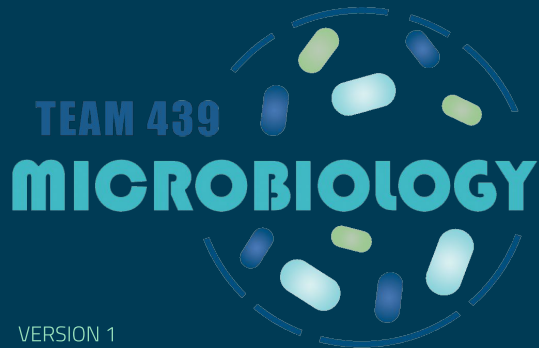


Host-Parasite Relationship



Objectives

- ❖ Define core terms related to host-parasite relationship.
- ❖ Recall host response to parasite invasion (specific & 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 pathogens.
- ❖ Describe the attributes of pathogenicity (including: adherence, survival, multiplication, invasion, tissue destruction) and recall example.
- ❖ Know the infection chain and the infectious disease process.
- ❖ Know Koch's postulates.

Colour index:

- **Red: Important .**
- Grey: Extra info & explanation.
- **Purple: only in girl's slides.**
- **Green: Only in boy's slides.**
-

Any future corrections
will be in the editing
file, so please check it
frequently.

Scan the code
Or click [here](#)

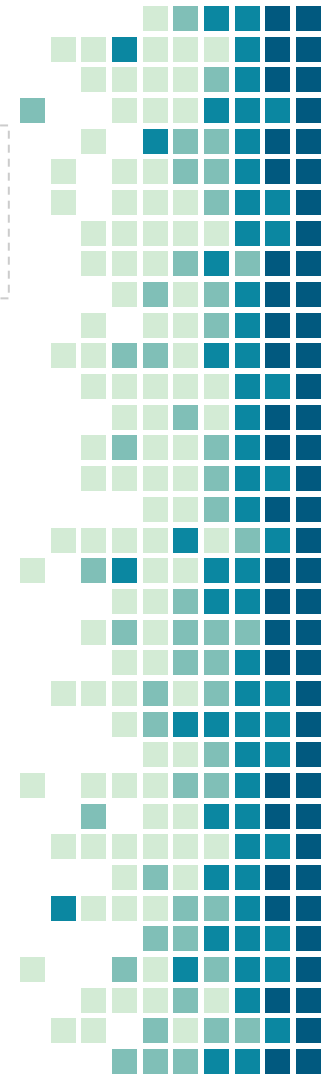


Host-Parasite Relationship

Host: a human, animal, or others that **support the growth, 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 is all the bacteria in our body that causes no disease.
- ❖ Only a small number of these microorganism (**primary and opportunistic pathogens**) can cause disease.
- ❖ Host-parasite relationships (interaction) is characterized by fighting the organism to invade the body, and the body defending itself by protective measures. (All defend lines in the body e.g. ,WBC or Tonsils).
- ❖ Host-parasite relationship is discussed under: Pathogenicity and Normal Flora.



Definitions

- ★ **Pathogenicity:** the **ability of a microorganism to cause disease.**
- ★ **Infection:** **invasion of cells and multiplication** by microorganisms without tissue destruction. (shows no symptoms). عند انتقال العدوى من بالضرورة أنه يمرض الشخص، يقدر يحمل العدوى بدون أعراض المرض.
- ★ **Disease:** is the **end product of an infectious process** and tissue destruction. (when the **microorganism causes symptoms**). It is the result of pathogenicity & pathogene.
- ★ **Resistance:** The **ability of a host to prevent establishment of infection** by using its defense mechanisms.
- ★ **Susceptibility:** **Lack of resistance** to organism and establishment of disease. (You can catch the disease easily, أكثر عرضة لانتقال العدوى).
- ★ **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, contact, vehicle (water, food), or vector (mosquitos, etc..).

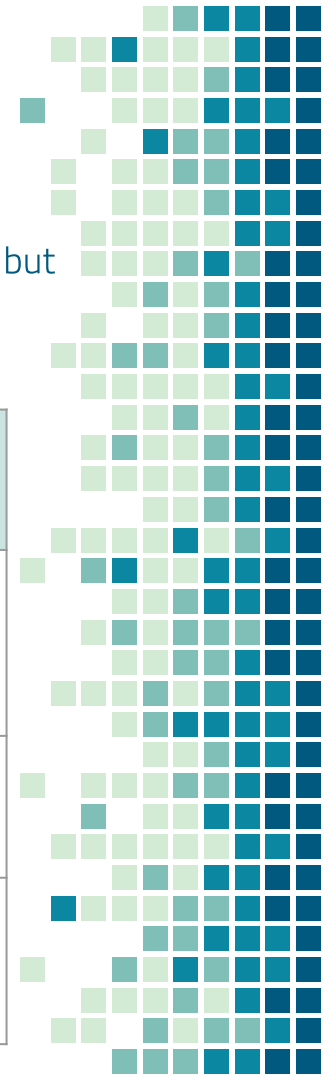


Pathogens,

According to degree of pathogenicity

Pathogen: (the infectious agent) a microorganism having the capacity to cause disease in a particular host. It might infect one or multiple body organs. Some pathogens enter into latent state (infection but no symptoms) e.g. **mycobacterium tuberculosis** (bacteria that causes TB), and **Herpes virus**.

Primary Pathogen True (full-time bad guys)	Secondary Pathogen Opportunistic (Part-time bad guys)
An organism that causes diseases in an apparently healthy host who is non-immune to that organism.	It has a low pathogenicity (Ability to cause diseases) and infects people with low or weakened immunity (immunocompromised host).
<ul style="list-style-type: none">- Mycobacterium tuberculosis TB**- Bordetella species	<ul style="list-style-type: none">- Pseudomonas**- S. epidermidis (staphylococcus epidermidis)
<ul style="list-style-type: none">- Associated with a specific & recognizable disease.- Causes diseases to healthy individual.	<ul style="list-style-type: none">- Gain access (injury) sterile regions- Causes disease only when host's defenses are impaired. <p>Usually it is normal flora, but acts as pathogen when immune system is weak. Ex:staphylococcus epidermidis ,E.coli</p>



Host Resistance To Parasite Invasion

Non-specific Resistance

Part of **natural** constitution of the host.

- 1- Skin mechanical barrier. (burn patients can suffer from serious infections due to lack of this barrier)
- 2- Ciliated epithelium of respiratory tract.
- 3- Competition by normal flora.
- 4- Low pH of the stomach.
- 5- Cough.
- 6- Peristalsis (movement of intestines and esophagus).
- 7- Lysozymes (abundant in the eye conjunctiva). (destroying peptidoglycan, thus killing the bacteria)
- 8- Neutrophils (white blood cells).

Specific & Acquired Resistance

Acquired (مكتسبة) resistance to a certain organism

- 1- Formation of antibodies.

بعد الإصابة بمرض أو التطعيم تتكون أجسام مضادة في الجسم ضد هذا الباثوجين



Virulence

Is Degree of pathogenicity (severity/harmfulness), or the ability to invade and destroy tissue to cause disease. by toxins, certain enzymes, or their capsid.

Measured by: **Lethal Dose 50% (LD50)**

The number or amount (usually measured by micro or milligrams) of microorganisms & toxins required to kill 50% of the test population (susceptible lab animals like mice).

In other words, LD 50 is the dose that we inject into lab animals until 50% of the animals dies.

If the lethal dose that caused 50% of test animals to die was a **small dose**, then this microorganism is **highly virulent**.

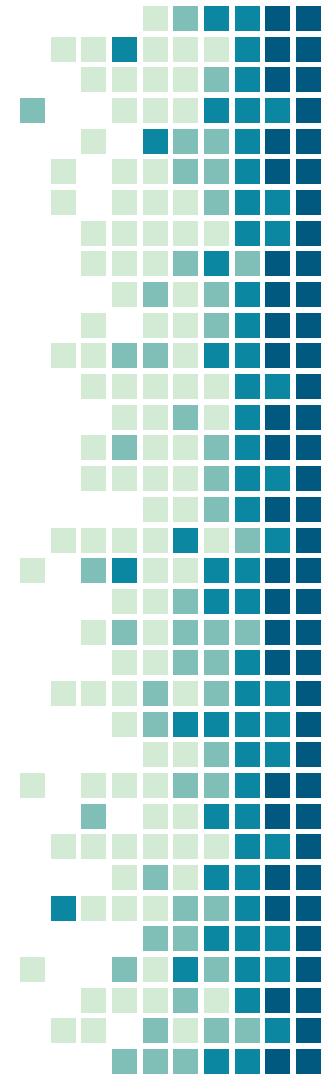
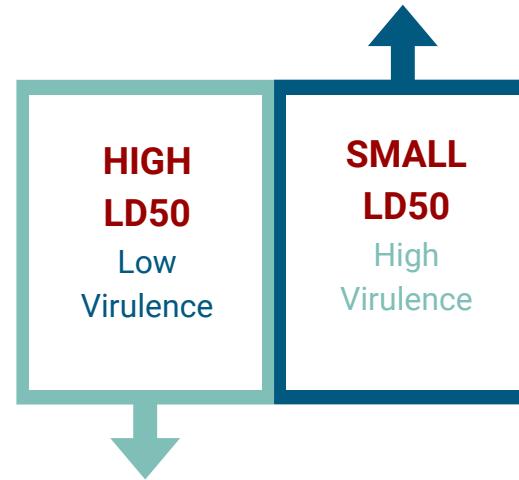
بما اننا احتجنا جرعة أو كمية قليلة بس لقتل 50% من عينة الاختبار إذا قوتها و عدوانيتها عالية

In contrast, if we needed a **high dose** to kill 50% of the animals, it means that this organism has a **low virulence**.

بما اننا احتجنا جرعة أو كمية كبيرة لقتل 50% من عينة الاختبار عدوانيتها ضعيفة وقوتها قليلة

E.g: **Shigella spp.** is **more virulent** than **Salmonella spp.**

E.g: kg of botulinum (bacteria), can kill all the people in the world, so it's highly virulent.



Determinants of pathogenicity (virulence factors)

- Virulence is predominantly associated with:

Adherence and Colonization

Attachment to host epithelial cells by means of adhesins (factors that helps to adhere)

Surviving (resist) Host defence mechanisms

It's the ability to **resist host immune defense**

Invasion (multiplication)

The ability of microorganisms to **multiply** and spread in large numbers in the host tissue.

Tissue Destruction

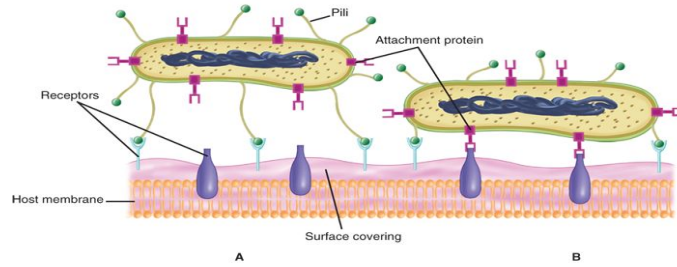
the ability to overcome host defense, invade the tissues and **cause destruction to produce clinical disease.**

By toxin formation



Factors of Adhesion

Means and factors that helps the parasite to adhere يلتصق is either found on itself (bacteria cell) or on the cell of the host (e.g:human cell)



Factors Of Adherence

On the bacterial cell
(Or Parasite)

Pili

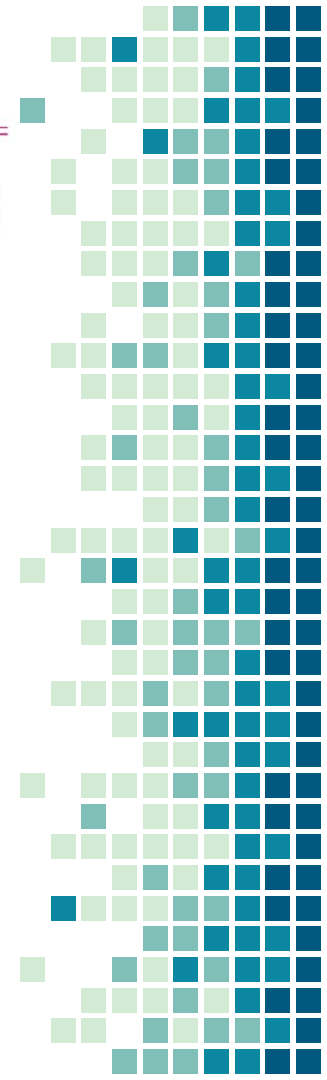
Other protein surface
structures

Capsid Spikes
(of Viruses)

On the host cell

Fibronectin

Protein and
Glycopeptide parts



Tissue Destruction

Toxins

Exotoxins

Found in -ev and +ev bacteria

A-B Type Exotoxins

Cholera toxins

Endotoxins

Found only in -ev

Membrane Active Exotoxin

Haemolysin of group A Streptococci

Invasion

Capsulated

-*S.pneumoniae* (Pneumococcus)
-Haemophilus influenzae

Non-Capsulated

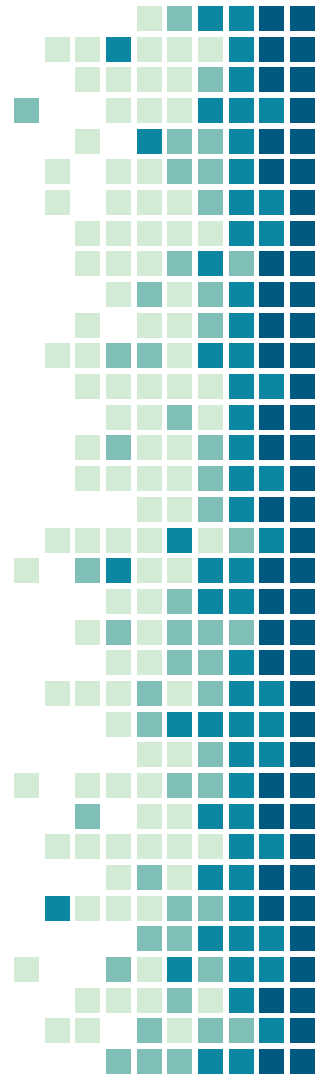
-*Mycobacterium tuberculosis*
- Salmonella typhi
- Brucella species

Note: virulence factors for the bacteria are the capsule, endotoxins and exotoxins.



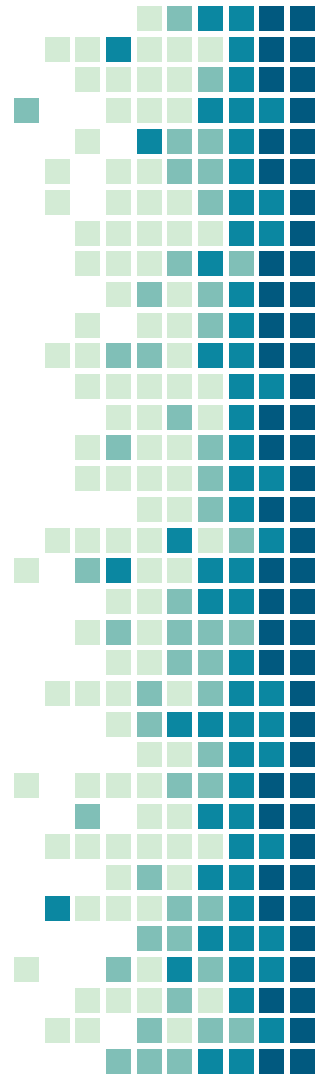
Invasion, Capsulated VS. Non-Capsulated

Capsulated	Non-Capsulated
<p>They have capsules and it protects it, thus they are highly virulent</p> <p>Bacteria capsules are polysaccharide <u>Except</u> the capsule of Bacillus anthracis** (which is a polypeptide-Protein).</p> <p>(Bacillus anthracis causes anthrax and was used as a bioweapon).</p> <p>The organism is readily killed once phagocytosed. Capsule prevents the phagocytosis and capture of the bacteria by the host immune System.</p> <p>It is called extracellular organisms (EC) (It lives outside of the cell)</p> <p>- S.pneumoniae (Pneumococcus) **** -Haemophilus influenzae *</p>	<p>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)</p> <p>-Mycobacterium tuberculosis*** (Primary pathogen, remember?)</p> <p>- Salmonella typhi - Brucella species</p>



Exotoxin vs Endotoxin **IMPORTANT*****

Protein	Lipopolysaccharide (lipid+sugar)
Soluble & Diffusible (can spread outside the cell)	Part of cell wall (it stays within the bacterium cell, until the bacteria is destroyed, then it will diffuse to the blood)
Heat Labile (changing)	Heat stable
Pharmacologically producing a specific action (goes to a specific site & causes a specific action)	Non-Specific action (It is more dangerous because the immune system becomes confused and it tries to fight this bacteria by destroying cells all over the body)
High Immunogenicity (capable of provoking the immune system, and trigger or induce the production of neutralizing antibodies which will target the effect of toxins).	Low Immunogenicity (they are not capable of provoking the immune system, thus it cannot produce neutralizing antibodies).
Inactivated by chemicals to toxoids (such as vaccines)	Do not form toxoids
No Fever	Induce Fever
BOTH Gram (-ve) & (+ve)	ONLY in gram (-ve)



A-B Subunit - EXOTOXIN

Example: Cholera toxins

A : Active unit

هي اللي تدخل للرايبوسوم وتوقف protein synthesis

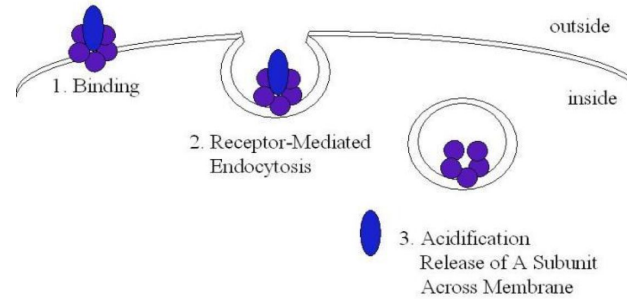
B : Binding unit for attachment

تساعد البكتيريا ترتبط بجدار الخلية

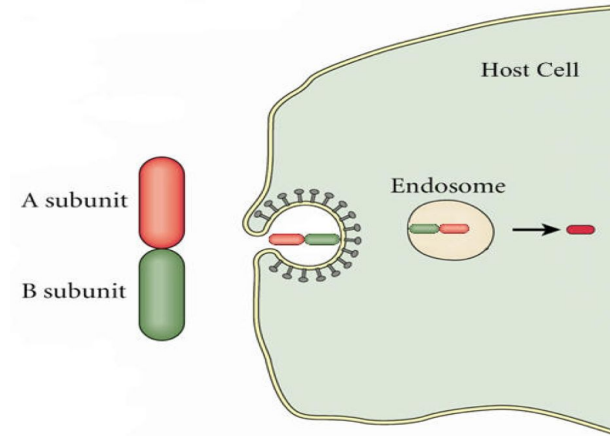
Cell entrance via:

- 1- Receptor mediated endocytosis.
- 2- Fusion of vesicle with lysosome.
- 3- Acid environment of lysosome reduces disulfide bonds and releases a into cell.

A-B Toxin Entry

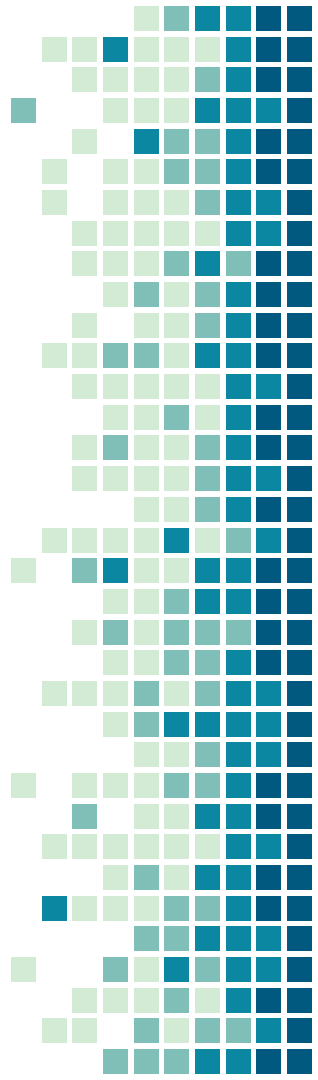
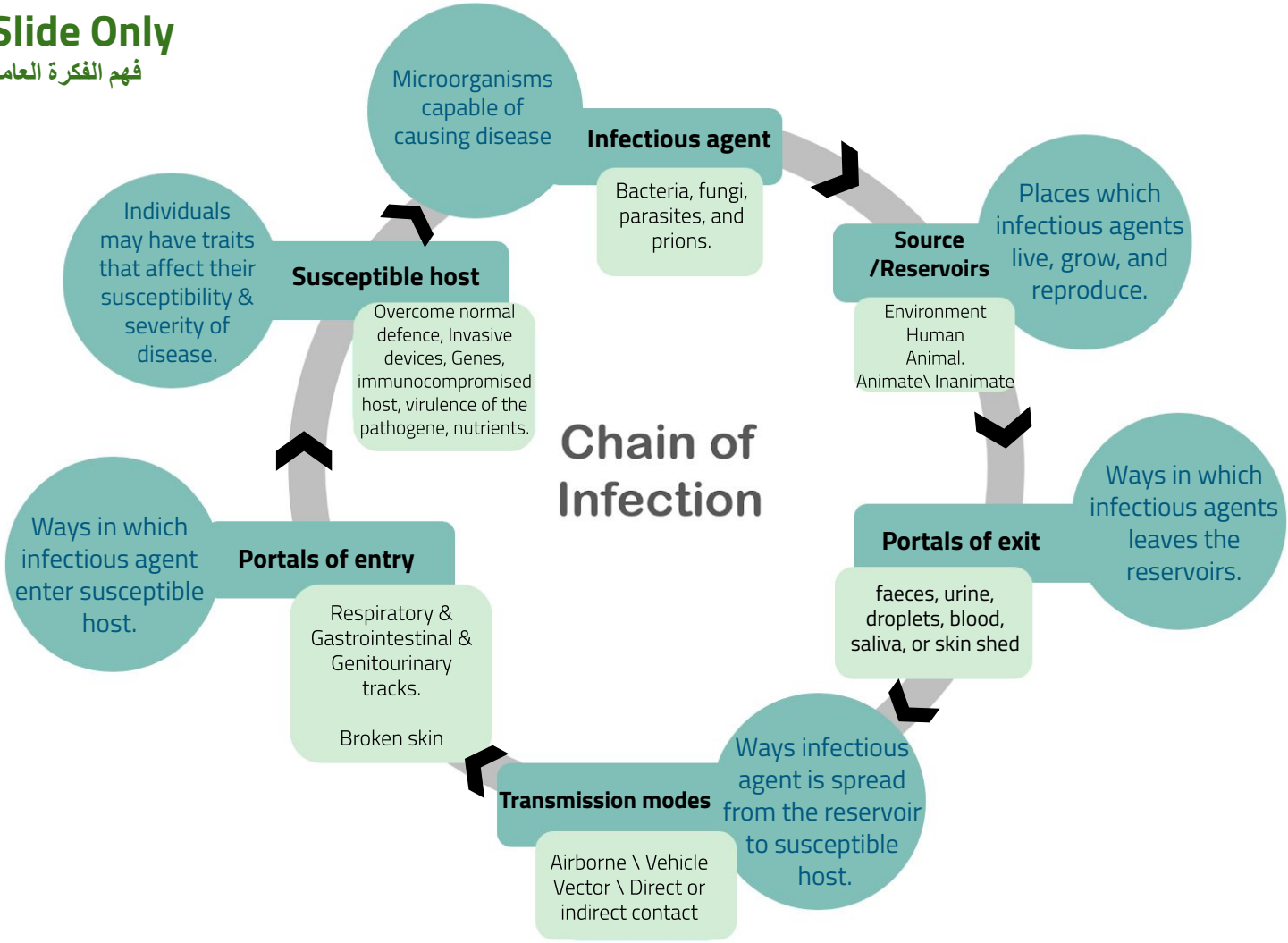


(c) 2004, Jenifer Coburn, Ph.D.



Boy's Slide Only

فهم الفكرة العامة بس



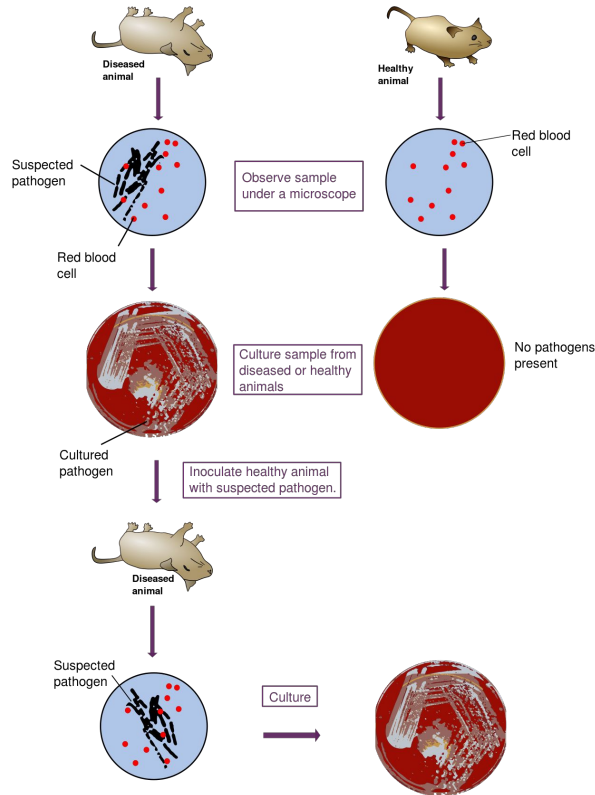
Infectious Disease Process

- 1- Incubation period (latent): from entry to showing signs and symptoms.
- 2- Prodromal stage: clinical signs are insufficient.
- 3- Illness: severe disease, immune system triggered.
- 4- Convalescent period: recovery.



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

- Pathogen must be found in **subject suffering from the disease**, but should never be found in a healthy subject.
- Pathogen **can be isolated** from a sick person and grown (purely cultured) in the lab.
- Pathogen injected into healthy person should **cause an infection with the same disease**. (have the ability to reproduce the disease in other hosts).
- Injected pathogen can be isolated from newly infected individual and it must be **identical to the original pathogen** (Reisolated, yet identical).



MCQs

1- Which of the following is an opportunistic pathogen?

- A) Bordetella
- B) HIV
- C) Mycobacterium TB
- D) Pseudomonas

2- Most gram negative bacteria are?

- A) Endotoxins
- B) Exotoxin
- C) Spore forming
- D) B+C

3- Exotoxin bacteria has..

- A) Lipopolysaccharide
- B) High immunogenicity
- C) Low immunogenicity
- D) Non- specific action

4- Which of the following is a characteristic of endotoxin bacteria

- A) No fever
- B) Heat labile.
- C) Don't form toxoids.
- D) Protein

SAQ

1- Host resistance to parasite invasion is divided into..

2- The ability of a microorganism to cause a disease is known as?

Slide 6

Slide 4



1-D
2-A
3-B
4-C

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