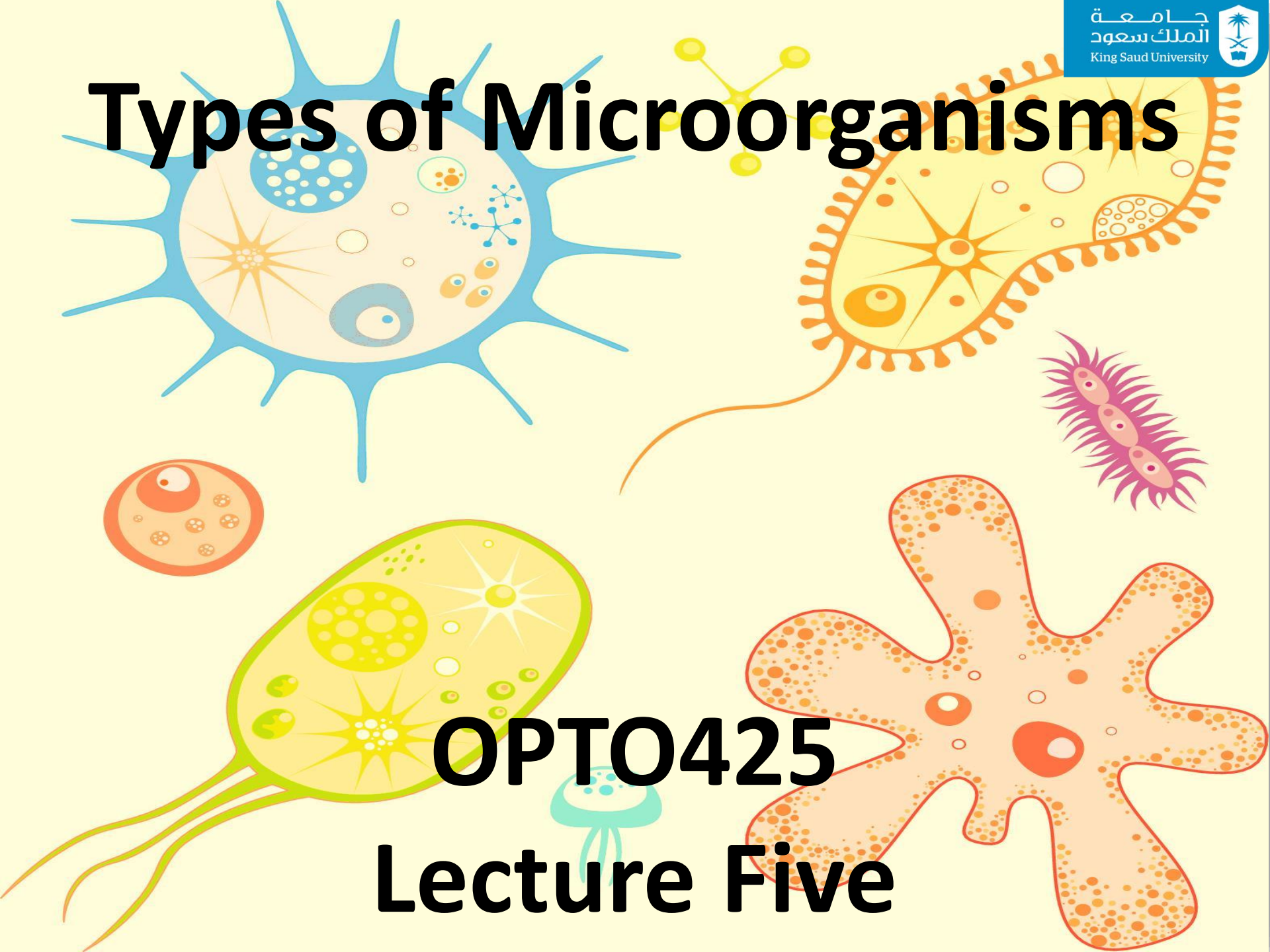


Types of Microorganisms



OPT0425

Lecture Five

Learning Outcomes

Outcomes

What are bacteria and what diseases they can cause?

How to classify bacteria based on shape and arrangement?

How to differentiate between Gram positive and negative bacteria?

What are fungi and what effects they have on human?

What is the structure of cell wall in fungi?

Normal Flora

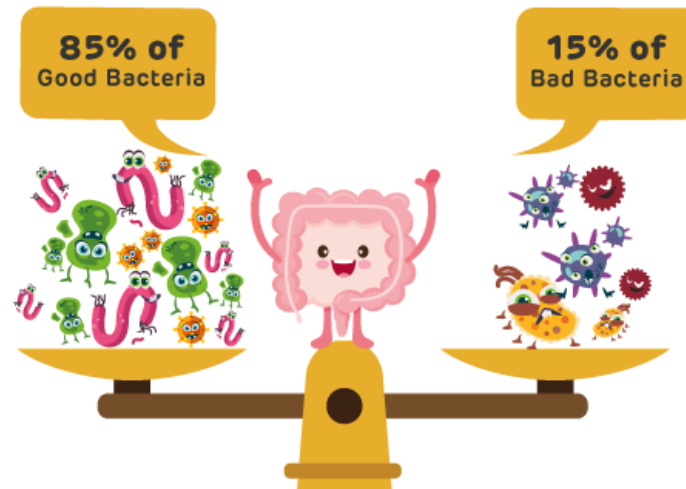
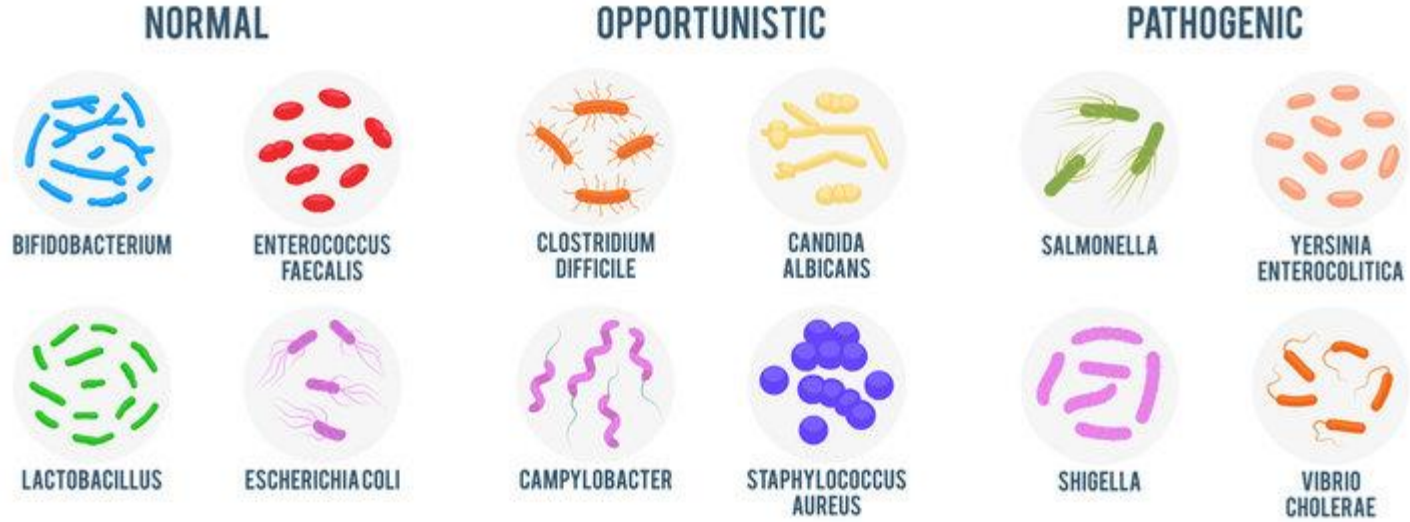
- Resident flora are known as normal microbiota.
- Normal flora establish permanent colonies inside the human body without causing diseases and protect the host.
- Normal flora occupy niches that normally pathogens might occupy.
- Normal flora produce bacteriocins and acids.
- Normal flora stimulate the immune system.
- Consume the available nutrients.

Normal Flora

- **Normal flora** are the microorganisms that live on another living organism (human or animal).
- Produce compounds that are toxic to other microorganisms.
- Microbial antagonism could be due to the competition between microbes.
- We are covered with approximately one hundred trillion bacteria.
 - **Normal flora** prevent dangerous bacteria to colonise us.

Normal Flora

INTESTINAL MICROFLORA



Normal Flora

- Dynamic nature of resident flora depend on:
 - Age
 - Type of food consumed
 - Hormonal state
 - Antibiotics
- **Probiotics:** Live microbes ingested into the body and exert a beneficial effect.
- **Transient microbiota:** Certain microbes that present for various periods (days, weeks, or months) before they disappears.

Normal Flora

- When the balance between normal flora and pathogens is upset, diseases can result.
- The normal bacterial microorganisms (**normal flora**) of the adult human vagina maintain the pH at about 3.4 – 4.5.
- The presence of this normal flora inhibits the overgrowth of *Candida albicans* (related yeast).
- *Candida albicans* (fungus) cannot live in acidic environment (pH = 3.4 – 4.5)

Bacteria

- Often considered the causes of most diseases.
- Bacteria are one-celled plants.
- Certain bacteria produce antibiotics.
- Live in the body without problems.
- Live on the roots of certain plants and convert nitrogen into usable form.
- Help break down dead organic matters.
- Classified by **shape** and **arrangement**.
- **Strep throat** and **pneumonia** are caused by form of bacteria.

Bacteria

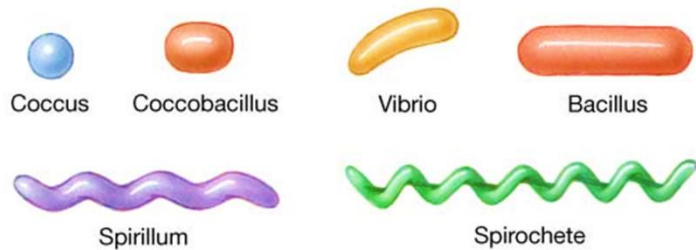
- Some bacteria are very difficult to cure.
- Some bacteria develop resistance to antibiotics.
- Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals or other agents designed to cure or prevent infections.
- **Methicillin-resistant *Staphylococcus aureus*** (MRSA; Gram-positive bacteria) is difficult to treat due to resistance.

Bacteria

- The cell walls of **bacteria** are made of **peptidoglycan**.
- **Peptidoglycan** is a polymer consisting of sugars and amino acids that forms a mesh-like layer outside the plasma membrane of bacteria forming the cell wall.
- The cell walls of **plants** contain **cellulose**.
- Cellulose is a polysaccharide consisting of a linear chain of several hundred to over ten thousand $\beta(1,4)$ linked *D*-glucose unit.

Bacteria

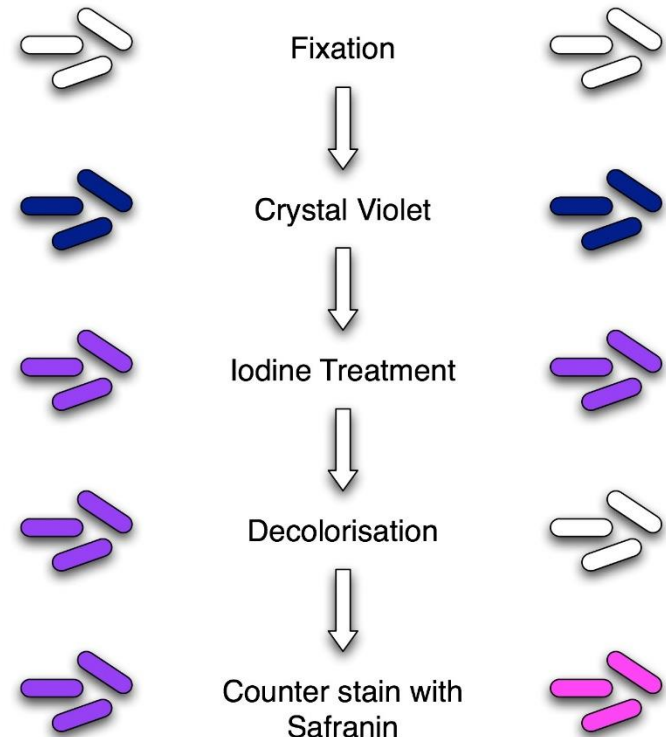
- Bacteria can be classified according to their shape, arrangement, staining and oxygen requirements, for example.



| | AEROBIC | ANAEROBIC |
|---------------|---|---|
| GRAM NEGATIVE | BACILLI E Coli <ul style="list-style-type: none"> • Haemophilus • Klebsiella • Proteus • Acinetobacter • Pseudomonas • Yersinia • Salmonella • Campylobacter • Enterobacter • Morganella | COCCI <ul style="list-style-type: none"> • Moraxella • Neisseria |
| GRAM POSITIVE | BACILLI <ul style="list-style-type: none"> • Bacillus | BACILLI <ul style="list-style-type: none"> • Actinomyces • Clostridium • Lactobacillus COCCI <ul style="list-style-type: none"> • Staphylococcus • <i>S Aureus is coag +ve</i> • Streptococcus • Enterococcus |

GRAM-POSITIVE

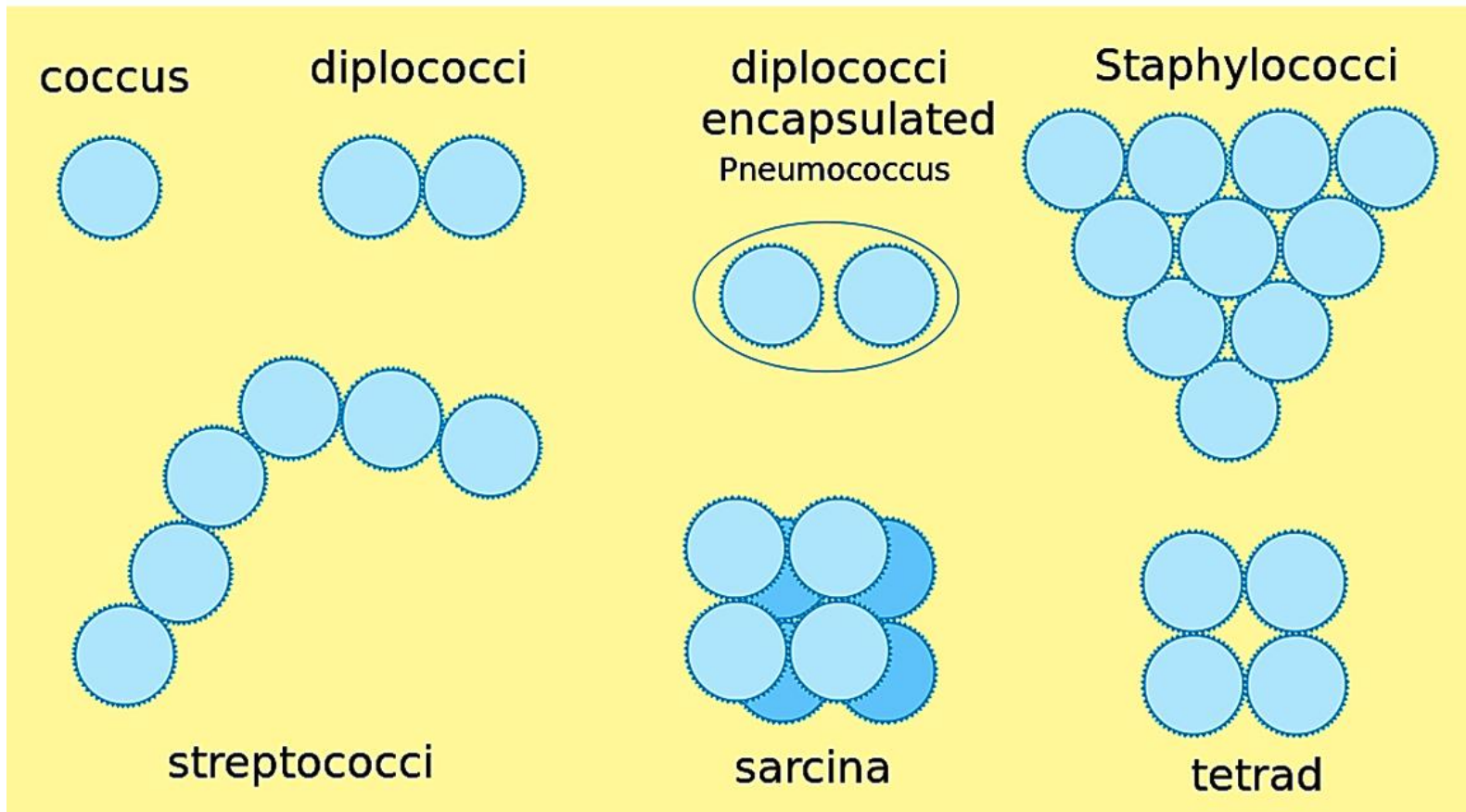
GRAM-NEGATIVE



Bacteria

- Round shaped bacteria (cocci)

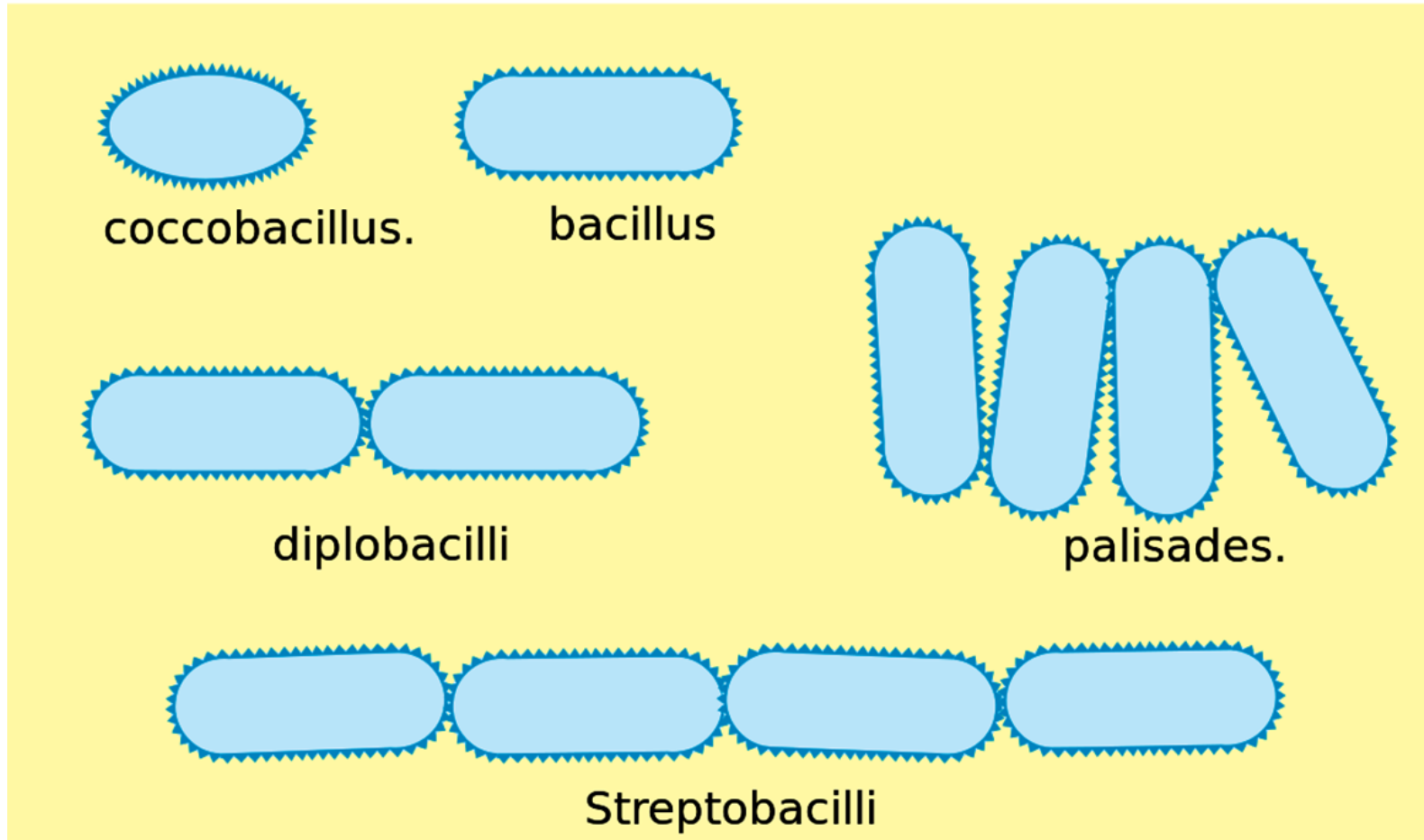
Cocci



Bacteria

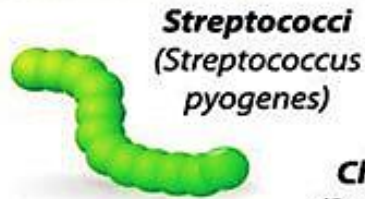
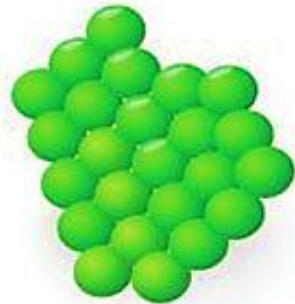
- Rod shaped bacteria (bacilli)

Bacilli



Bacteria

SPHERES (COCCI)

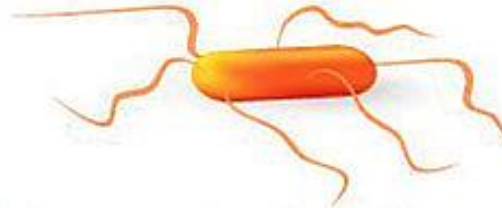


Tetrad



Sarcina
(*Sarcina ventriculi*)

RODS (BACILLI)



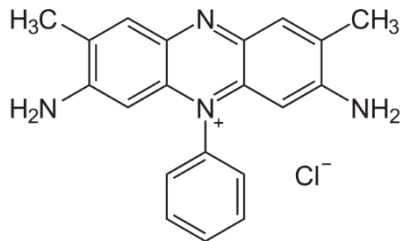
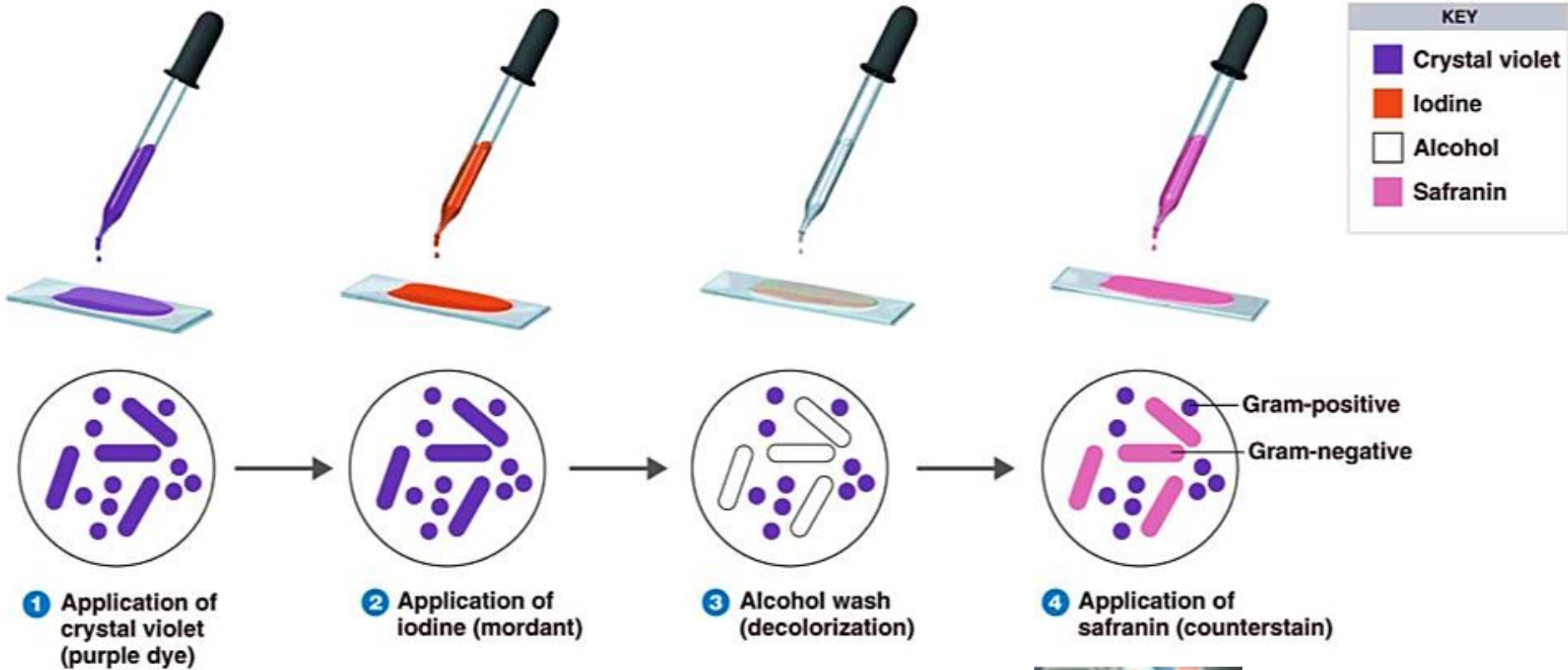
SPIRALS



Bacteria

- Gram-negative bacteria do not retain the colour of the crystal violet dye in the Gram staining protocol.
- **Gram staining test** involves several steps as staining with a water-soluble dye called crystal violet, decolonization (I_2), alcohol wash and counterstaining, usually with **safranin**.
- Gram-negative bacteria become red or pink.
- Gram-positive bacteria retain the **color** of crystal violet dye.

Bacteria



Safranin

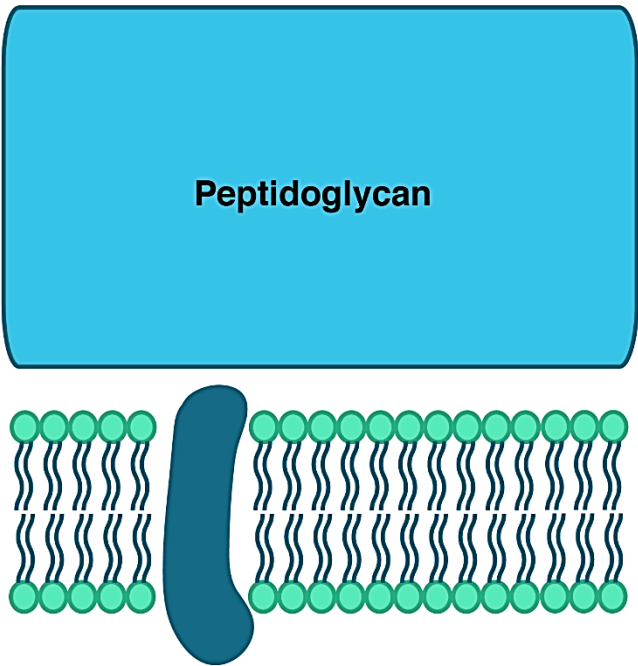


Bacteria

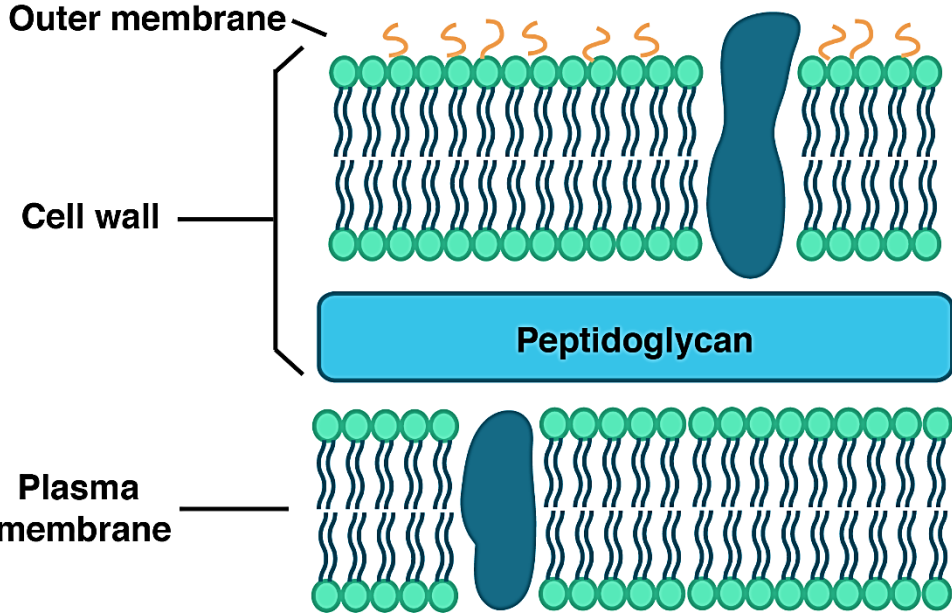
- The test differentiate two distinct types of bacteria based on the structural differences of their bacterial cell walls.
- Gram-negative bacteria are more resistant against antibiotics.
- Gram-negative bacteria have a thinner peptidoglycan layer compared to Gram-positive bacteria.
- However, Gram-negative bacteria have an additional lipid membrane (rigid and strong) and therefore resist antibiotics.

Bacteria

Gram-positive bacteria

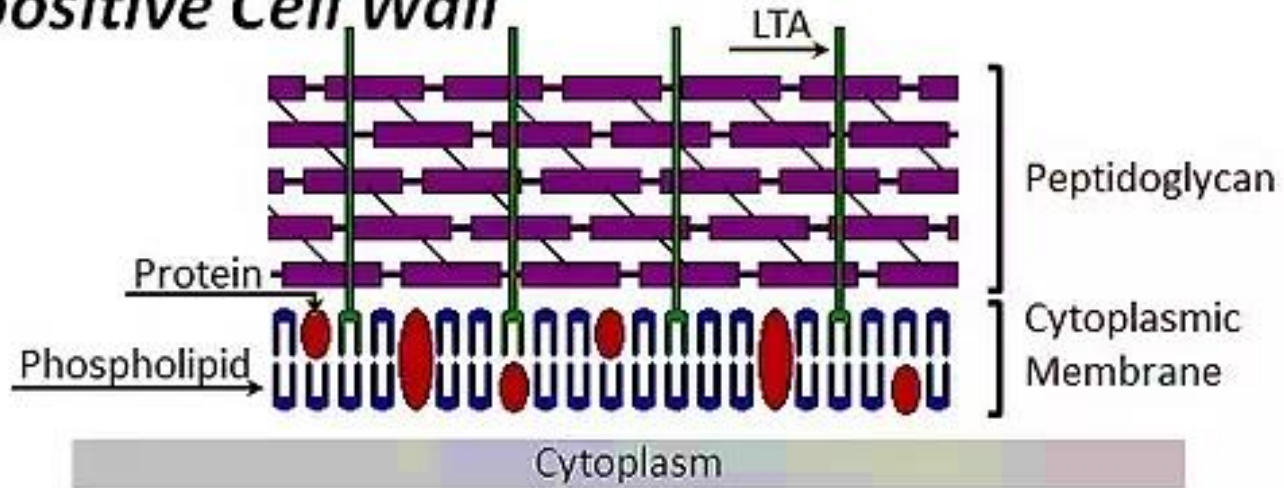


Gram-negative bacteria

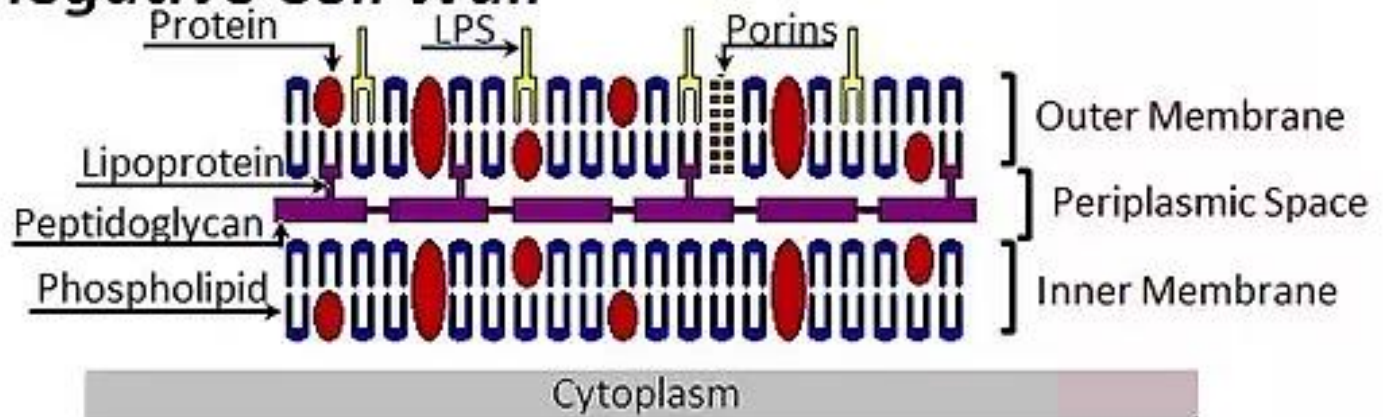


Bacteria

Gram-positive Cell Wall



Gram-negative Cell Wall



Bacteria

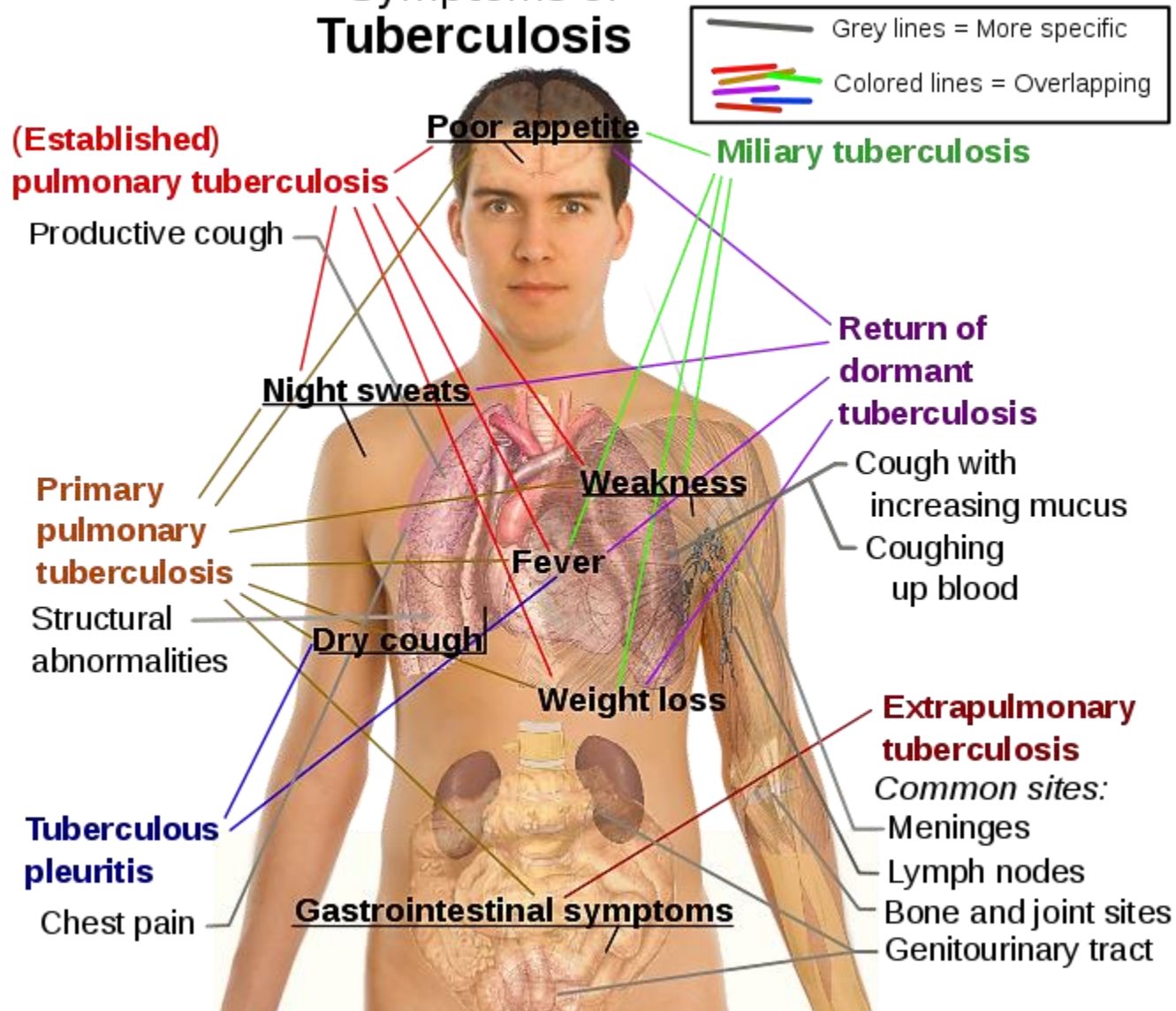
- Bacterial diseases are contagious and can result in many serious or life-threatening complications.
- *Escherichia coli* causes food poisoning.
- *Staphylococcus aureus* causes boils, wound infections and food poisoning.
- *Streptococcal bacteria* cause pneumonia, meningitis, ear infections and strep throat.
- *Mycobacterium tuberculosis* causes Tuberculosis (TB) and is responsible for the killing of millions.

Tuberculosis

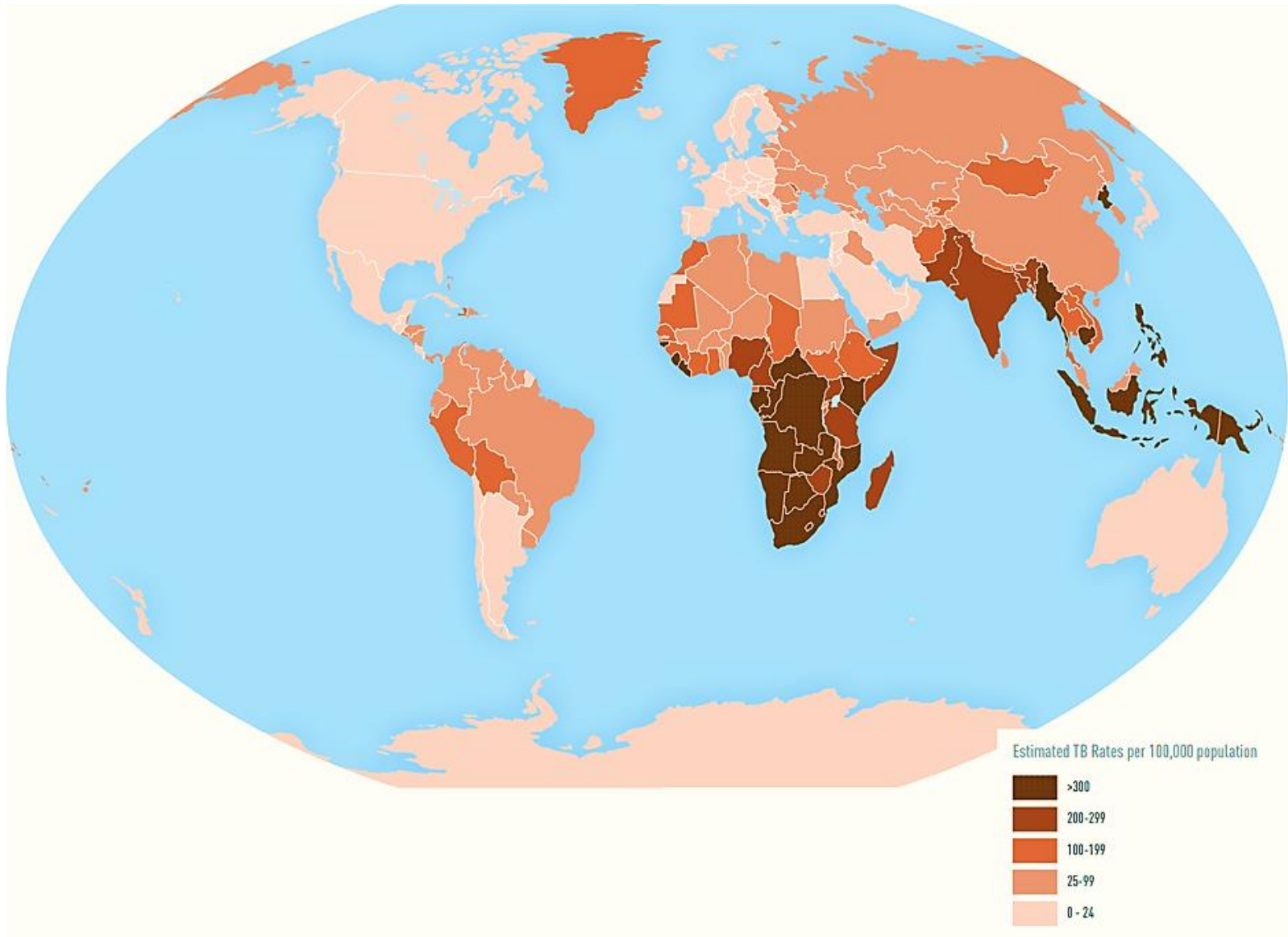
- Tuberculosis (TB) is a bacterial infection.
- It spreads through the lymph nodes and bloodstream to any organ in the body.
- It is most often found in the lungs.
- Most people who are exposed to TB never develop symptoms because the bacteria can live in an inactive form in the body.
- But if the immune system weakens, TB bacteria can become active.
- Active TB disease can be fatal if left untreated.

Tuberculosis

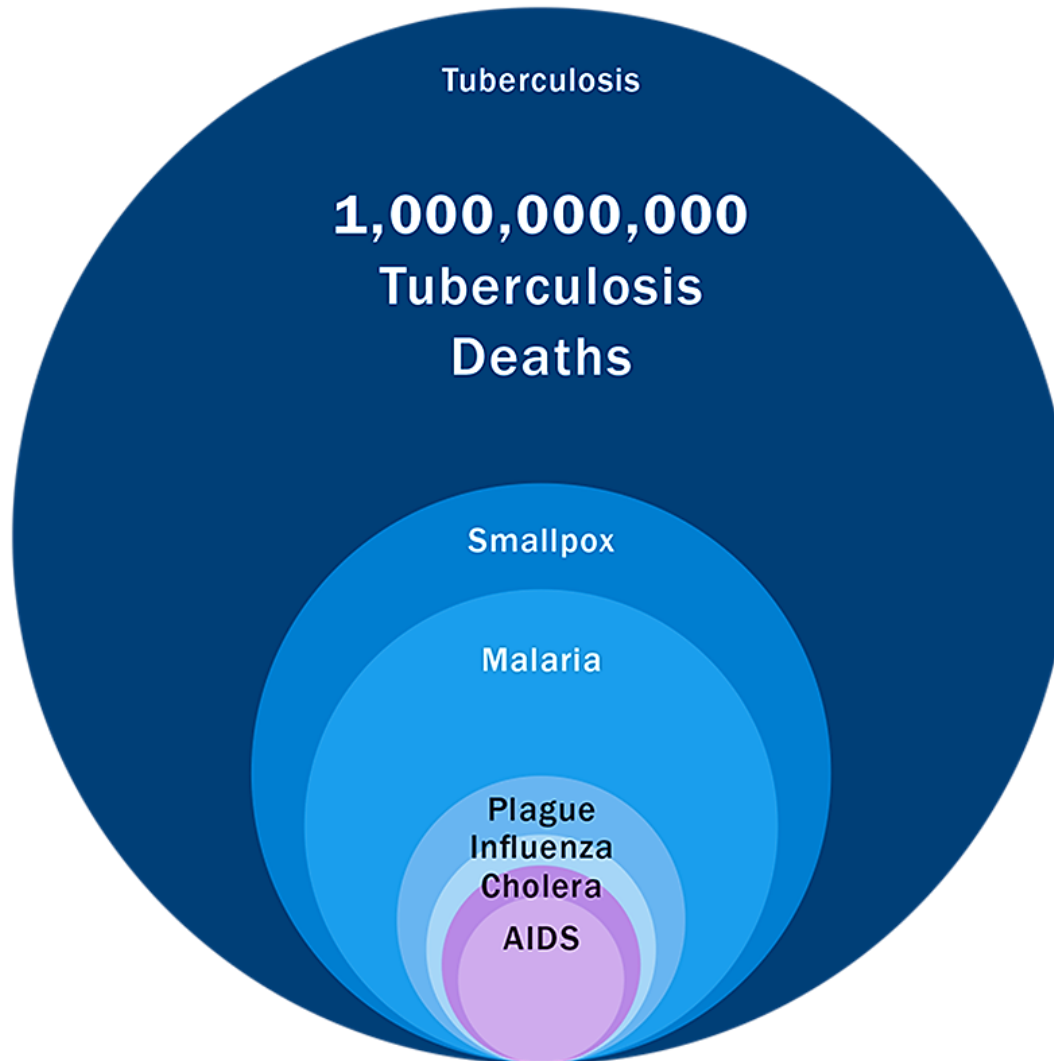
Symptoms of Tuberculosis



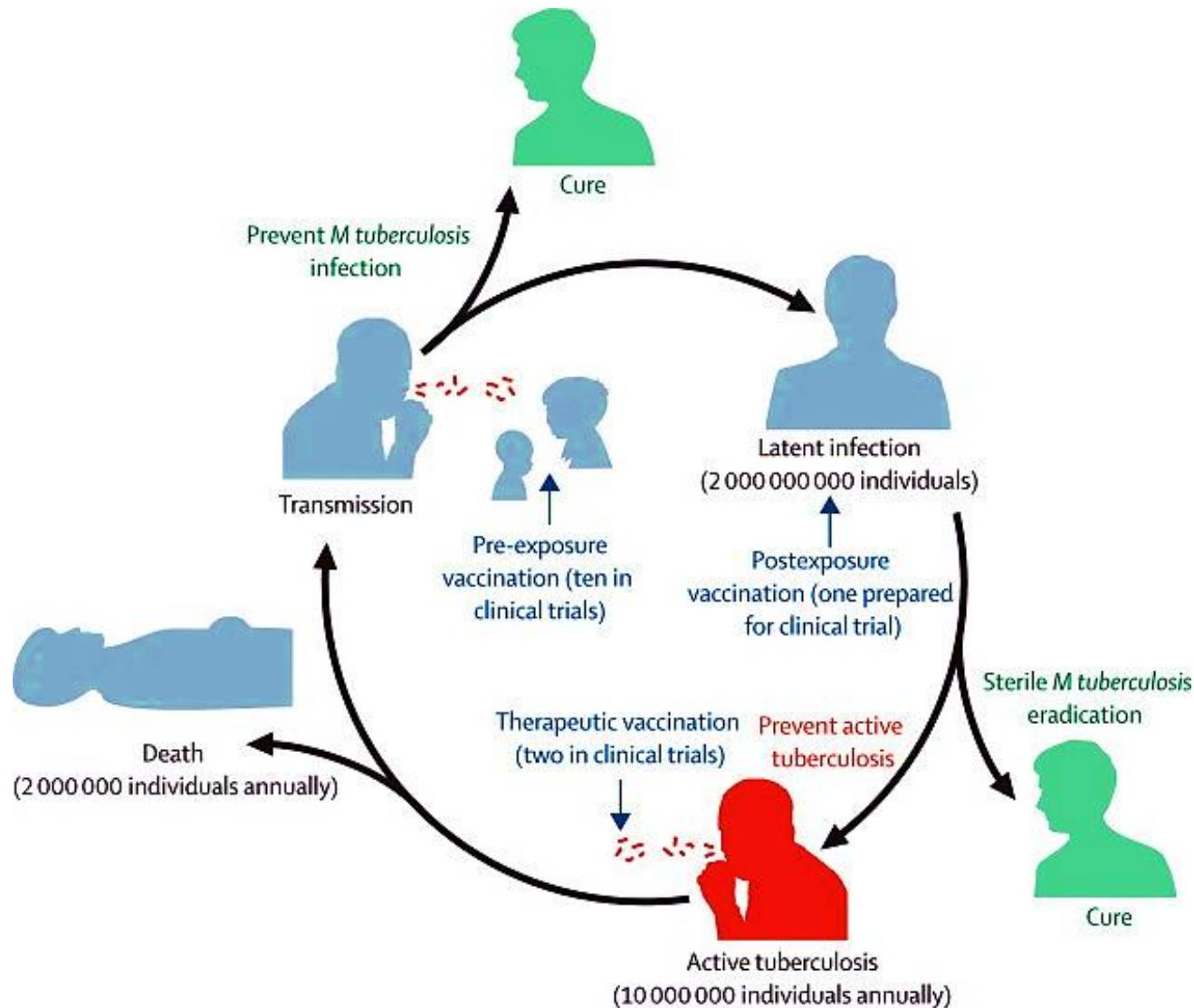
Tuberculosis



Tuberculosis

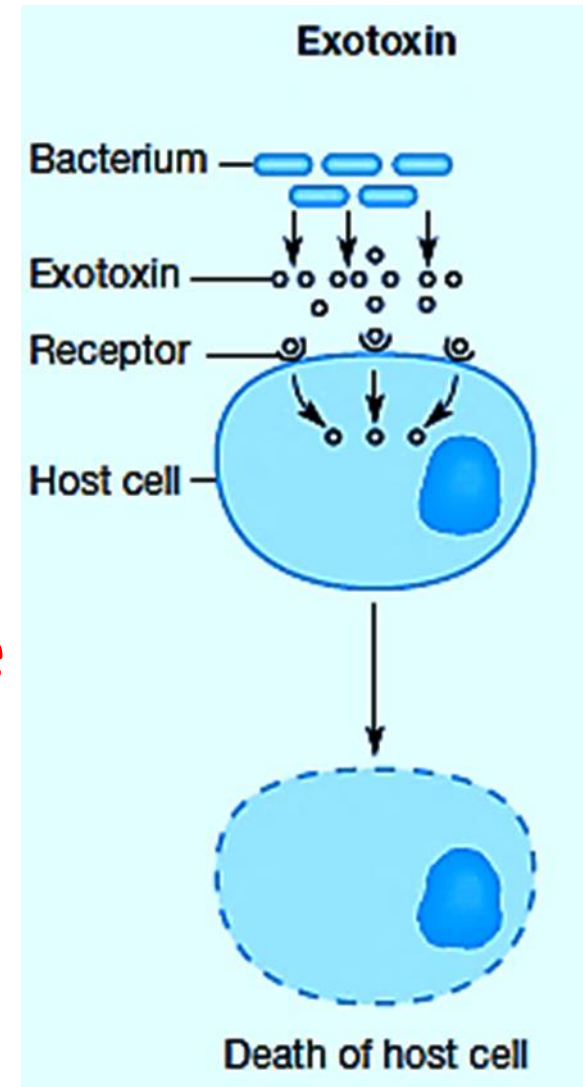


Tuberculosis



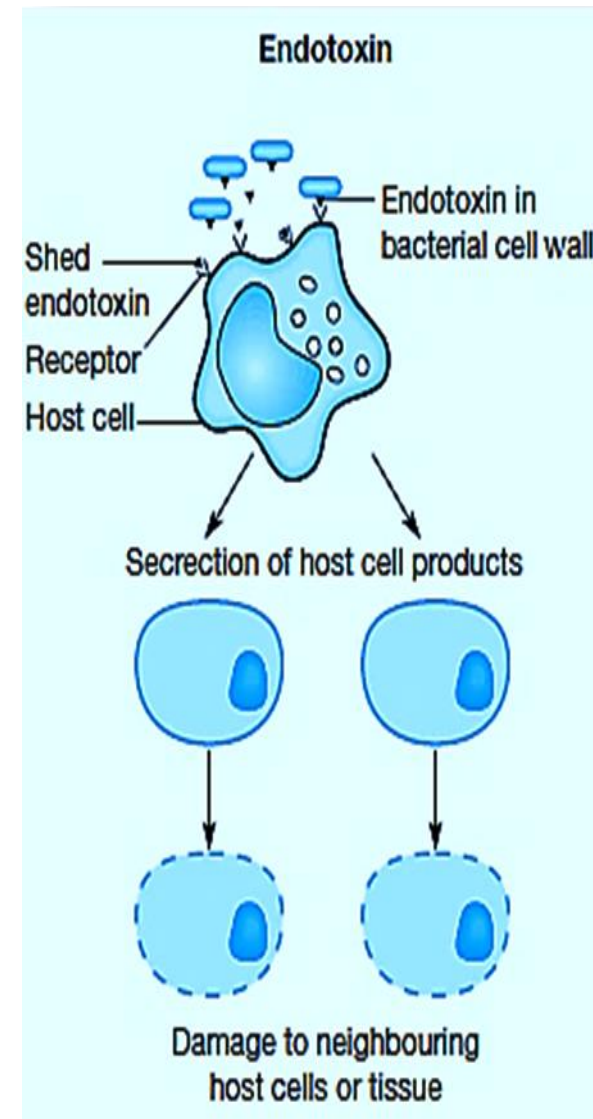
The Production of Toxins

- Toxins capable of causing damage include **exotoxins** or **endotoxins**.
- **Exotoxins**
- Protein toxins released from a living cell (*e.g.* bacteria).
- Mostly found in **Gram-positive** bacterial cells.
- **Exotoxins** are secreted by the bacteria or released following **lysis**.

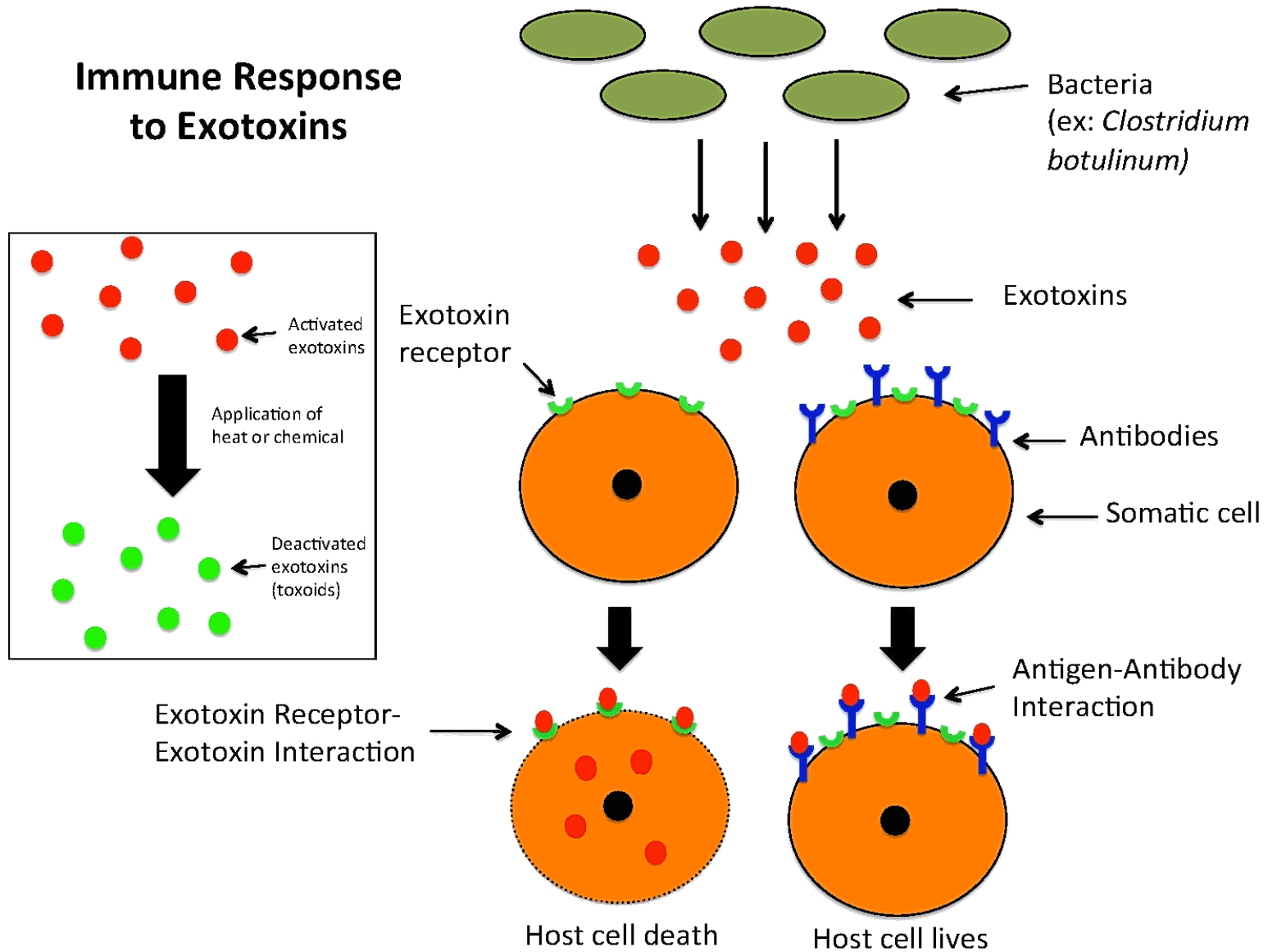


The Production of Toxins

- **Endotoxins** are lipopolysaccharides (LPS) found in the lipid portion of the outer wall of Gram-negative bacteria.
- **Endotoxins** released when Gram-negative bacteria die and the cell wall undergoes lysis.
- Antibiotics used to treat Gram-negative diseases can lyse the bacterial cells, releasing the endotoxin.



The Production of Toxins



Fungi

- **Fungi** is a member of a large group of eukaryotic organisms.
- Eukaryotic organism is a single-celled or multicellular organism whose cells contain a distinct membrane-bound nucleus.
- The nucleus, or nuclear envelope, carried out the genetic material.
- **Fungi** classified as a kingdom.
- **Fungi** cell wall are made of **chitin** (sugar).
- **Fungi** cause various diseases.

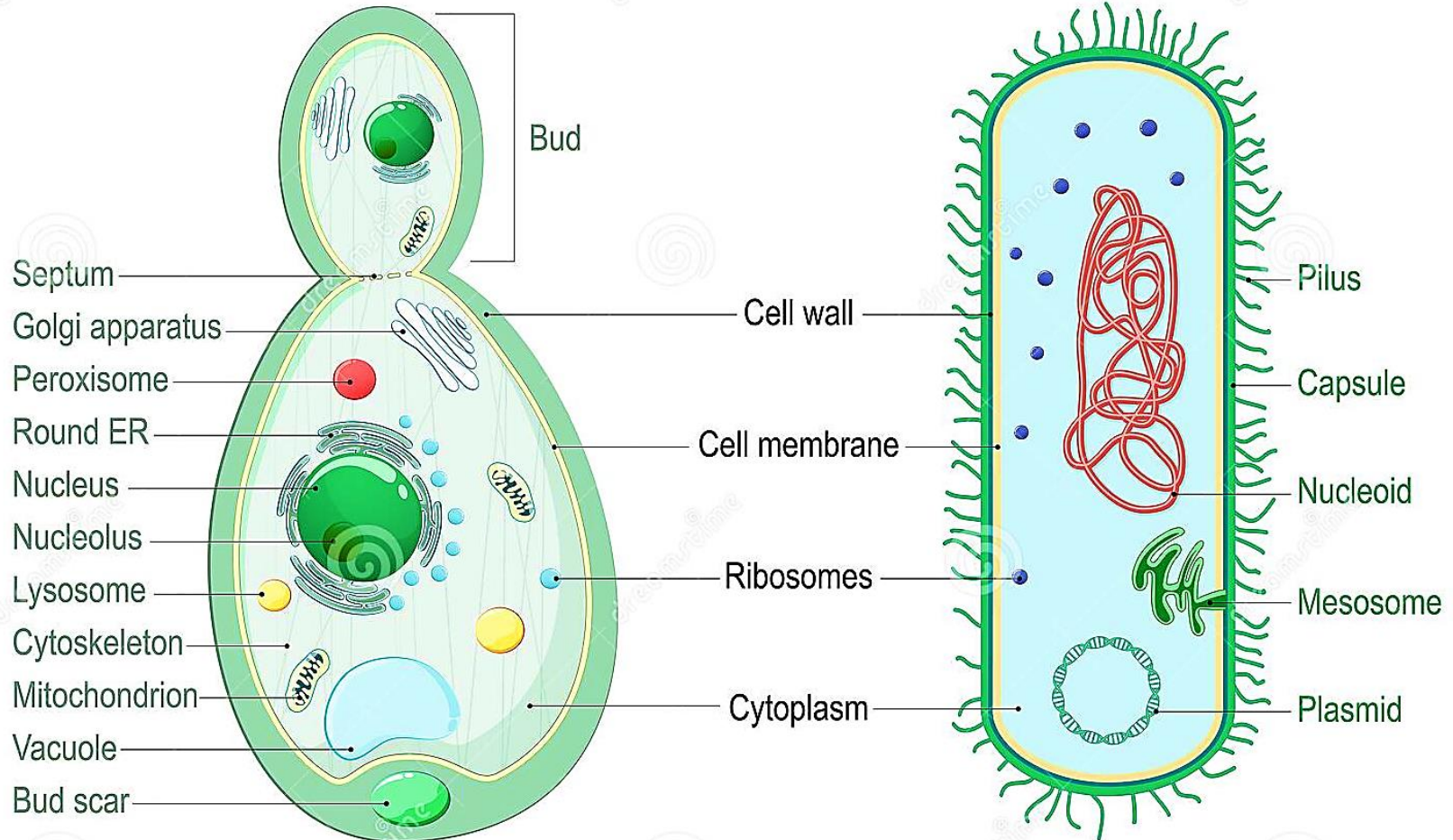
Fungi

- **Fungi** are eukaryotic organisms that have structures similar that for human.
- **Fungi** are more close to animals structure than plants.
- **Chitin** is a long-chain homo-polymer of *N*-acetyl-*D*-glucosamine units (β -1,4 linkage).
- Fungi include **yeasts, moulds, mushrooms**, a **plant-like organism** that lives on dead matter and contribute to illness, and **ringworm**, a condition caused by fungal infection of the skin in humans and pets such as cats.

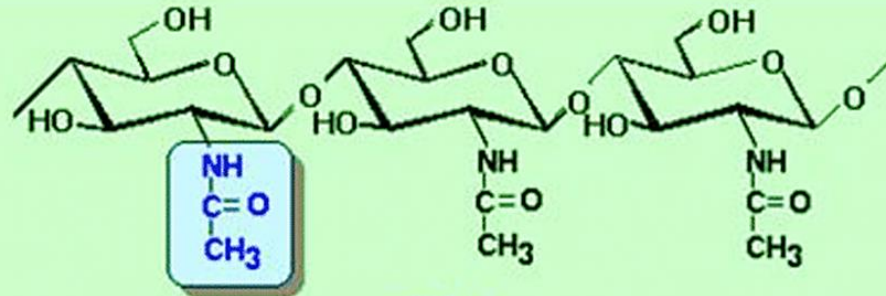
Fungi

Fungal cell

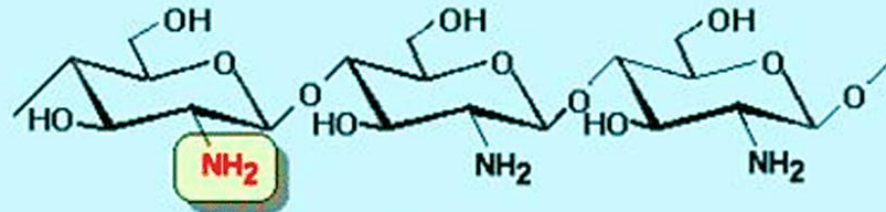
Bacterial cell



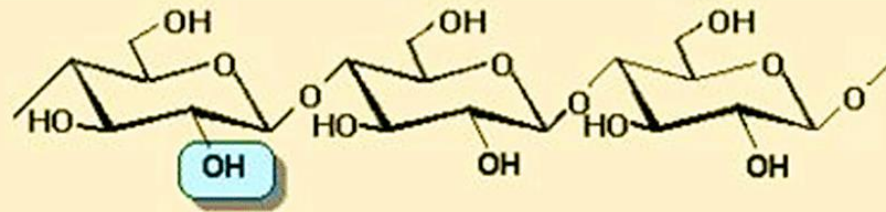
Fungi



Chitin



Chitosan

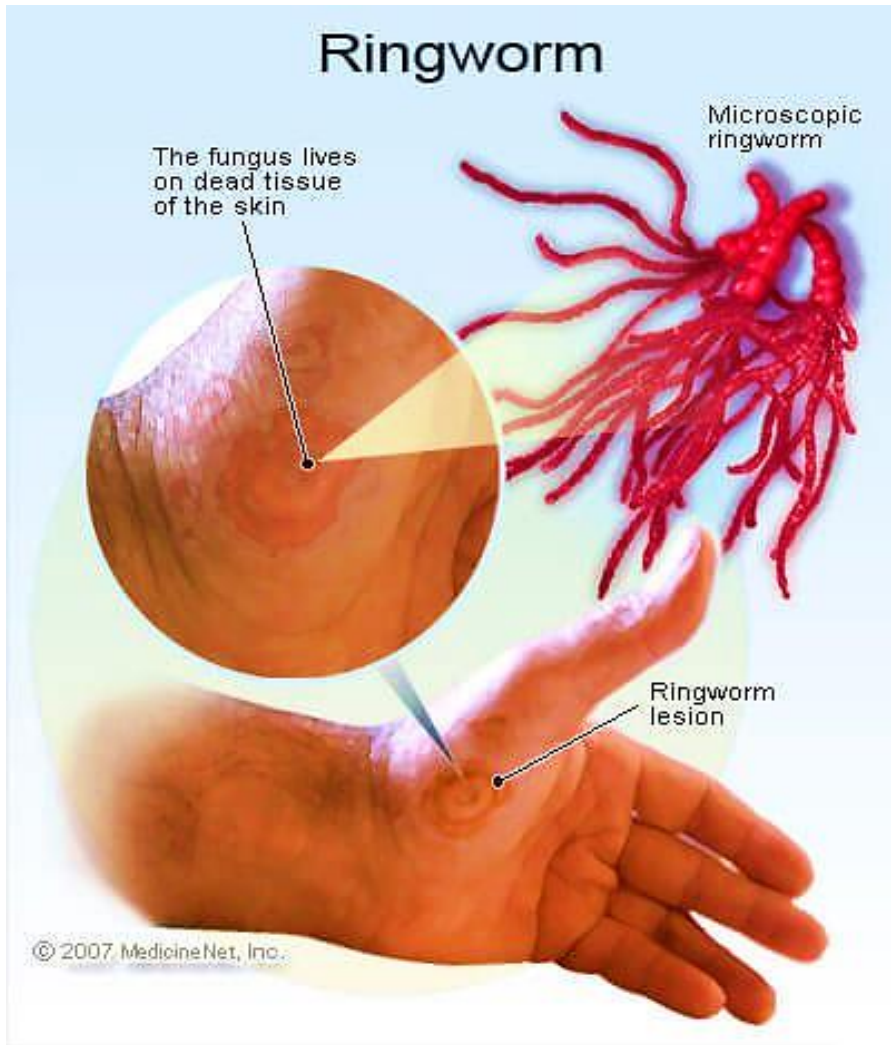


Cellulose

Fungi



Fungi



Fungi

- In addition, fungi include athlete's foot (tinea pedis) and yeast infections.



Ways to Avoid Foot Infections



Keep toenails trimmed



Change socks and shoes regularly



Keep skin undamaged



Avoid going barefoot in public places



Avoid sharing footwear or nail clippers

Wash feet daily with soap and water



Fungi

Natural Home Remedy Yeast Infection Treatment

