



# Host Parasite Relationship

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# OBJECTIVES

- Define core terms important in host-parasite relationship.
- Know 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 know how virulence is measured.
- Recognize the transmissibility of pathogens.
- Describe the attributes of pathogenicity and recall examples.
- State Koch's postulates

# Host-Parasite Relationship

- Human host is normally in contact with many microorganisms (normal flora), only a small number of these microorganism (primary and opportunistic pathogens) can cause disease.
- Host-parasite relationships: is characterized by fighting the organism to invade the body and the body defending itself by protective measures.

# **Host-Parasite Relationship can be discussed under:**

- A) Pathogenecity**
- B) Normal flora**

# Pathogenicity :

## Host Resistance To Parasite Invasion

1. Non specific resistance is part of natural constitution of the host. eg.
  - Skin mechanical barrier
  - ciliated epithelium of respiratory tract
  - Competition by normal flora
  - Low pH in the stomach
  - Cough
  - peristalsis
  - Lysozymes
  - Neutrophils
2. Specific / Acquired : resistance to certain organism: e.g. formation of Antibodies

# Definitions

- **Pathogenicity** : the ability of an microorganism to cause disease.
- **Pathogen** : a microorganism having the capacity to cause disease in a particular host.
- **Disease** : is the end product of an infectious process

# Definitions- cont,.

## **Resistance:**

- The ability of the host to prevent establishment of infection by using its defense mechanisms.

## **Susceptibility:**

- Lack of resistance to organism and establishment of disease.

# Pathogens

Can be divided according to the degree of Pathogenecity into:

## a) Primary pathogens:

Cause disease in non- immune host to that organism.

- e.g.           ~ *Bordetella species*  
                  ~ *Mycobacterium tuberculosis*

## b) Opportunistic pathogens:

Having low pathogenecity and infect people with low immunity.

- e.g.           *Pseudomonas*



- **Infection** is simply invasion of cells and multiplication by microorganisms without tissue destruction.

**Virulence** is an ability to invade and destroy tissue to produce disease.

**Virulence** is measured by the Lethal dose 50 (**LD50**) which is the number of organisms or mg. of toxins that will kill 50% of susceptible lab. animal ( usually mice ) when injected into such animal. When the LD 50 is small, the microorganism is considered highly virulent and when it is high the organism is said to be of low virulence.

# 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.

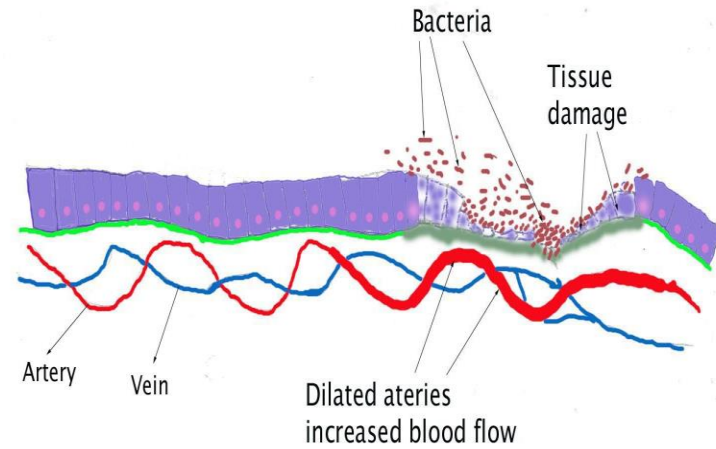
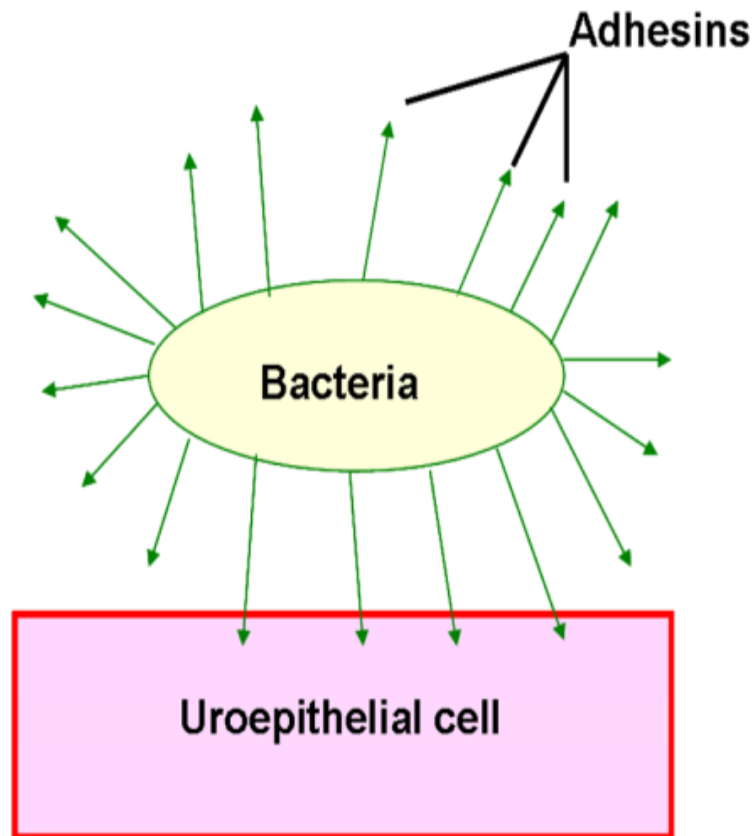
- When the organism is able to produce disease even in an apparently healthy host it is referred to as **primary pathogen** .
- When the organism causes disease only when the host's defenses are impaired, it is called **secondary pathogen (opportunistic pathogen)**.

# Determinants of Pathogenecity

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

- a) **Adhere:** the ability to attach firmly to host epithelial surface.
- b) **Survive** host natural defense mechanisms.
- c) **Multiply** to large numbers.
- d) **Tissue Destruction:** the ability to overcome host defense , invade the tissues and cause destruction to produce clinical disease.

# Adhesion & Tissue Destruction



## **Adherence:**

- By means of adhesins (attachment apparatus) on bacterial surfaces.

e.g. a) **Pili**

b) **Other protein surface structures**

Structures on host cells include:

a) **Fibronectin**

b) **Proteins and glycopeptide parts**

## **Tissue destruction is produced by:**

**a) Toxin** production ,either:

- Exotoxin, or
- Endotoxin

**b) Invasion** by:

- Capsulated ,or
- Non-capsulated organism

- **Capsulated organisms** : bacteria that have capsule.
- Bacterial capsules are all made of **polysaccharide** except that of *Bacillus anthracis* (made of polypeptide).
- **Capsule prevents phagocytosis.**
  - But such organisms are readily killed once they are phagocytosed.
  - So called extracellular organisms  
*e.g. Pneumococcus*



- **Non capsulated organisms** resist intracellular killing so called intracellular organisms.

*e.g. Mycobacterium tuberculosis, Salmonella typhi, Brucella species, etc.*

- **Exotoxin** can be:

a) **A – B exotoxins** *e.g.* Cholera toxins

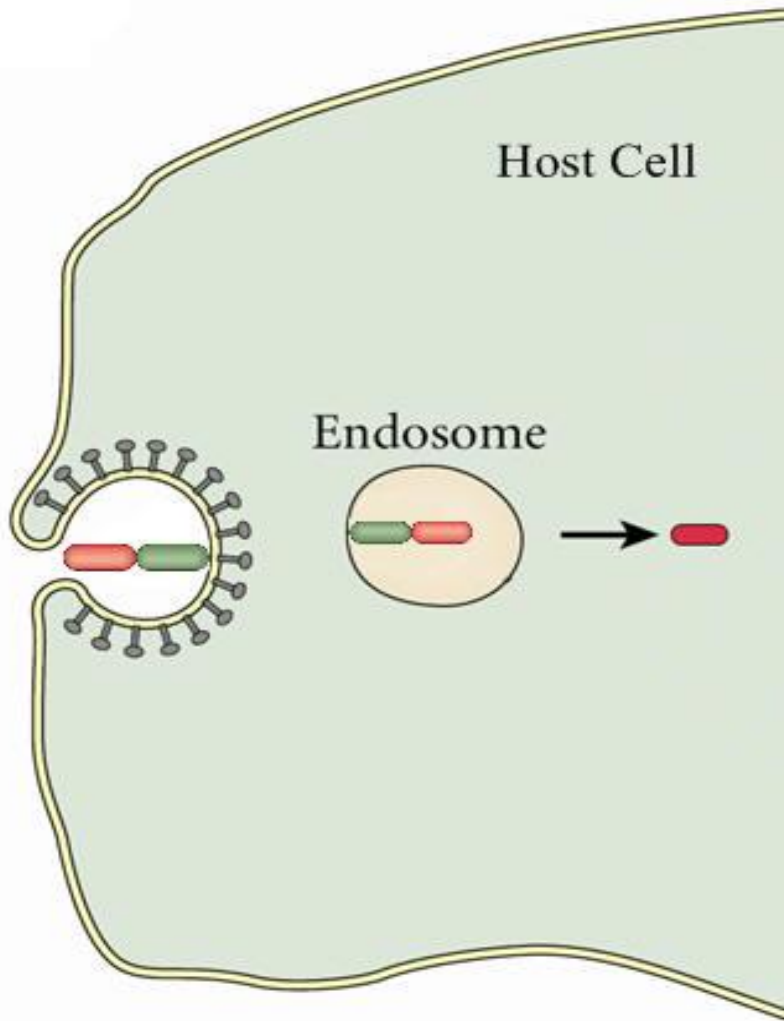
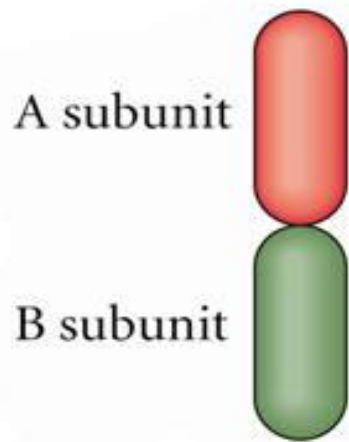
**A** : Active unit

**B** : Binding unit for attachment

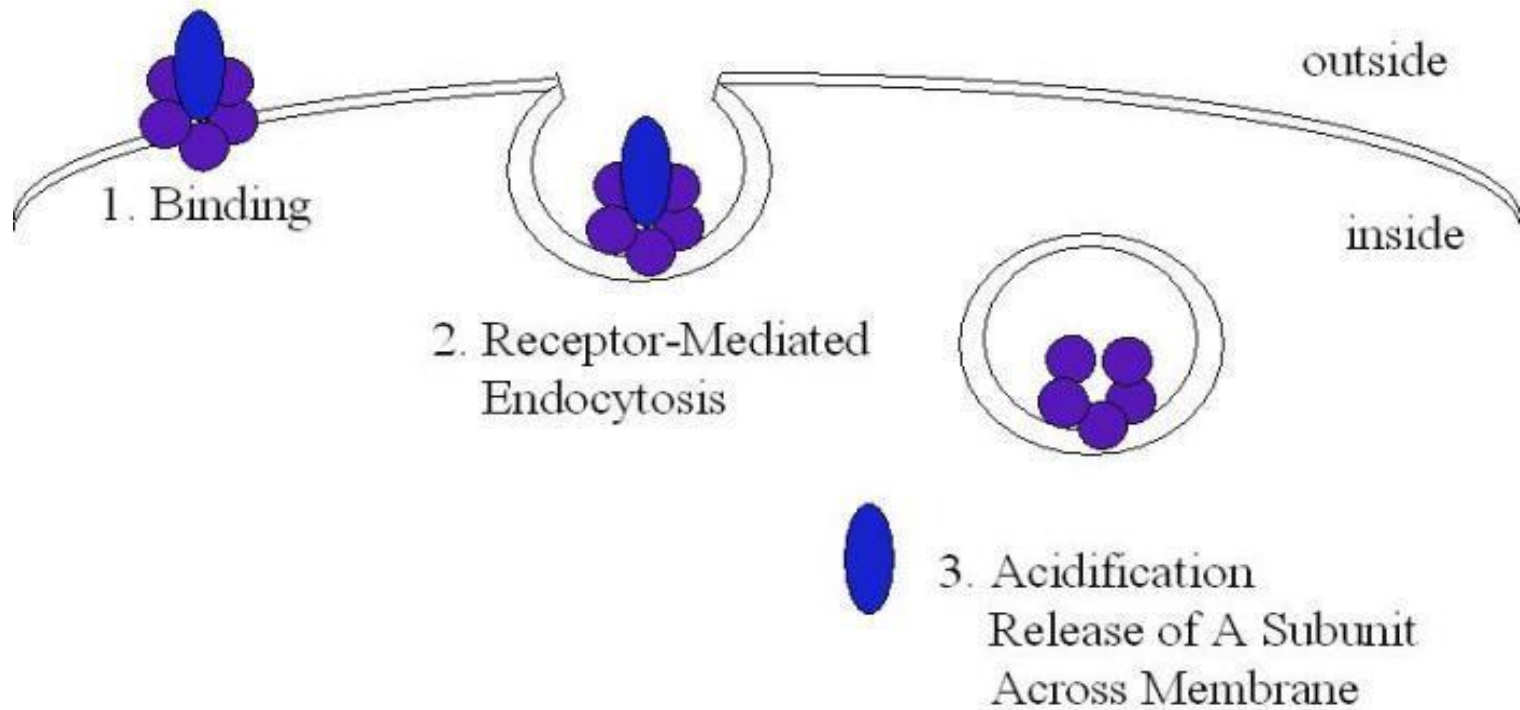
Or:

b) **Membrane active exotoxin**

*e.g.* Haemolysin of group A Streptococci



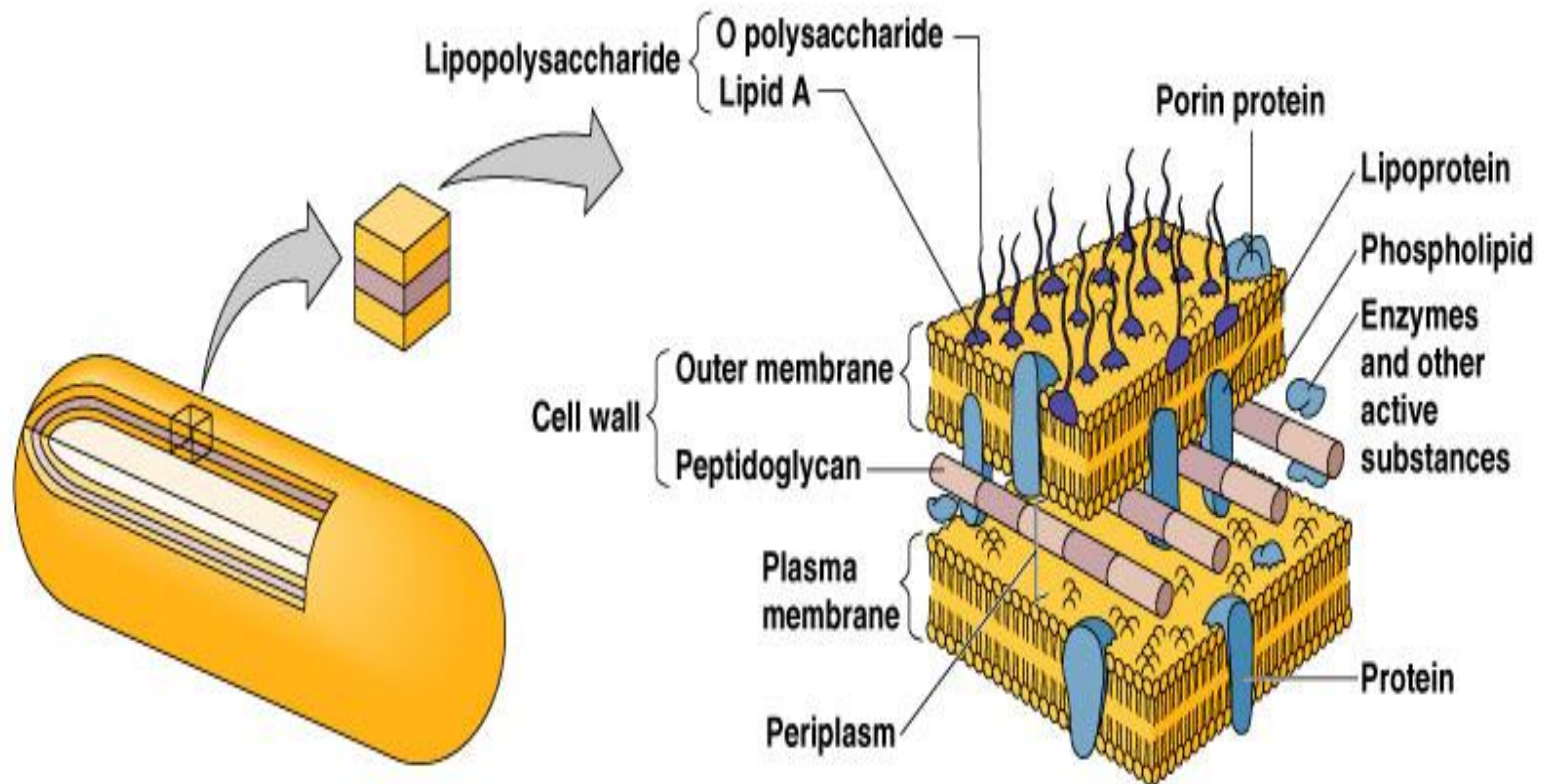
## A-B Toxin Entry



# Exotoxin vs Endotoxin

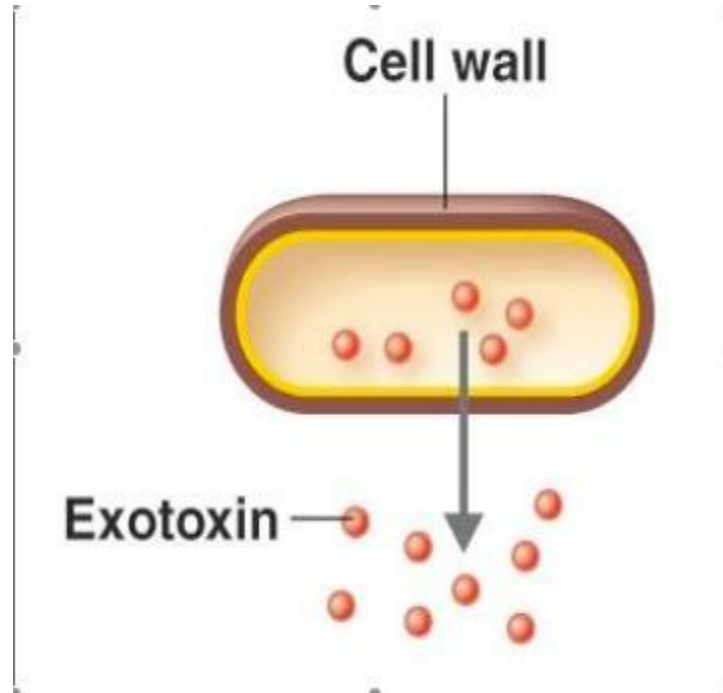
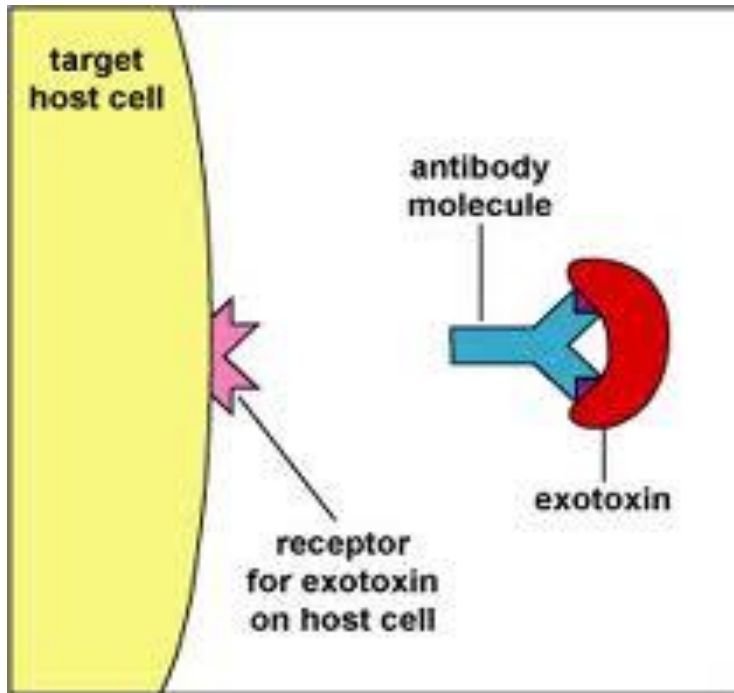
Exotoxin	Endotoxin
1~ Protein	Lipopolysaccharide
2~ Soluble	Part of cell wall
3~ Heat Labile	Heat stable
4~ Pharmacologically specific action	Non-Specific
5~ High Immunogenicity	Low Immunogenicity
6~ Inactivated by chemicals to toxoids	Do not form toxoids
7~ No Fever	Induce Fever

# Endotoxin



**(c) Gram-negative cell wall**

# Exotoxin



# **Koch's Postulates**

**For an microorganism to be accepted as the cause of an infectious disease it must satisfy all or most of Koch's criteria:**

- 1) The organism must be found in all cases of the disease and its distribution in the body must correspond to that of the lesions observed in the host.**

## **Koch's Postulates cont,..**

**2) The organism should be cultured in pure culture from all cases of the disease.**

**N.B. Some organisms cannot be cultured in the lab.**

**e.g.. *Treponema pallidum*, *Mycobacterium leprae*.**

**3) The organisms should reproduce the disease in other susceptible animal hosts.**

**4) Antibodies to the disease usually develop in the course of the disease.**