

# Lecture 3



## Host Parasite Relationship

- Additional Notes
- Important
- Explanation
- Examples

# OBJECTIVES:

- Define the terms:
  - ✓ Host-parasite Relationship
  - ✓ Pathogenicity
  - ✓ Pathogen
  - ✓ Disease
  - ✓ Resistance
  - ✓ Susceptibility
  - ✓ Infection
  - ✓ Virulence
  - ✓ Transmissibility
- Know the division of host resistance to parasite
- Know the division of pathogens
- Know the determinants of pathogenicity
- Differentiate between Exotoxin and Endotoxin
- Know about Koch's Postulates

- Human host is in contact with many microorganisms “normal flora”. Only a small number of these microorganisms can cause disease “primary and opportunistic pathogens”
- Host-parasite relationship: is characterized by fighting of the organism to invade the body and the body defending itself by protective measures.

It can be discussed under:

- ✓ Pathogenicity
- ✓ Normal Flora

- Definition of Pathogenicity, Pathogen and Disease:

Pathogenicity	Pathogen	Disease
<ul style="list-style-type: none"><li>• The ability of a microorganism to cause disease. (الإمراضية)</li></ul>	<ul style="list-style-type: none"><li>• A microorganism having capacity to cause disease in a particular host. (الممرض)</li></ul>	<ul style="list-style-type: none"><li>• Is the end product of an infectious process. (المرض)</li></ul>

# PATHOGENICITY

- Host resistance to parasite invasion is divided into:
- Non specific resistance:

It is part of natural constitution of the host.

Ex:

- ✓ Skin mechanical barrier
- ✓ Ciliated epithelium of respiratory tract
- ✓ Competition by normal flora
- ✓ Low PH in the stomach
- ✓ Cough
- ✓ Neutrophils
- ✓ Peristalsis<sup>(1)</sup>
- ✓ Lysozymes<sup>(2)</sup>

- Specific “Acquired” resistance:

It is specific to a certain organism.

Ex: Antibodies

<sup>(1)</sup>The progressive wave of contraction and relaxation of a tubular muscular system, especially the alimentary canal by which the contents are forced through the system.

<sup>(2)</sup>An enzyme that is destructive of bacteria and functions as an antiseptic.

- Pathogens can be divided according to degree of Pathogenicity into:
  - Primary pathogens:  
They cause disease in non immune host to that disease.  
Ex: *Bordetella species*, *Mycobacterium tuberculosis*
  - Opportunistic pathogens:  
They have low pathogenicity and infect people with low immunity.  
Ex: *Pseudomonas*
- Resistance: the ability of the host to prevent establishment of infection by using its defense mechanisms.
- Susceptibility: the lack of this resistance and establishment of disease
- Transmissibility: the ability to spread from one host to another. This enables microorganism to maintain continuity of its species in the event of death of original host.

- 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. It 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. If the LD50 is **small** the microorganism is considered **highly virulent** and when it is **high** the microorganism will be **lowly virulent**.
- When the organism is able to produce disease even in an apparently healthy host it is referred to as **primary pathogen** but when it causes disease only when the host's defenses are impaired it is called **secondary pathogen “opportunistic pathogen”**.

# DETERMINANTS OF PATHOGENICITY:

- Before causing disease a microorganism should have the ability of:
  - ✓ Adherence: It is the ability to attach firmly to host epithelial surface by the help of **pili** or **other protein surface structures**.
  - ✓ Surviving the host natural defense mechanisms.
  - ✓ Multiplied to large numbers.
  - ✓ Tissue destruction: It is the ability to overcome host defense and invade tissue and cause destruction to produce clinical disease.

And it is produced by: Toxin production & Invasion.

- **Toxin production either:** Exotoxin or Endotoxin.
- **Invasion by:** Capsulated or Non-capsulated organisms.

# CAPSULATED AND NON-CAPSULATED ORGANISMS:

## CAPSULATED

- Bacterial capsules are **ALL** made of **polysaccharide** except that of **Bacillus anthracis** made of **polypeptide**.
- Capsule prevent phagocytosis.
- Capsulated organisms are called **extracellular organisms** and they are readily killed once they are phagocytosed.

Ex: **Pneumococcus**

## NON-CAPSULATED

- Non-capsulated organisms resist intracellular killing so they are called **intracellular organisms**.
- Ex: **Mycobacterium tuberculosis, Salmonella typhi, Brucella species.**



## Exotoxin

- Protein
- Soluble & Diffusible
- Heat labile
- Pharmacologically specific action
- High Immunogenicity
- Forms toxoid by chemicals
- No fever

## Endotoxin

- Lipopolysaccharide
- Part of cell wall
- Heat stable
- Pharmacologically non-specific action
- Low Immunogenicity
- Does not form toxoids
- Induce fever

Exotoxin can be:

- ✓ A-B<sup>(1)</sup> exotoxin Ex: Cholera toxins. <sup>(1)</sup>A: Active Unit, B: Binding Unit for attachment
- ✓ Membrane active exotoxin Ex: Haemolysin of group A Streptococci

THIS TABLE IS VERY IMPORTANT !!!

# KOCH'S POSTULATES

- For a microorganism to be accepted as the cause of an infectious disease it must satisfy all or most of these 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.
  2. The organism should be cultured in pure culture from all cases of the disease.<sup>(1)</sup>
  3. The organism should reproduce the disease in other susceptible animal hosts.
  4. Antibodies to the disease usually develop in the course of the disease.

<sup>(1)</sup>Some organisms are yet to be cultured in the lab.

Ex: *Treponema pallidum*, *Mycobacterium leprae*.

# Quiz

1..... is an example of specific resistance:

- a) Cough    b) Antibodies    c) Neutrophils    d) Peristalsis

2.Opportunistic Pathogens:

- a) Is the end product of an infectious process.  
b) Have low pathogenicity and infect people with low immunity.  
c) Is a microorganism that have capacity to cause disease in a particular host.

3..... are organisms that are readily killed once they are phagocytosed .

- a) Extracellular organisms    b) Non capsulated organism    c) Intracellular organisms

# Quiz

4. One of these is not a characteristic of Exotoxin:

- a) High immunogenicity   b) Heat labile   c) Gram negative bacteria   d) no fever

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

- a) T   b) F

6. When the lethal dose 50 is high the microorganism is considered highly virulent.

- a) T   b) F

7. All bacterial capsules are made of polysaccharide.

- a) T   b) F