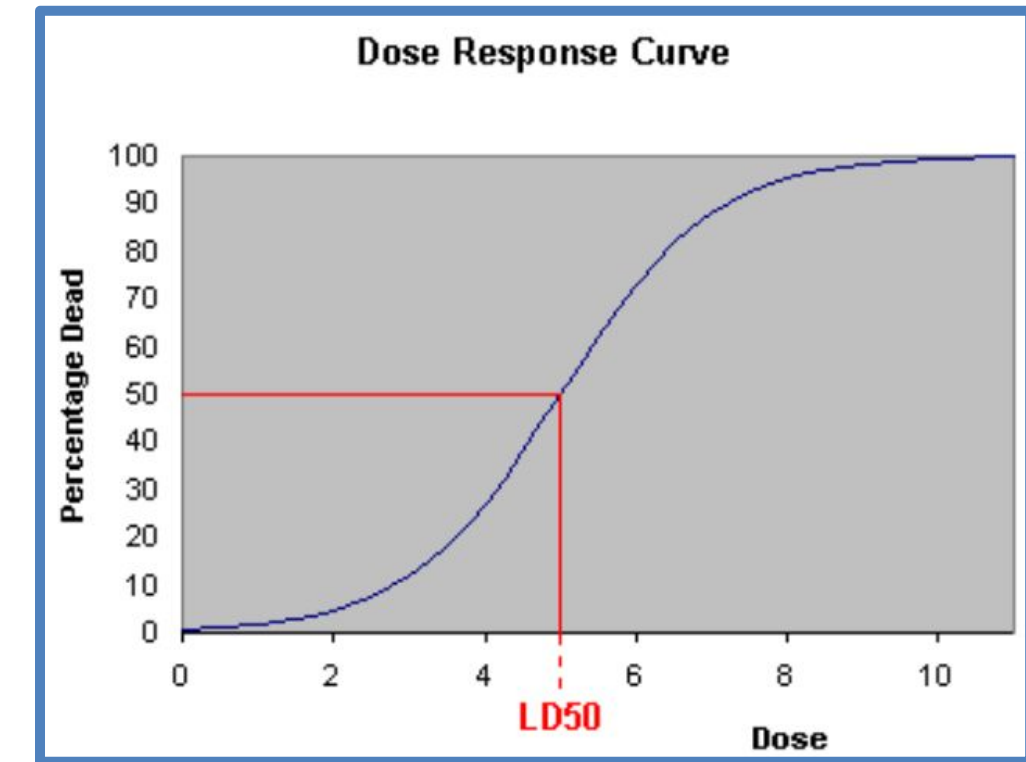


# Virulence:

Virulence is the degree of pathogenicity (severity / harmfulness), or the ability to invade and destroy tissue to produce disease. by toxins, certain enzymes, or their capsid

## Virulence is measured by : the Lethal dose 50 (LD50)

which is the number or amount of organisms or mg of toxins that **will kill 50%** of susceptible lab animals ( usually mice ) when injected into such animals.



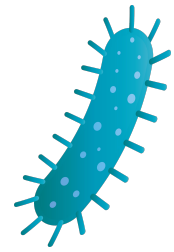
- When the LD50 is **small**, the microorganism is considered **highly virulent** and when it is **high** the organism is considered having **low virulence**.

eg. Shigella spp./species is more virulent than Salmonella spp.

- Virulence is predominantly associated with adherence and colonization, invasion, avoidance of host responses and toxin formation.

Note: Virulence factors where the bacteria are the capsule endotoxins and exotoxins.

- Low LD50 = high virulence
- High LD50 = low virulence



# Host Resistance To Parasite Invasion:

Non specific defense is part of **natural** constitution of the host:

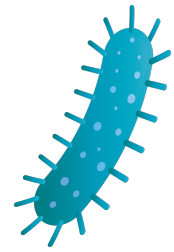
- **Skin** mechanical barrier (burn patients can suffer from serious infections due to lack to this barrier)
- Ciliated epithelium of respiratory tract
- Competition by **normal flora**
- Low pH of the stomach
- **Cough**
- Peristalsis (the movement of intestines or esophagus)
- **Lysozymes** (destroying peptidoglycan , thus killing the bacteria)
- **Neutrophils** (white blood cell)

Specific defense is an **acquired** resistance to certain organism:

- Formation of Antibodies

بعد الاصابة او التطعيم تتكون اجسام مضادة في الجسم ضد هذا الباثوجين



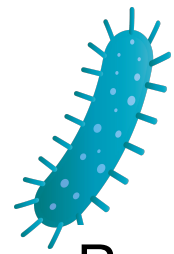


# Determinants of Pathogenicity:

Before causing disease, the microorganism should have the ability to:

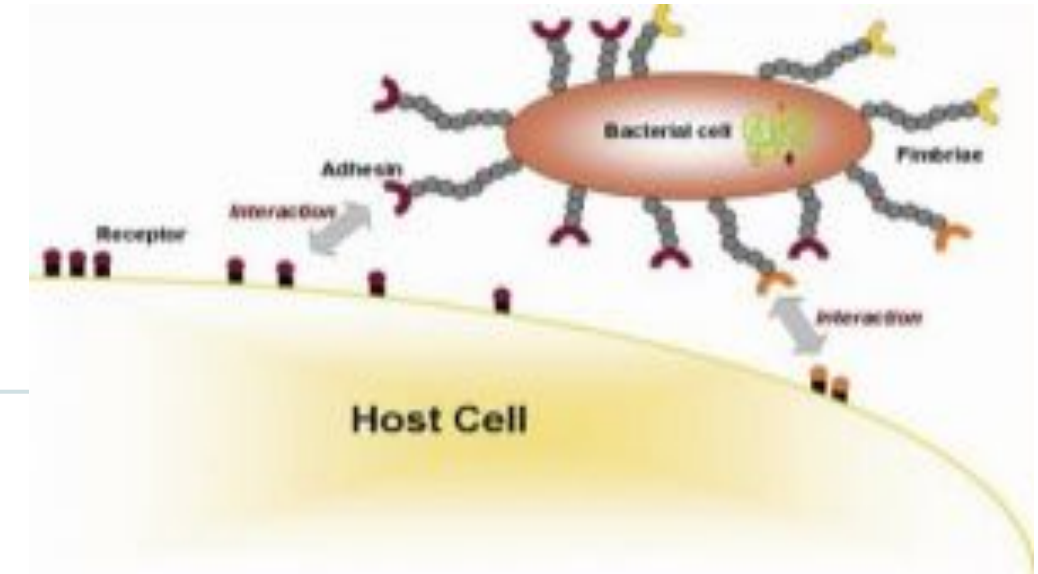
<b>Adherence and colonization:</b>	<b>Survive (resist):</b>	<b>Tissue Destruction:</b>	<b>Multiply:</b>
Attachment to host epithelial surface by means of adhesins (factors that helps to cause adherence)	Resist host natural defense mechanisms.	the ability to overcome host defense , invade the tissues and cause destruction to produce clinical disease. By toxins formation	Multiply to large numbers.



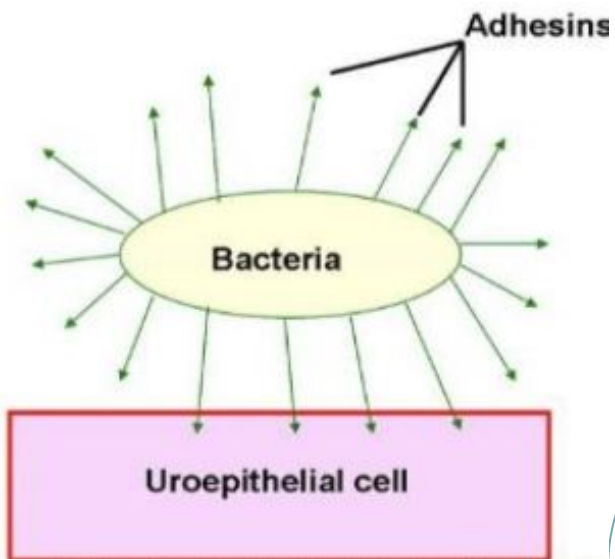
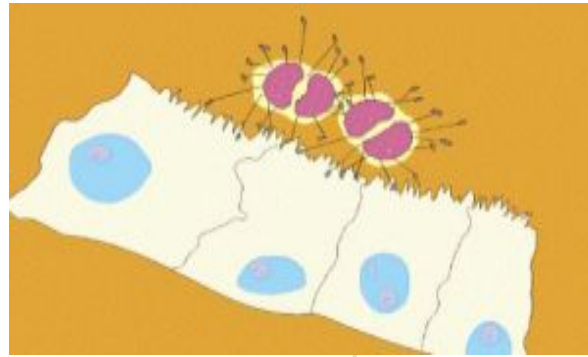


# Adherence and Colonization:

By means of adhesins (adherence factors) found on bacterial surfaces.



## Factors of Adhesion



**Found on bacterial surfaces**

**Structures found on host cells**

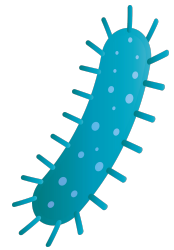
**Pili**

**Other protein surface structures**

**Capsid spikes of viruses**

**Fibronectin**

**Proteins and Glycopeptide parts**



# Tissue Destruction :

## Tissue Destruction

### Toxin

### Invasion

**Exotoxin**  
Gram(+ve) &(-ve)  
Eg. Cholera Toxin

**Endotoxin**  
Gram(-ve)

**Capsulated**

**Non-Capsulated**

▶ The toxin is secreted outside the gram (+ve) &(-ve)


▶ Part of outer membrane

A-B Type exotoxins  
A-active unit  
B-Binding unit for attachment  
eg.cholera toxins

Membrane active exotoxin  
Eg. Haemolysin of group A  
Streptococcus

*S.Pneumoniae(Pneumococcus),  
Haemophilus Influenzae*

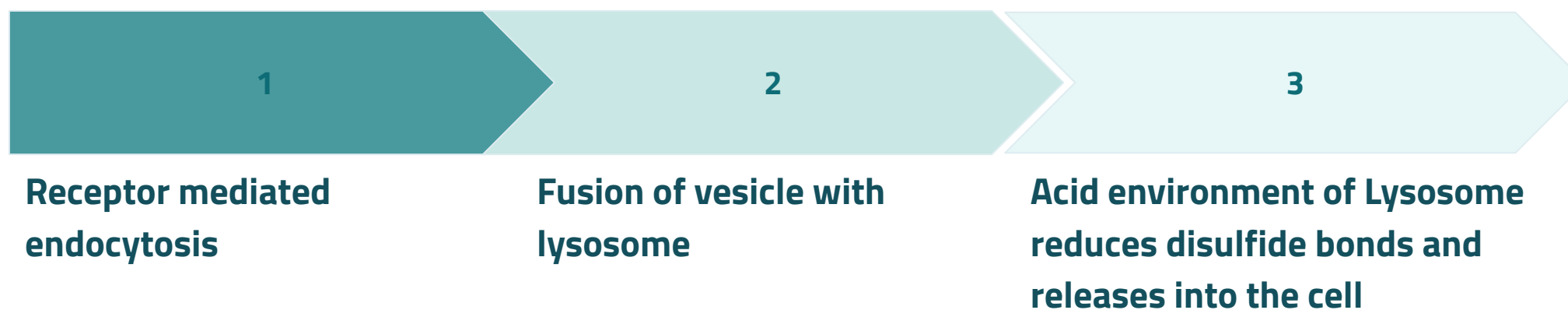
*Mycobacterium Tuberculosis  
Salmonella typhi, Brucella Species,  
Legionella pneumophila*

 A little help :)  
[Toxin](#) entry

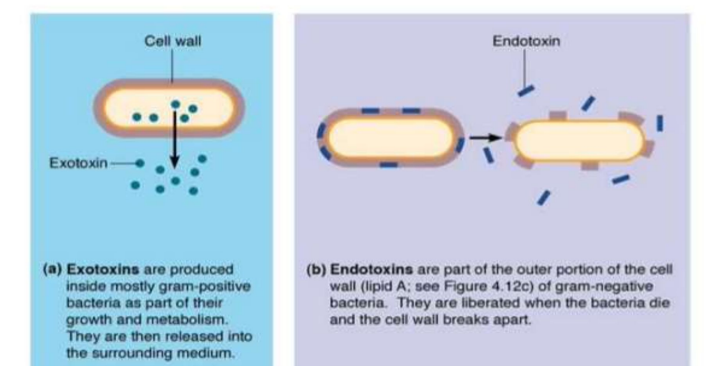
**Note:**  
**A: Active Unit:**  
Enters the ribosome and stops protein synthesis

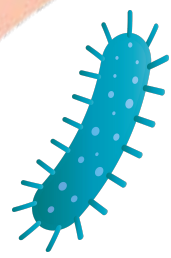
**B: Binding Unit for attachment:**  
Helps bacteria attach to cell membrane

▶ Enters Cell via:



### EXOTOXINS VERSUS ENDOTOXINS

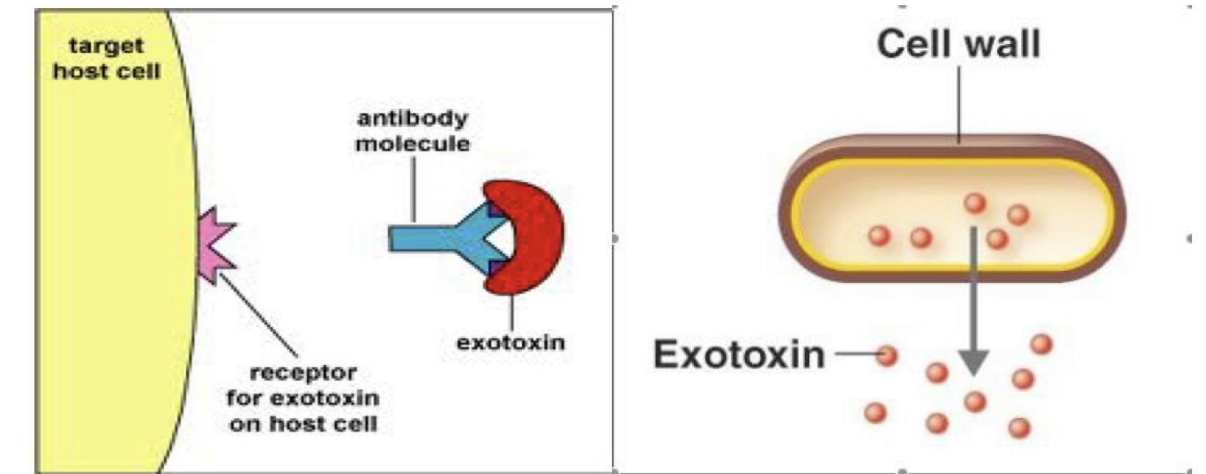




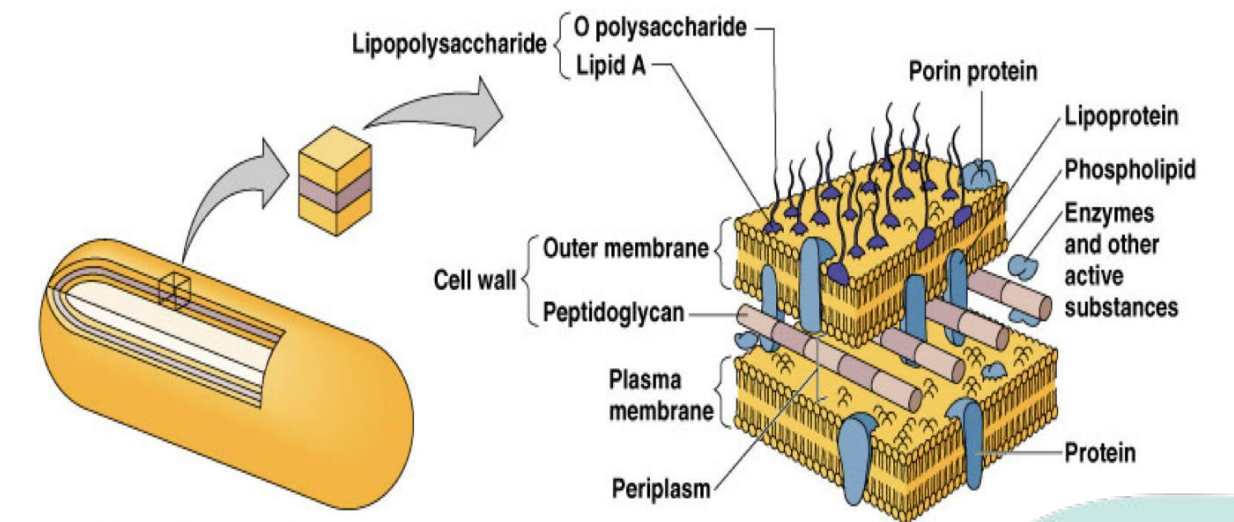
# Exotoxin Vs. Endotoxin :

Exotoxin (More Specific)	Endotoxin (Less Specific)
Protein	Lipopolysaccharide (Lipid+Sugar)
Soluble & Diffusible	Part of the cell wall (out of membrane in Gram(-ve)) Stays within bacterium cell, until the bacteria is destroyed, then it will be diffused to the blood
Heat <b>Labile</b> (Destroyed by heat/changing)	Heat <b>Stable</b>
Pharmacologically <b>specific</b> action (Goes to a specific site and causes a specific action)	<b>Non Specific</b> (Which is considered more dangerous since the immune system becomes confused, thus it destroys cells all over the body)
<b>High</b> Immunogenicity (Capable of provoking the immune system, and trigger or induce the production of neutralizing antibodies, which will target the effect of toxins)	<b>Low</b> Immunogenicity (Not capable of provoking the immune system, thus it cannot produce neutralizing antibodies)
Inactivated by <b>chemicals to form toxoids</b> (Such as vaccines)	<b>Does not form toxoids</b>
No fever	Induces fever

## Exotoxin



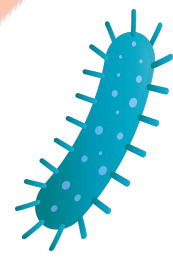
## Endotoxin



(c) Gram-negative cell wall

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# Capsulated Vs. Non-Capsulated :

## Capsulated

-They have capsules which protects it, thus they are **highly virulent**.

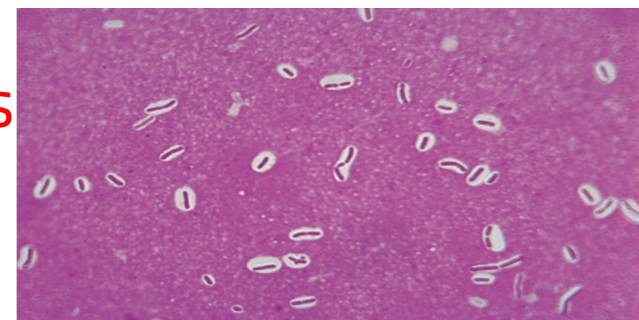
-Bacteria capsules are made of **polysaccharides**, except the capsule of bacillus anthracis (polypeptide protein)(Bacillus anthracis causes anthrax and was used as a bioweapon)

- The organism is readily killed once phagocytosed
- Capsules prevents the phagocytosis and capture of the bacteria by the host immune system
- It is called extracellular organisms (EC)
- Lives outside of the cell

**Important examples:**

**S.Pneumoniae(Pneumococcus)**

**Haemophilus Influenzae**



## Non-Capsulated

-Resist intracellular killing so it is called **intracellular organisms (IC)** It lies within the cell because it does not have a capsule that will protect it from phagocytosis

Eg:

**Salmonella non-typhi**

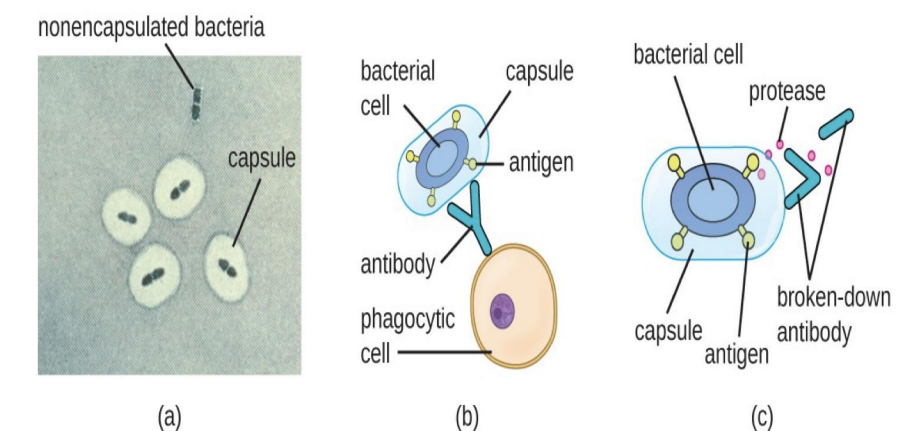
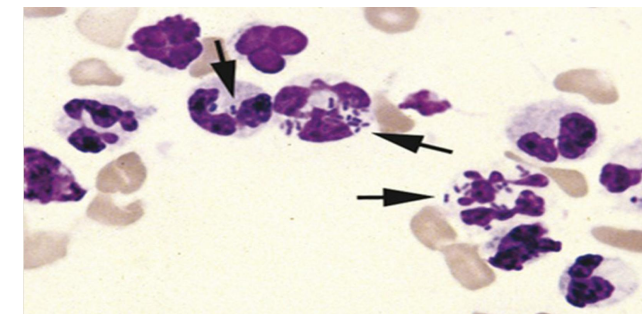
**Legionella Pneumophila**

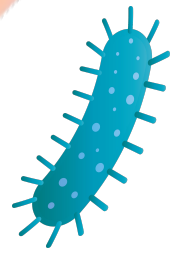
**Mycobacterium Tuberculosis**

-Primary Pathogen

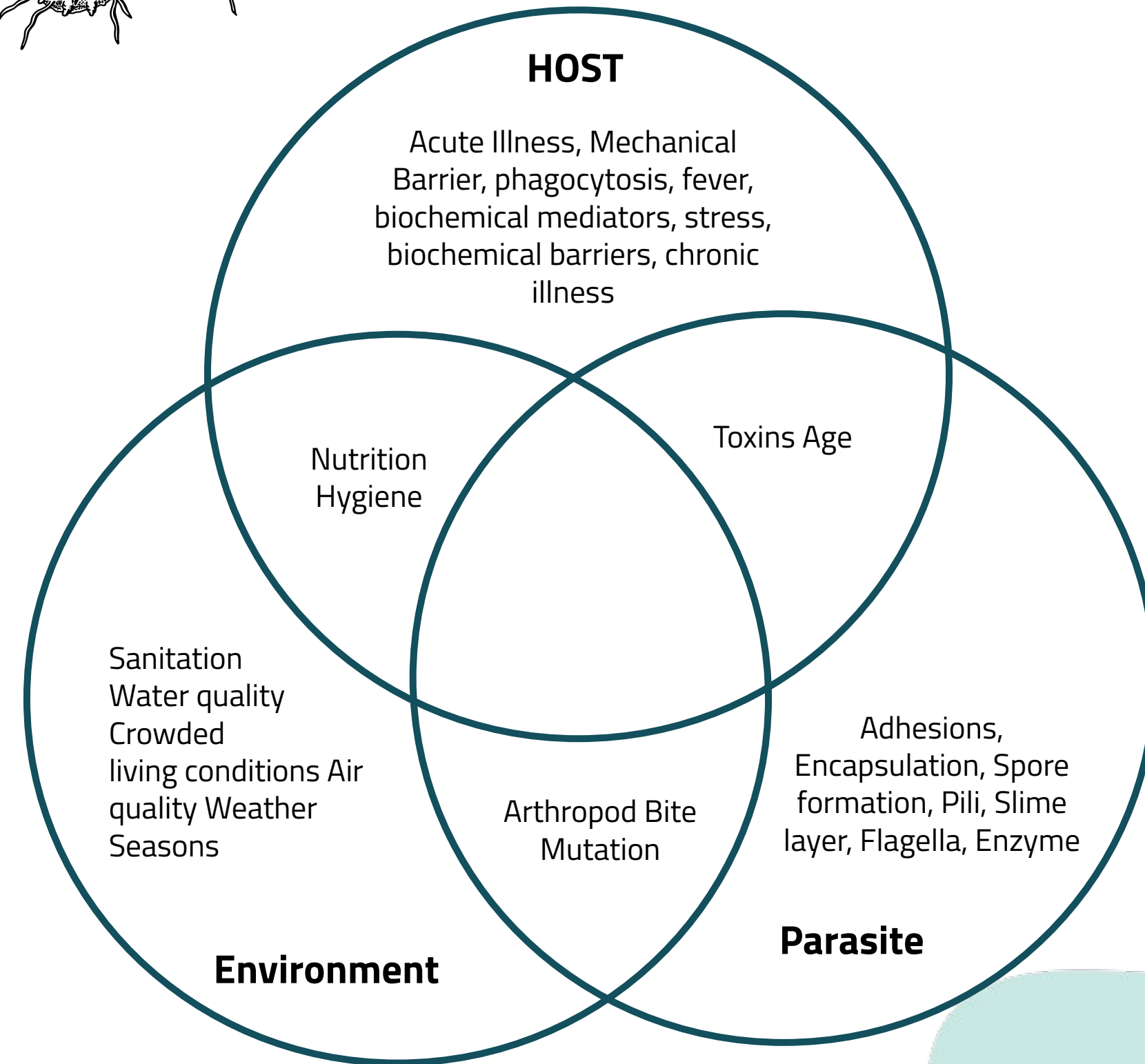
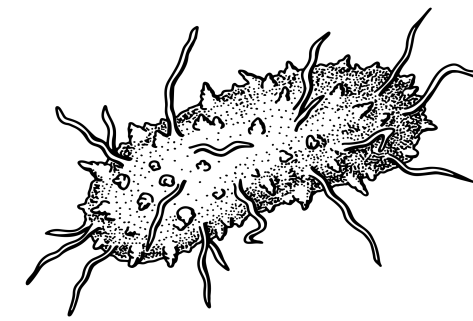
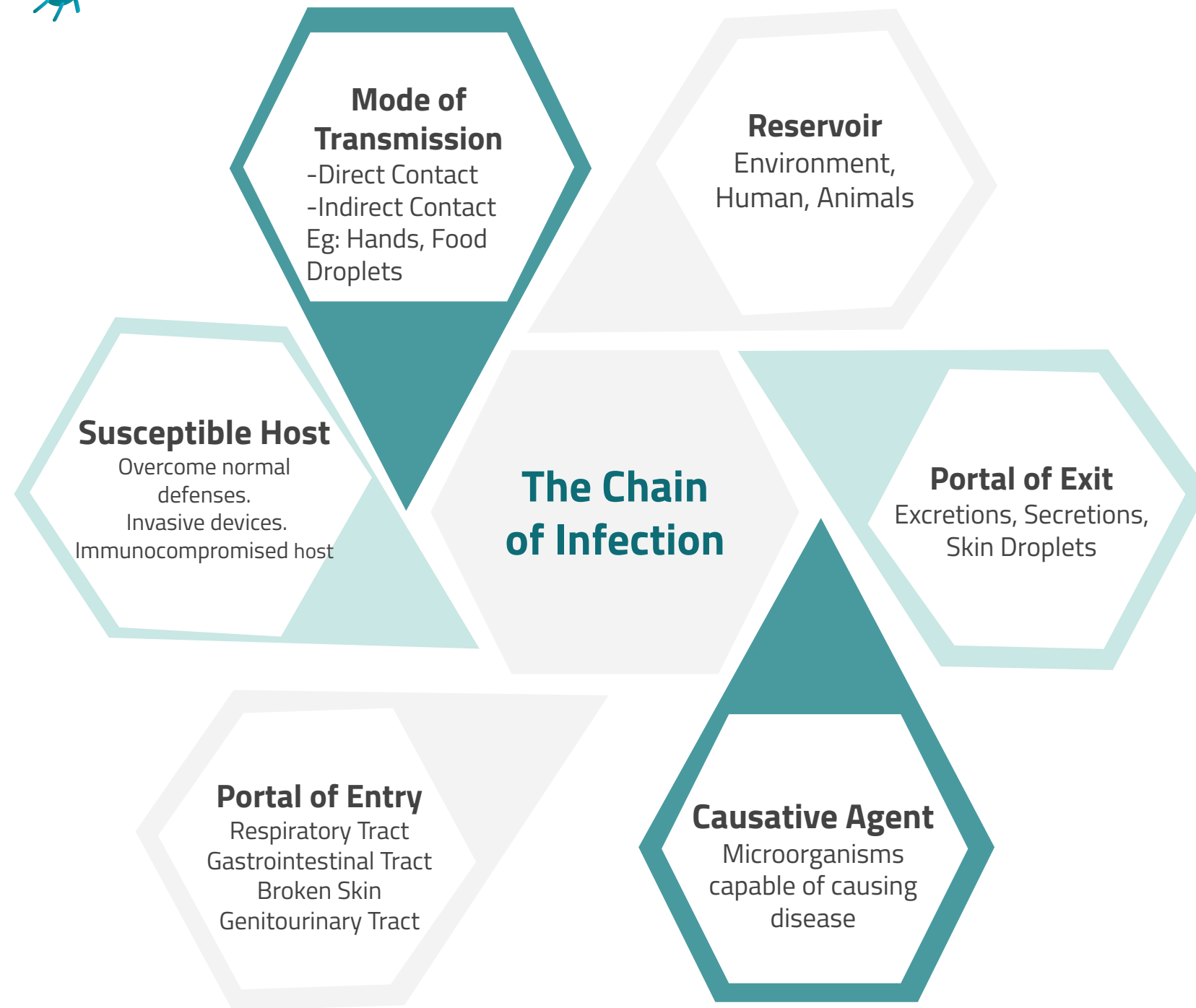
**Salmonella Typhi**

**Brucella species**



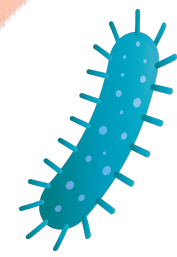


# Chain of Infection :



1. Pathogen source/reservoir (animate or inanimate)
2. Transmission modes (airborne, contact, vehicle, vector)
3. Host susceptibility (immune status, host nutrition, virulence of pathogens, genetic predisposition, etc.)
4. Exiting the host (excretion in faeces, urine, droplets, blood, saliva, or shed from the body).





# Infectious Disease Process :

Once organism inside the host ,it passes into several phases before initiating infectious disease :



1

2

3

4

## Incubation Period (atent):

From entry until signs and symptoms start to show

## Podional Stage:

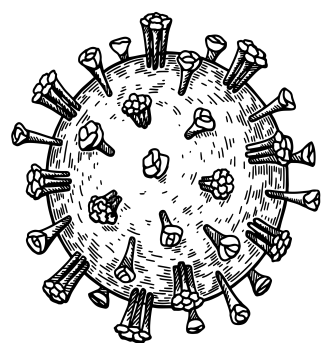
Clinical signs are insufficient

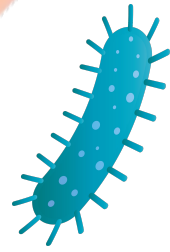
## Illness:

Severe disease, immune system triggered

## Convalescent Period:

Recovery





# Koch's Postulates :

1

Pathogen must be found in subject suffering from the disease, but should never be found in a healthy subject. The organism must be found in all cases of the disease, and its distribution in the body should correspond to that of the lesions observed in the host

2

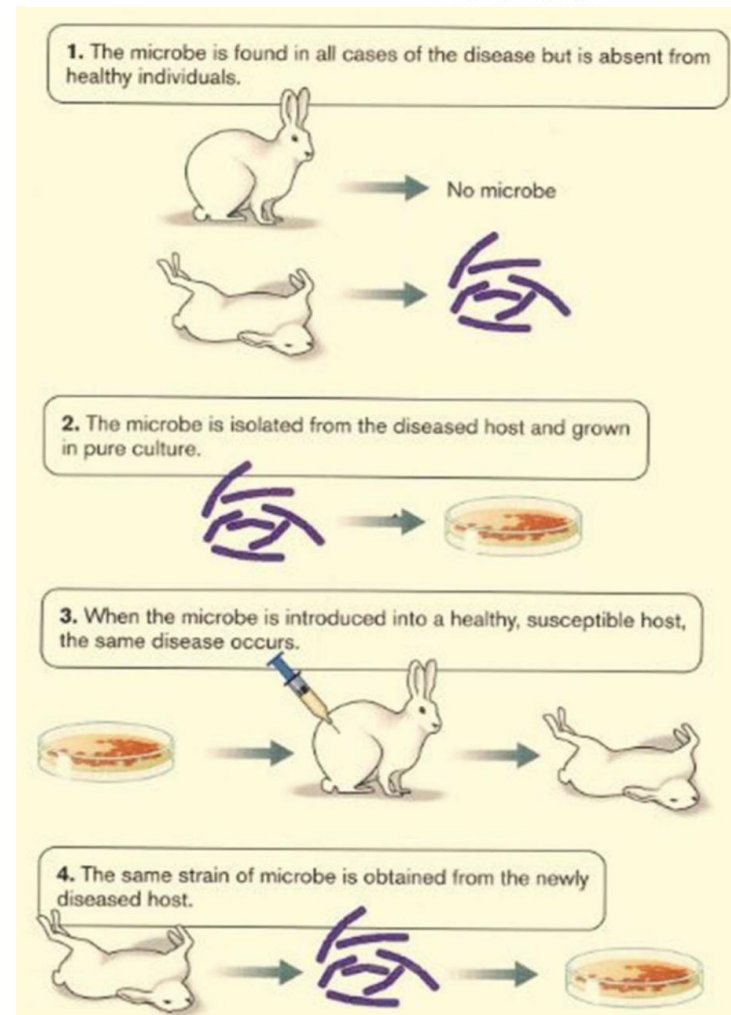
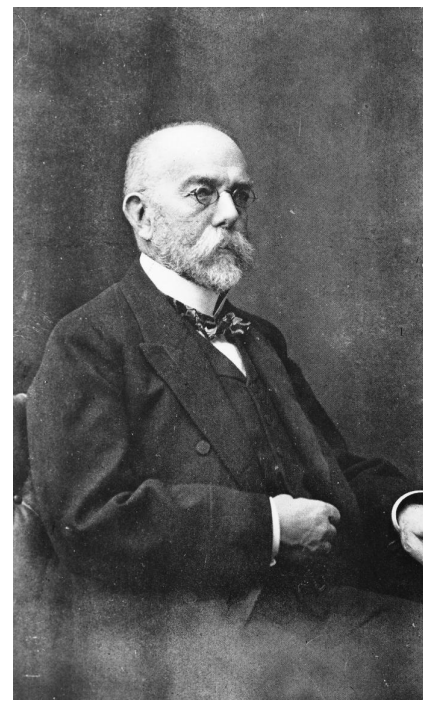
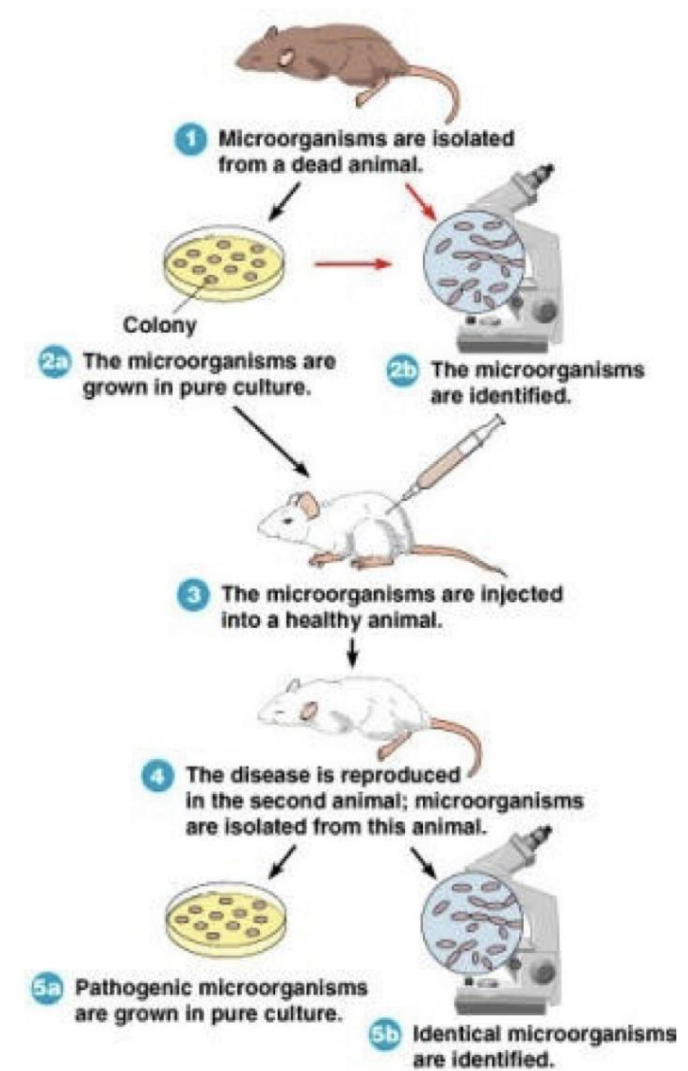
Pathogen can be isolated from a sick persons and grown in a lab. The organism should be cultured in pure culture demo all cases of the disease. N.B. Some organisms are yet to be cultured in the lab. eg: Treponema pallidum, M. leprae

3

Pathogen injected into a healthy person should cause an infection with the same disease (Have the ability to reproduce the disease in other hosts). The organisms should reproduce the disease in other susceptible animal hosts

4

Injected pathogen can be isolated from newly infected individual and out must be identical to the original pathogen. (Reisolated yet identical). The organism should be cultured, and antibodies to the disease usually develop in the course of the disease.



# Quiz

Q1: Which of the following is a primary pathogen?

- |   |                            |   |                  |   |               |   |            |
|---|----------------------------|---|------------------|---|---------------|---|------------|
| A | Mycobacterium Tuberculosis | B | Salmonella Typhi | C | S.epidermidis | D | Pseudomona |
|---|----------------------------|---|------------------|---|---------------|---|------------|

Q2: Invasion of cells and multiplication by microorganisms without tissue destruction ?

- |   |            |   |          |   |           |   |         |
|---|------------|---|----------|---|-----------|---|---------|
| A | Resistance | B | Parasite | C | Infection | D | Disease |
|---|------------|---|----------|---|-----------|---|---------|

Q3: Which of the following is a characteristic of endotoxin bacteria.?

- |   |                      |   |             |   |         |   |          |
|---|----------------------|---|-------------|---|---------|---|----------|
| A | Doesn't form toxoids | B | Heat Labile | C | Protein | D | No fever |
|---|----------------------|---|-------------|---|---------|---|----------|

Q4: Which of the following is found only in gram negative bacteria?

- |   |           |   |          |   |              |   |      |
|---|-----------|---|----------|---|--------------|---|------|
| A | Endotoxin | B | Exotoxin | C | Both A and B | D | Pili |
|---|-----------|---|----------|---|--------------|---|------|

Q5: Which of the following bacteria is an opportunistic pathogen?

- |   |          |   |                    |   |                       |   |                            |
|---|----------|---|--------------------|---|-----------------------|---|----------------------------|
| A | Brucella | B | Bordetella species | C | Pseudomona aeruginosa | D | Mycobacterium Tuberculosis |
|---|----------|---|--------------------|---|-----------------------|---|----------------------------|



# MEET THE TEAM

## Leaders



## Members

