

Virulence

It's the ability of being virulent (as in infection). Which means the capacity of microorganism to overcome the body defenses.

Virulence depends on :

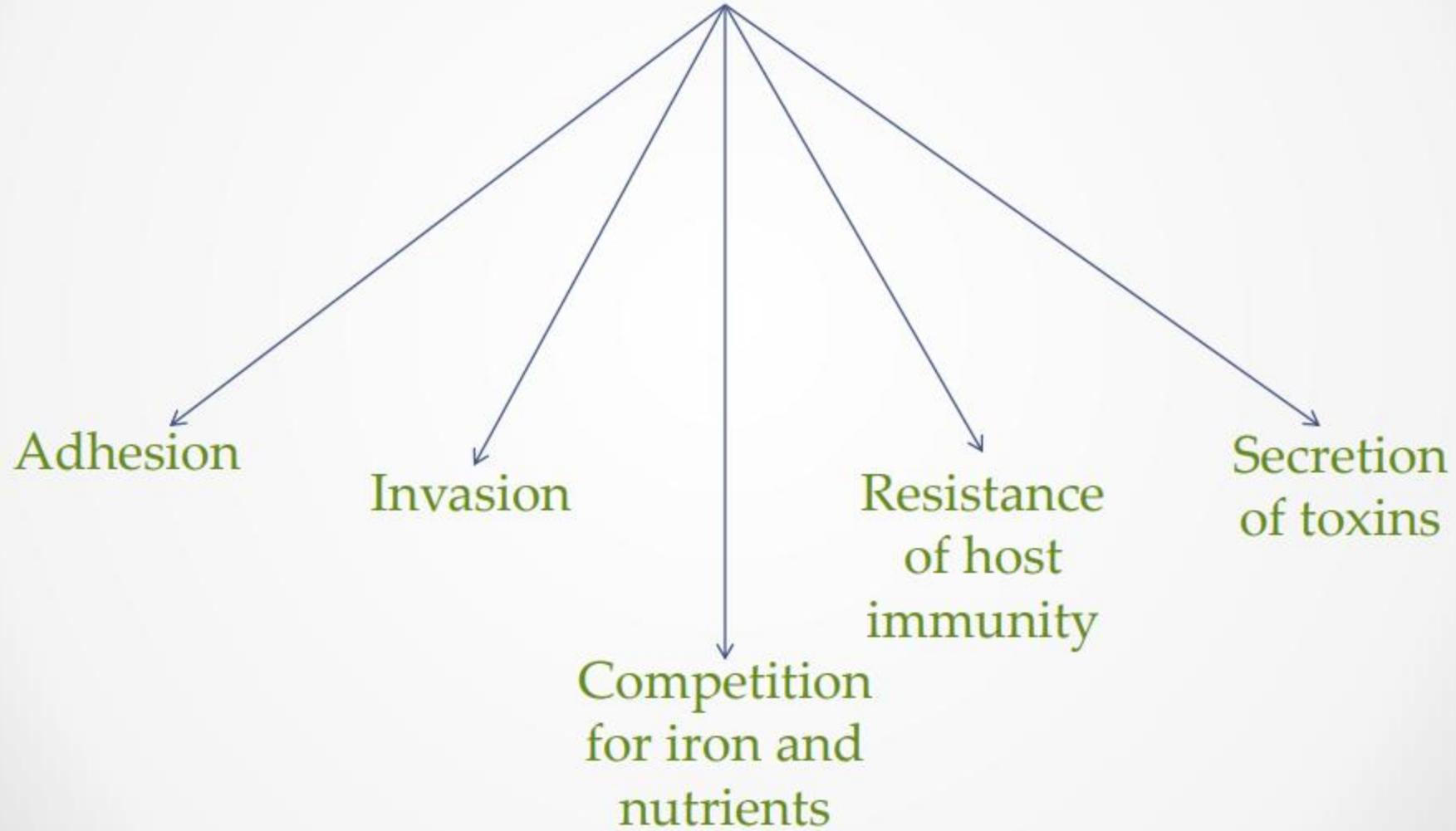
- The number of infecting microorganisms.
- Their route of entry into the body.
- The response of the host immune system.

VIRULENCE FACTORS

These are the molecules expressed and secreted by the bacteria

May be encoded on chromosomal, plasmid, transposon or temperate bacteriophage DNA

Virulence Factors



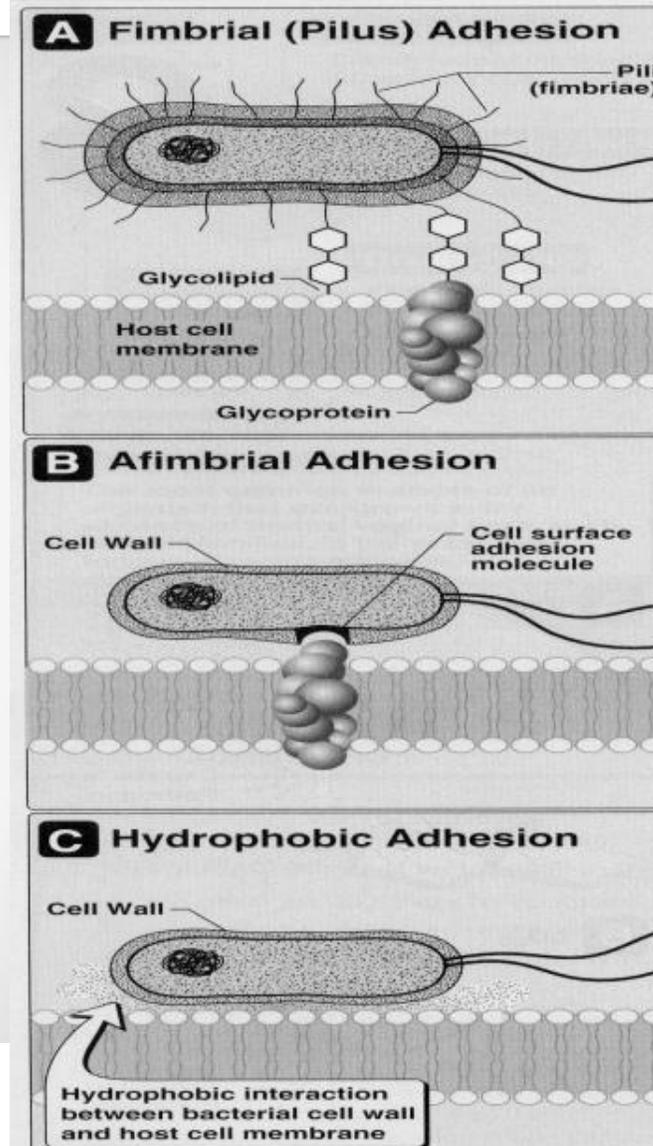
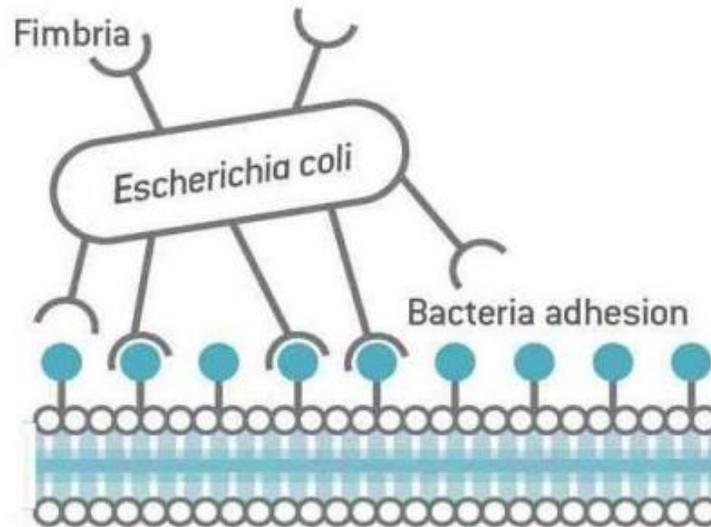
1 - Adhesion

Its the ability to adhere to host cells and resist physical removal :

-Bacteria resist physical removal by :

- Producing fimbriae (pili)
- Non fimbrial adhesins
- Biofilm-producing glycocalyx

These enable bacteria to adhere to receptors on target host cells

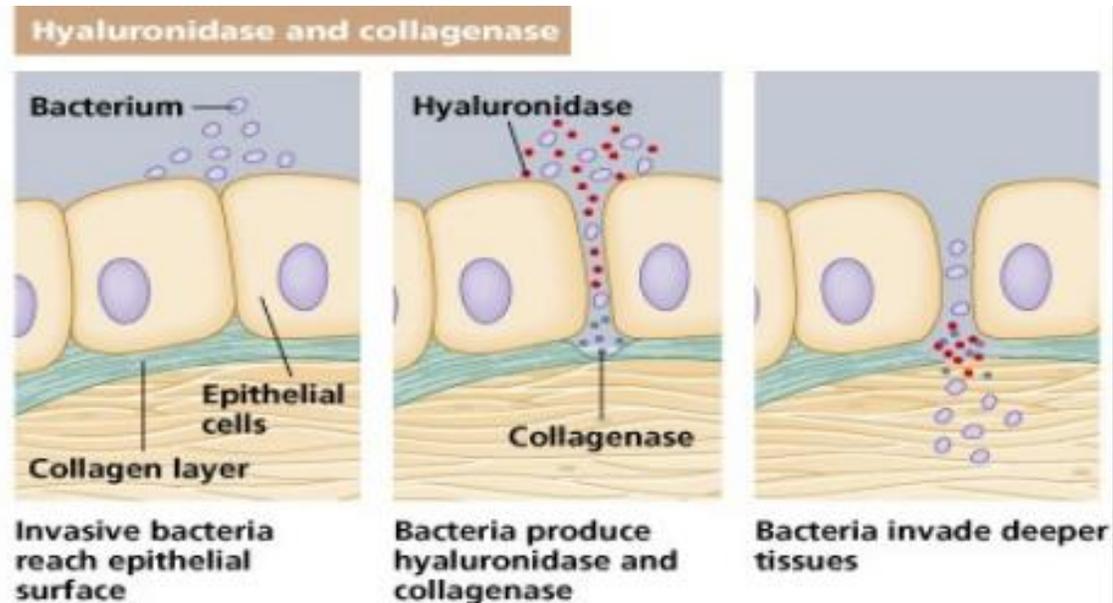


2-Invasion

-It's the ability of microorganisms to **enter host's** tissues, multiply and spread to other tissues.

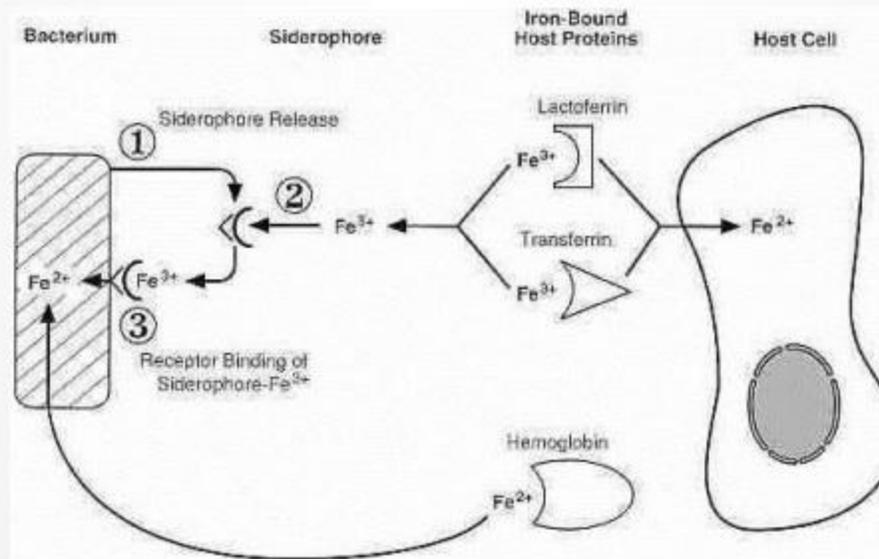
-This invasion is helped by enzymes, :

- collagenase (breaks down collagen).
- Hyaluronidase (breaks down hyaluronic acid).
- Lecithinase (breaks down lecithin of cell membrane).



3-Competition for iron and nutrients

- It's the ability to compete for iron and other nutrients as they are essential for bacterial and human cell growth
- Bacteria synthesize iron chelators (compounds capable of binding iron) called siderophores.
- Many siderophores are excreted by the bacteria into the environment, bind iron, and then re-enter the cell

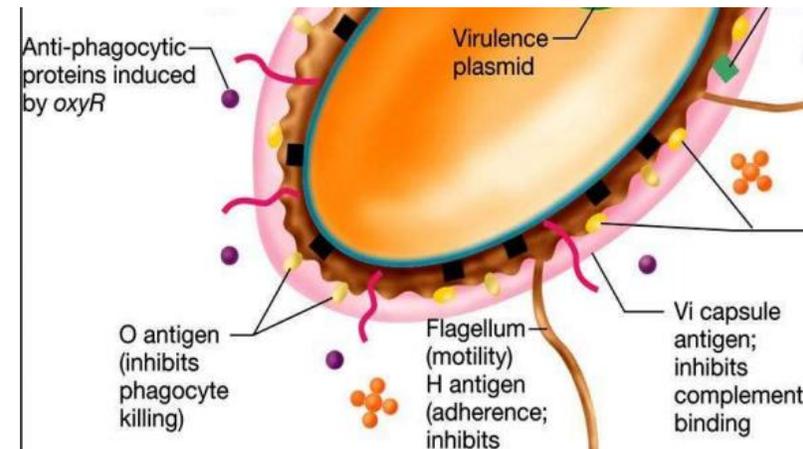
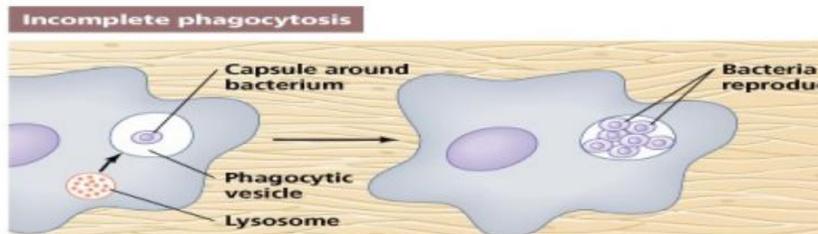
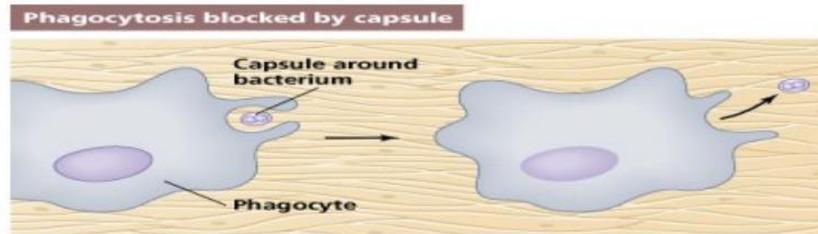
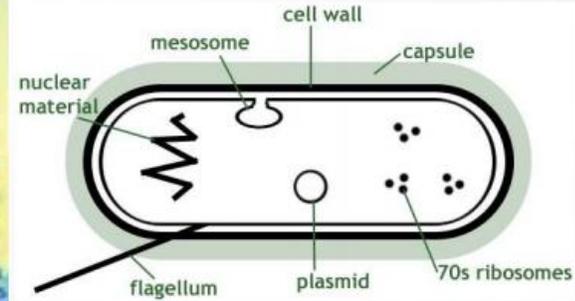
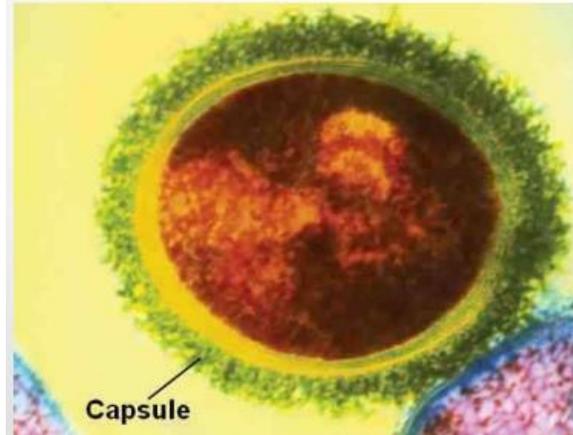


4-Resistance of host immunity

-It's the ability to resist host immune defense.

-Bacteria resist host immune defense by :

- **Capsules** : some resist phagocytosis by presence of capsules that prevent the phagocytes from adhering to the bacteria



- **Immunoglobulin A protease :**

Lysis of IgA by protease which allows the microorganisms to adhere to mucus membrane

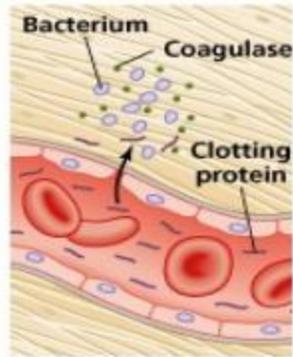
- **Leukocidin :** destroy both neutrophils and macrophages

- **Coagulase Enzymes :**

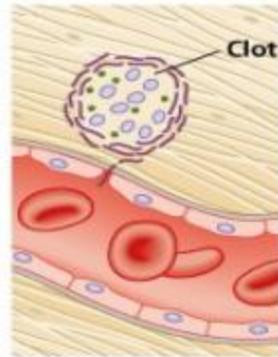
Accelerates the formation of fibrin clot from fibrinogen. This clot can protect the bacteria from phagocytosis.



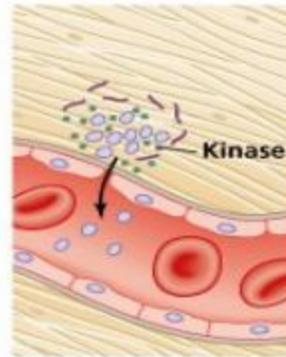
Coagulase and kinase



Bacteria produce coagulase



Clot forms



Bacteria later produce kinase, dissolving clot and releasing bacteria

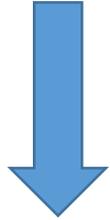
Toxins

- They are products of a pathogen that **destroy/ damage/**
- **inactivate** one or more vital component of the host.

Types of toxins

Exotoxin

Endotoxin

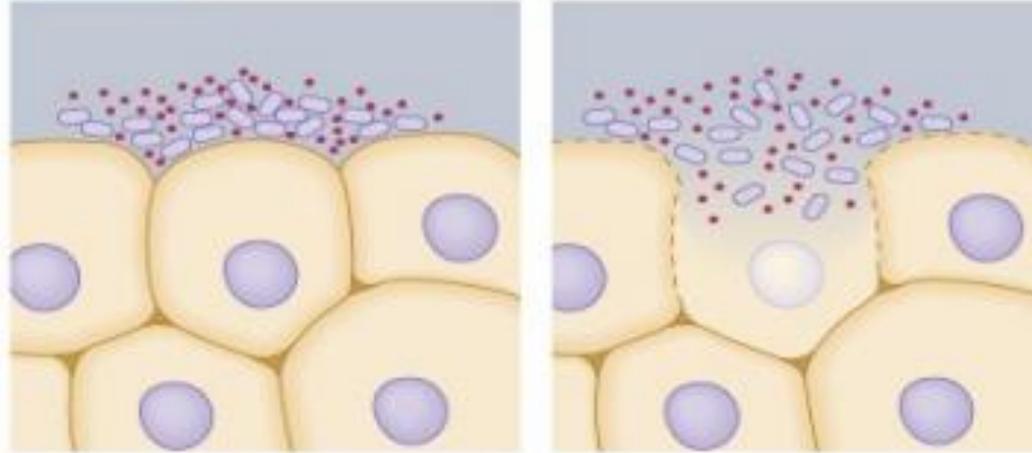


Neuro
toxin

Entero
toxin

Cyto
toxin

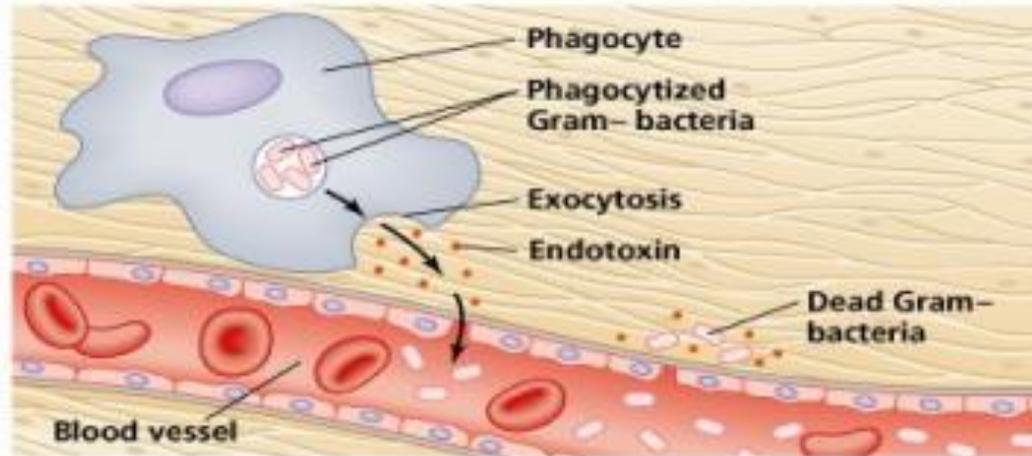
Exotoxin



Bacteria secrete exotoxins, in this case a cytotoxin

Cytotoxin kills host's cells

Endotoxin



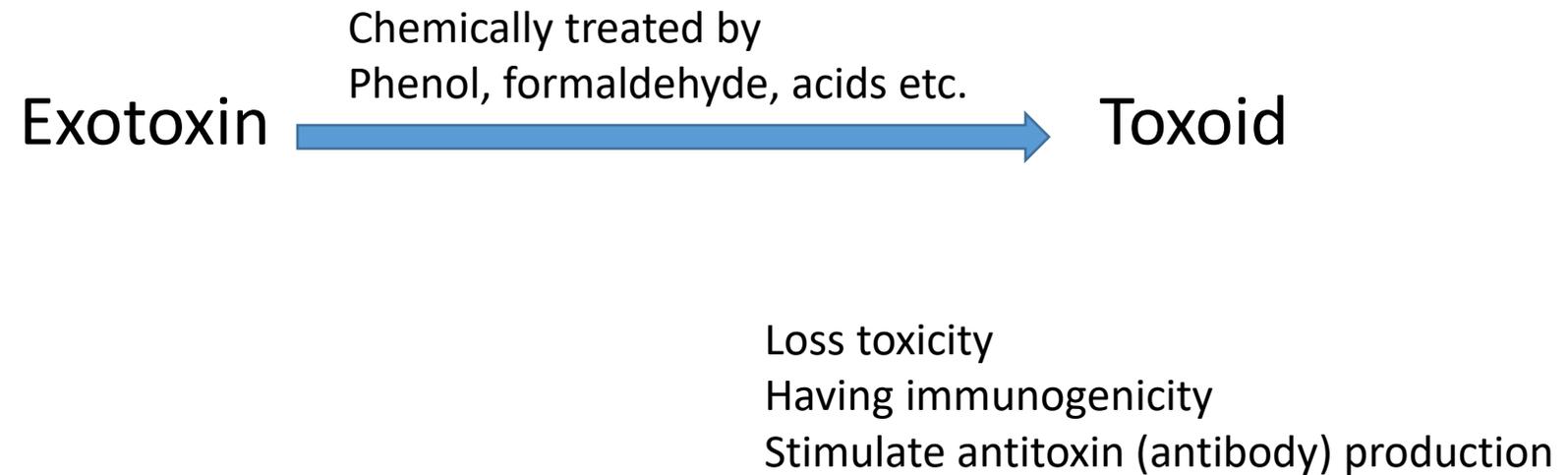
Dead Gram-negative bacteria release endotoxin (lipid A) which induces effects such as fever, inflammation, diarrhea, shock, and blood coagulation

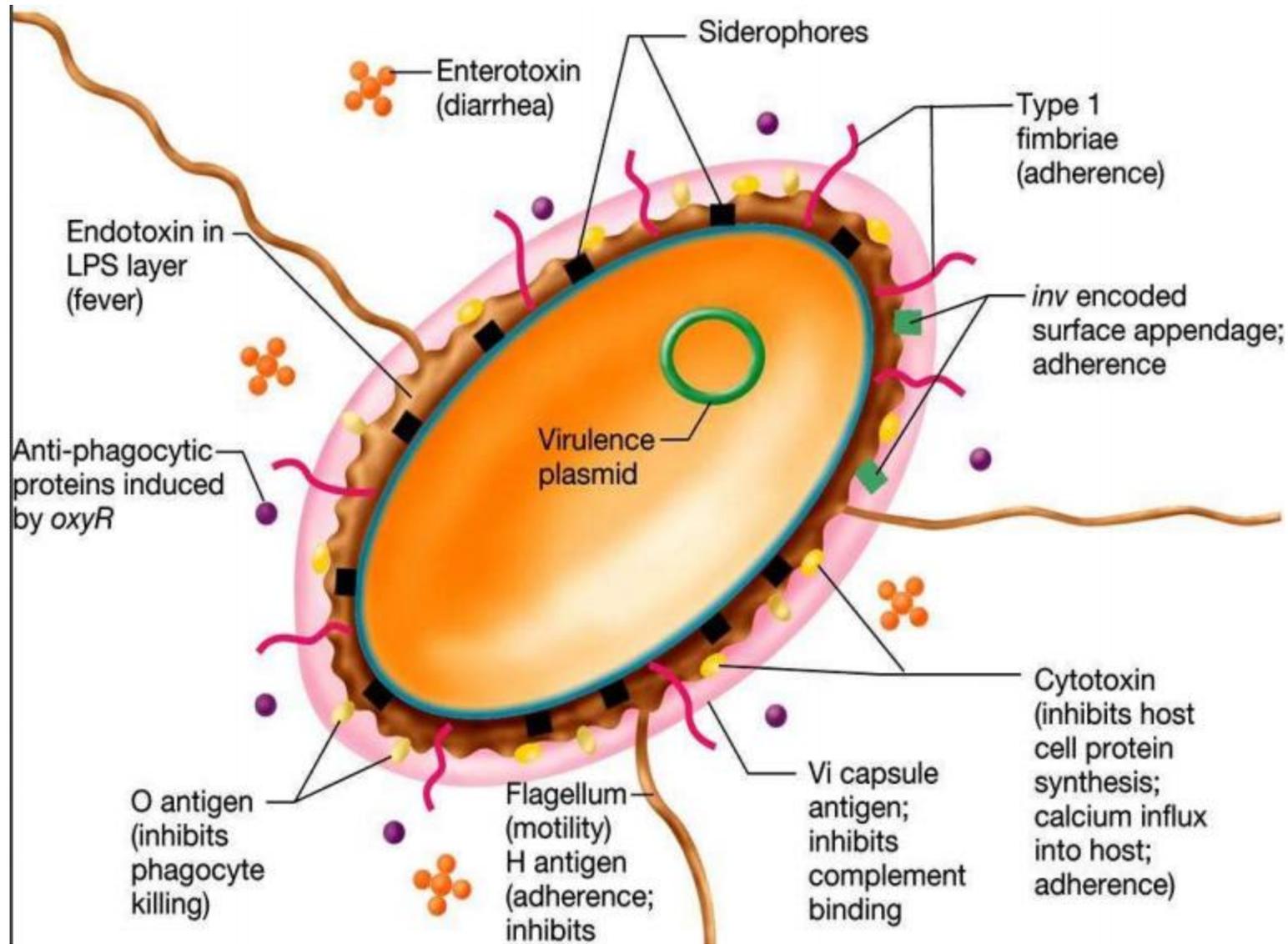
Endotoxins	Exotoxins	
Integral part of cell wall of Gm – organisms.	Gm + & Gm – organisms.	Source
Lipopolysaccharide.	Protein (polypeptide).	Chemistry
Non diffusible, released on cell lysis.	Diffusible, secreted by living cells.	Mechanism of release
Low toxicity.	Very high toxicity.	Toxicity
Poorly antigenic.	Highly antigenic.	Antigenicity
Stable at temperature > 60°C for several hours without loss of toxicity.	Unstable to temperature > 60°C , toxicity destroyed rapidly.	Effect of heat
No effect, can not be converted	Convert it into toxoid	Effect of Chemical
Not specific action (all give fever and shock).	Every toxin has specific action.	Specificity
Produce fever in the host through release of interleukin-1 from macrophages	Do not produce fever in the host.	Fever

Types of Exotoxins and Example of exotoxin producing bacteria

Category	Bacteria	Infection
Neurotoxin (alters the structure or function of the nervous system)	<i>Clostridium botulinum</i>	Botulism
	<i>Clostridium tetani</i>	Tetanus
Enterotoxin (affecting the intestines and induce intestinal fluid loss without altering the morphology of the intestine)	<i>Vibrio cholerae</i>	Cholera
	<i>Staphylococcus aureus</i>	Staphylococcal food poisoning
Cytotoxin (has a direct toxic or destructive effect on certain cells of the body)	<i>Corynebacterium diphtheriae</i>	Diphtheria
	<i>Streptococcus pyogenes</i>	Scarlet fever
	<i>Shigella dysenteriae</i>	Bacillary dysentery

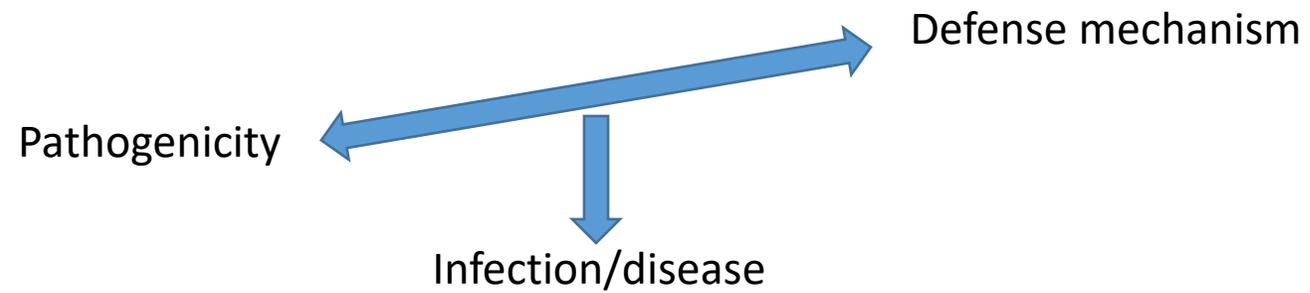
Toxoid





Why or when is a host susceptible to pathogen

Pathogenicity of organism and Non/specific defense mechanism of host



Portal of exit

the site from where micro-organisms leave

Upper respiratory tract

- saliva from the oral cavity
- sneezing
- coughing

Gastrointestinal tract

- faeces / diarrhoea from the bowel
- vomitus

Blood

- infected blood

Urogenital tract

- semen
- vaginal secretions
- infected urine

Skin and mucous membranes

- discharges from infected skin lesions and infected wounds

