

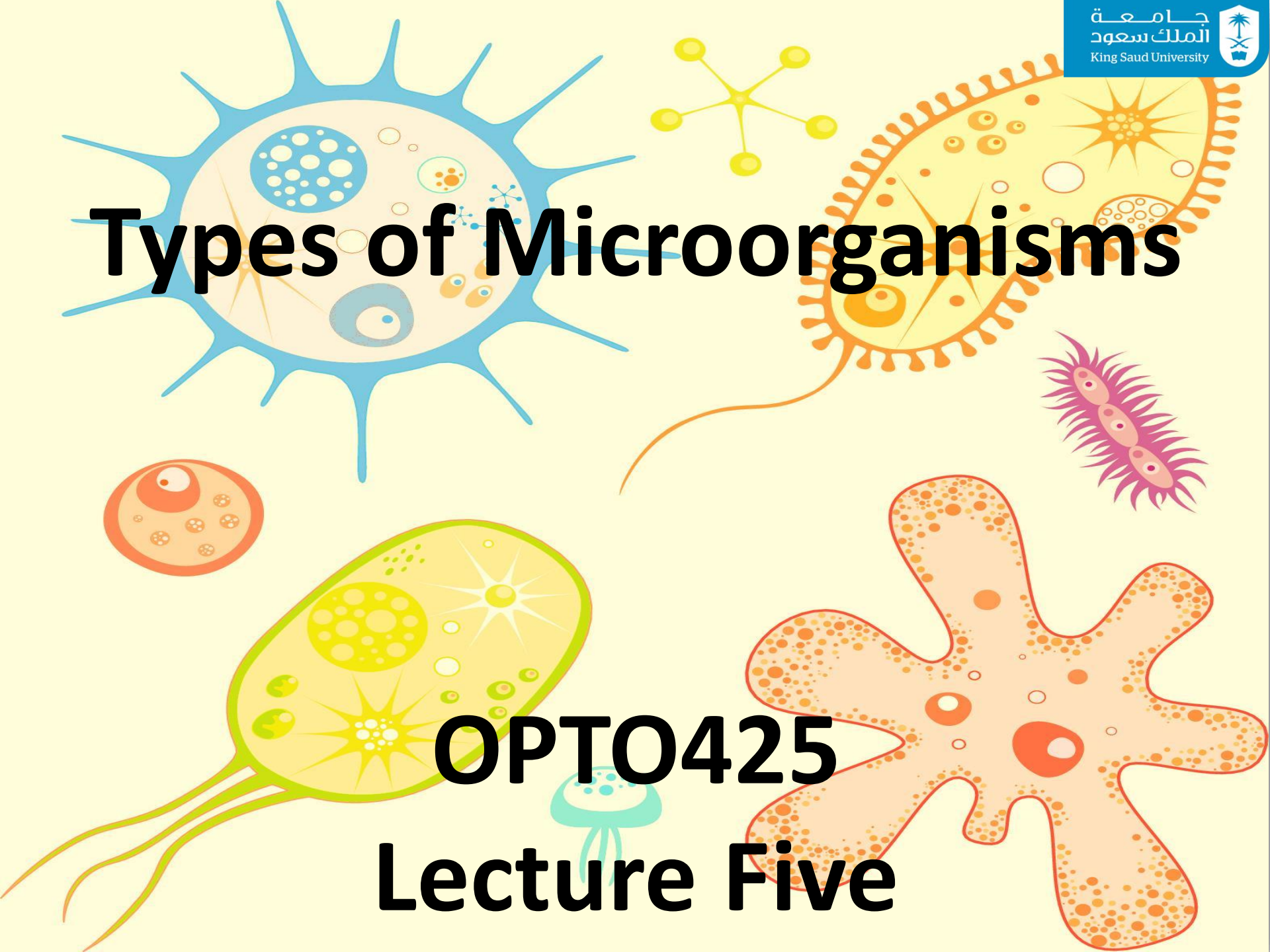


OPT0425 MICROBIOLOGY I

GAMAL EL-HITI



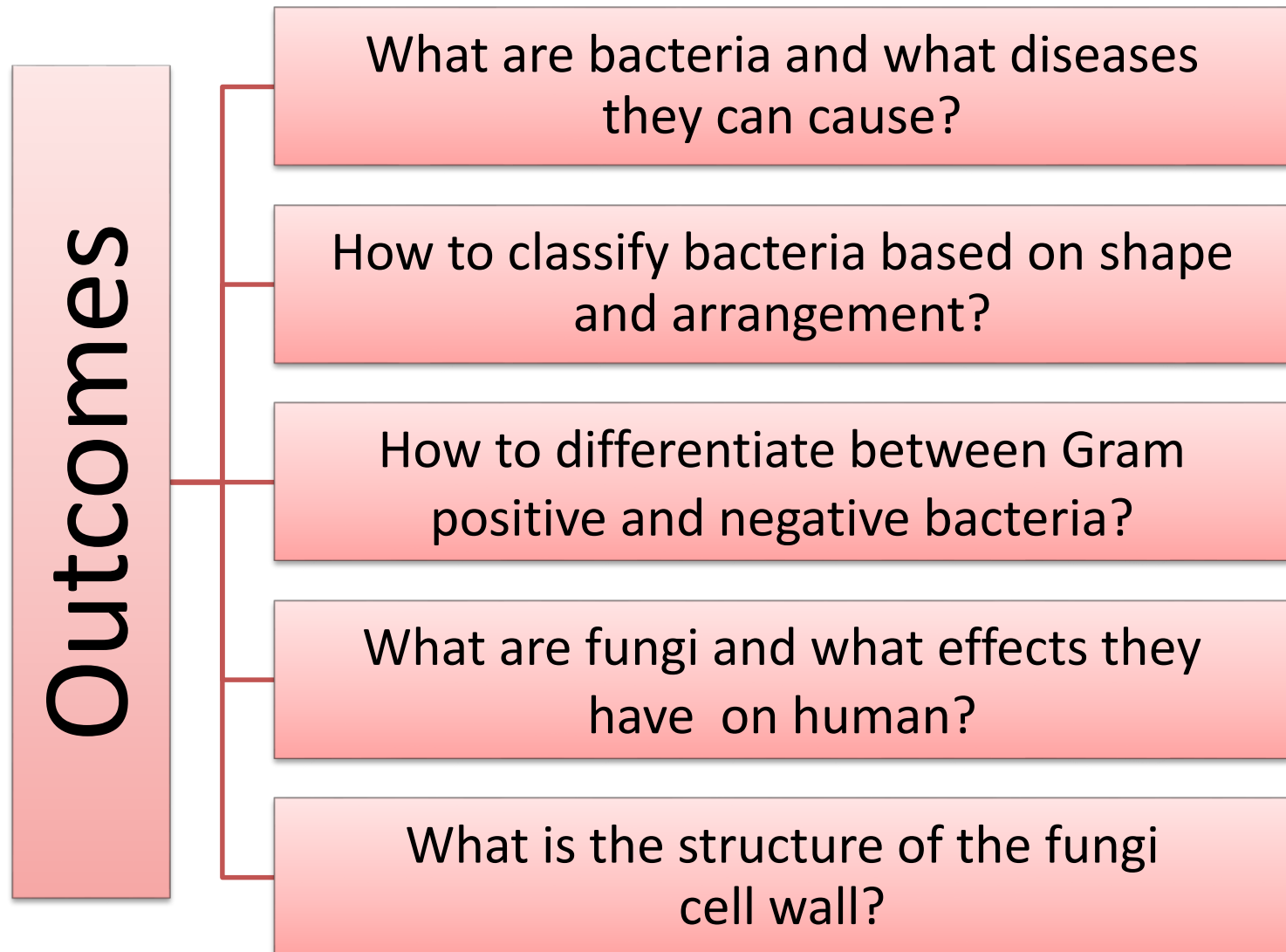
Types of Microorganisms



OPT0425

Lecture Five

Learning Outcomes



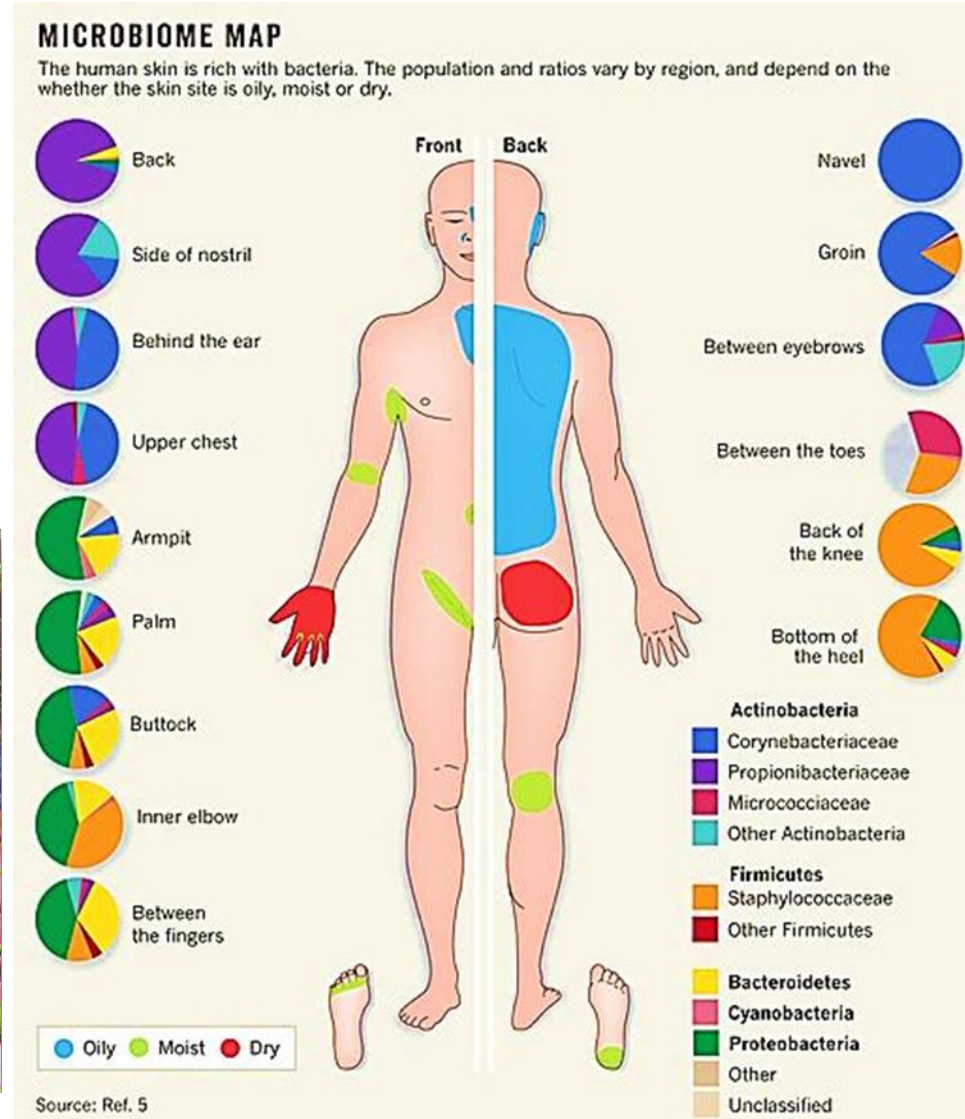
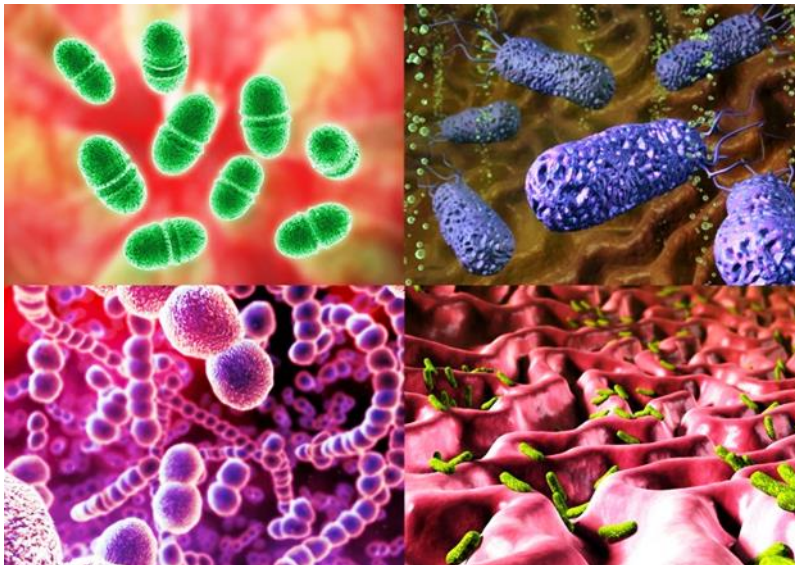


Normal Microbiota (Flora)

- Microbial antagonism could be due to competition between microbes.
- Resident flora is a normal microbiota.
- Normal flora establish permanent colonies inside body without causing diseases and protect host.
- Flora occupy niches that pathogens might occupy.
- Flora produce acids and bacteriocins.
- Flora stimulate immune system.

Normal Microbiota (Flora)

- Consume the available nutrients.
- Produce compounds that are toxic to other microorganisms.

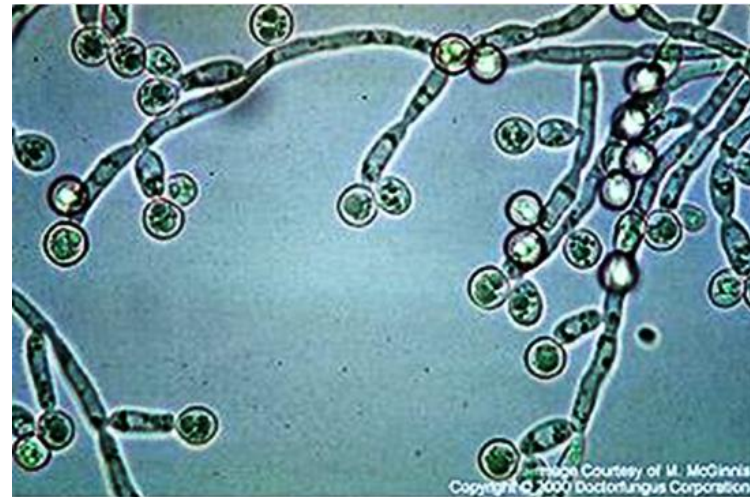


Normal Microbiota (Flora)

- 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, disease 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).



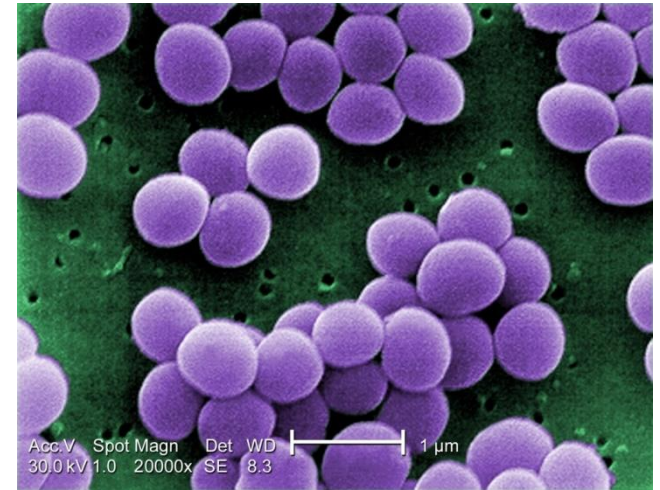
Candida albicans

Bacteria

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

Bacteria

- Some 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.
- *e.g.* **Methicillin-resistant *Staphylococcus aureus*** (MRSA).

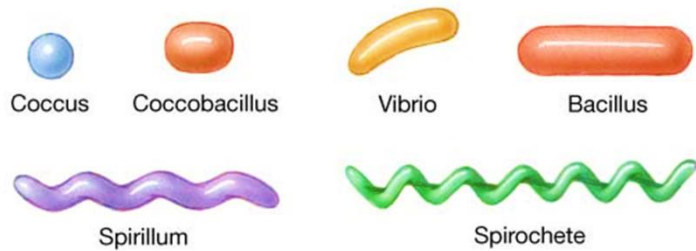


Bacteria

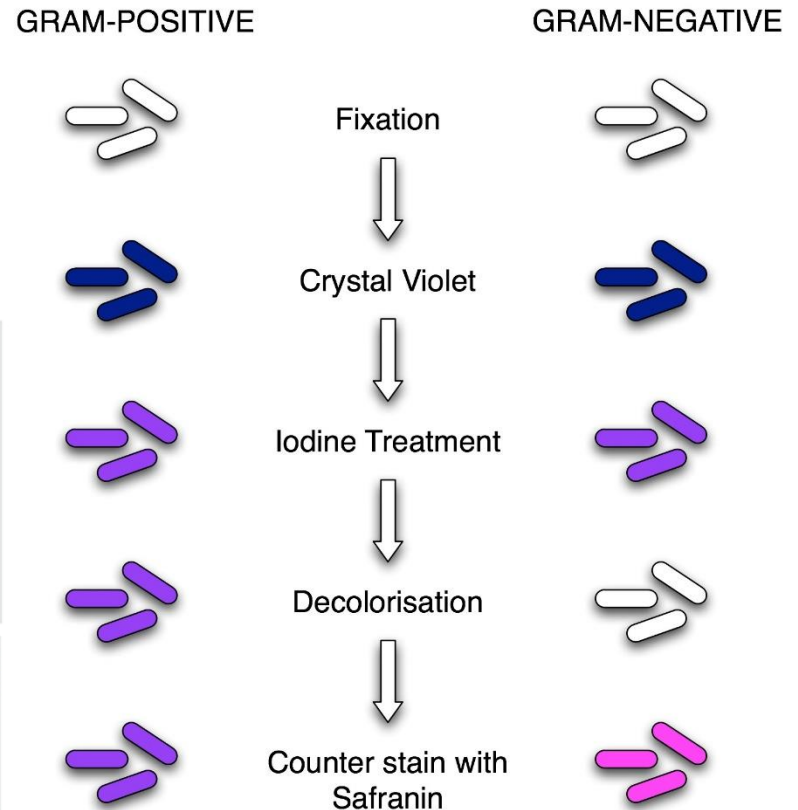
- The cell walls of **bacteria** are made of **peptidoglycan**.
- A polymer consisting of sugars and amino acids that forms a mesh-like layer outside the plasma membrane of bacteria forming the cell wall.
- The cell walls of **plants** contain **cellulose**.
- Cellulose is a polysaccharide consisting 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.



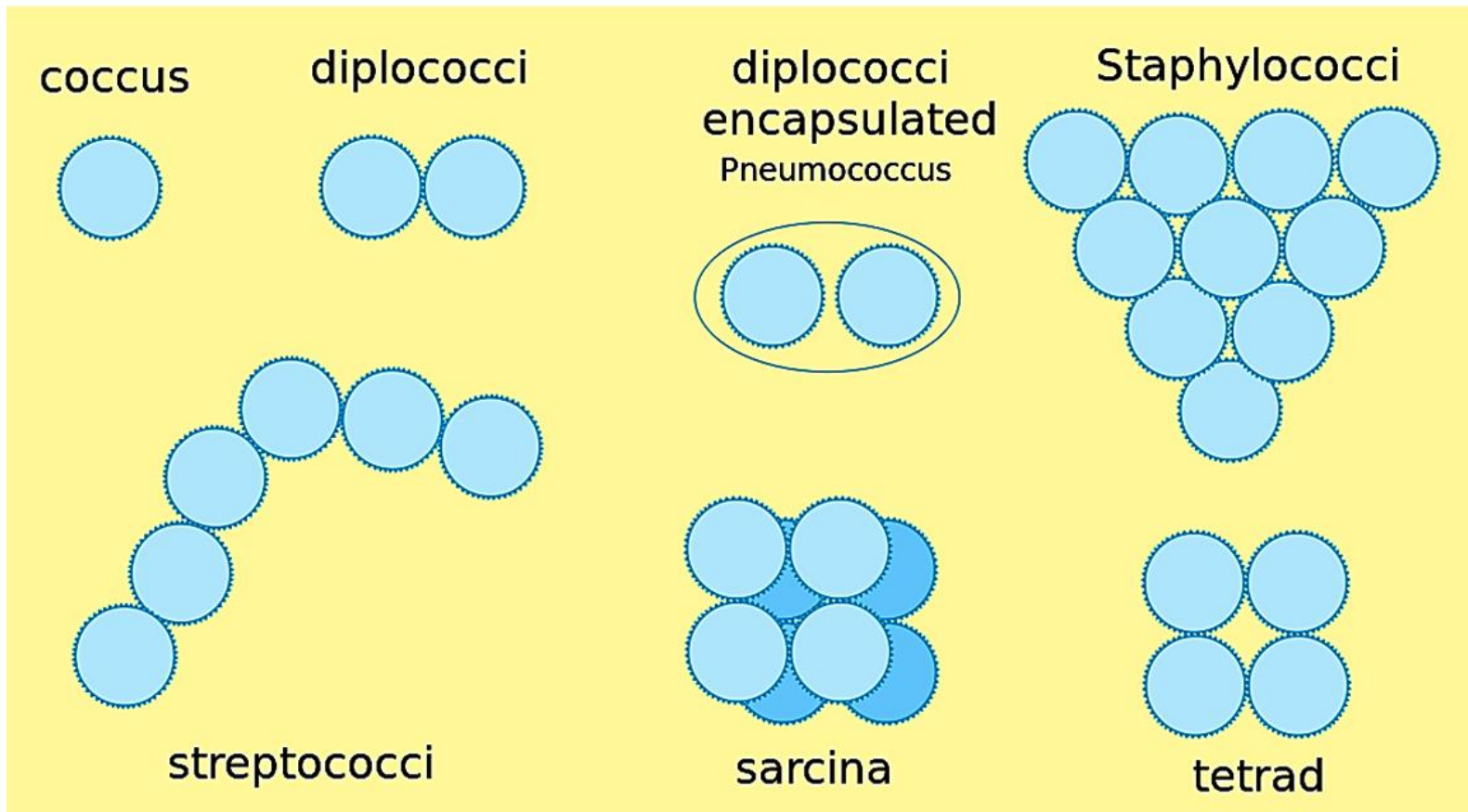
	AEROBIC	ANAEROBIC
GRAM NEGATIVE	BACILLI E Coli <ul style="list-style-type: none"> • Haemophilus • Klebsiella • Proteus • Acinetobacter • Pseudomonas • Yersinia • Salmonella • Campylobacter • Enterobacter • Morganella 	COCCI <ul style="list-style-type: none"> • Moraxella • Neisseria
GRAM POSITIVE	BACILLI <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



Bacteria

- Round shaped bacteria (Cocci)

Cocci



Bacteria

- Rod shaped bacteria (Bacilli)

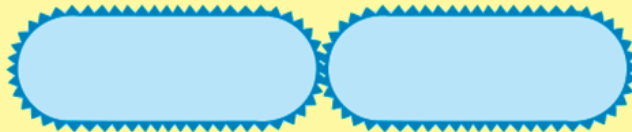
Bacilli



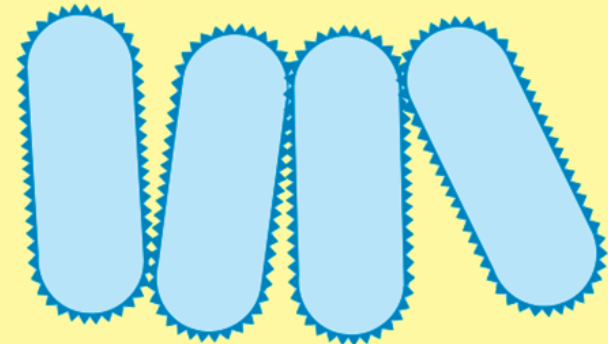
coccobacillus.



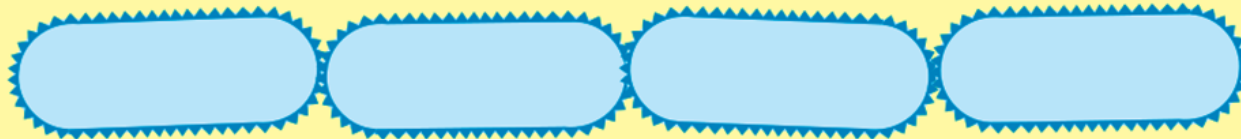
bacillus



diplobacilli



palisades.

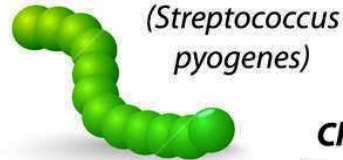


Streptobacilli

Bacteria

SHAPES OF BACTERIA

COCCI



Tetrad

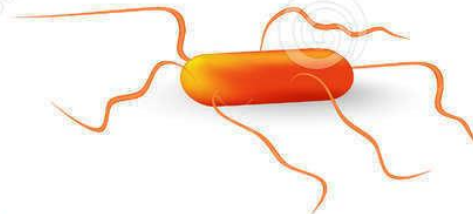


Staphylococci
(*Staphylococcus aureus*)



Sarcina
(*Sarcina ventriculi*)

BACILLI



Spore-former
(*Clostridium botulinum*)

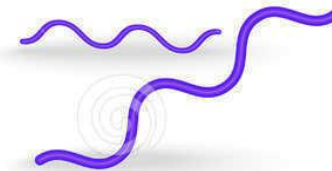
OTHERS



Vibrios
(*Vibrio cholerae*)



Spirilla
(*Helicobacter pylori*)



Spirochaetes
(*Treponema pallidum*)

Bacteria

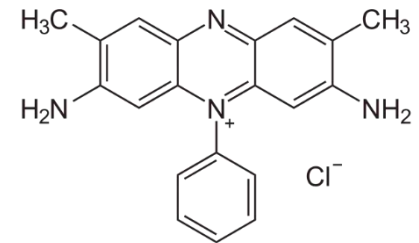
- Gram-negative bacteria do not retain the colour of the crystal violet dye in the Gram staining protocol.

- **Gram stain test** involves three steps as staining with a water-soluble dye called crystal violet, decolonization (I_2) and counterstaining, usually with **safranin**.



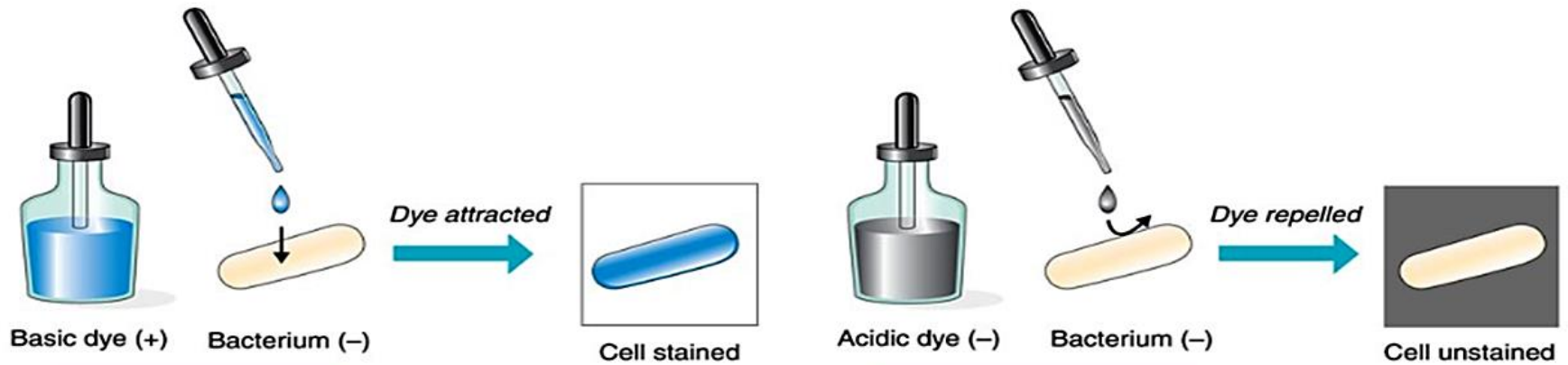
Gram-negative bacteria become red or pink.

- Gram-positive bacteria retain the **colour** of crystal violet dye.



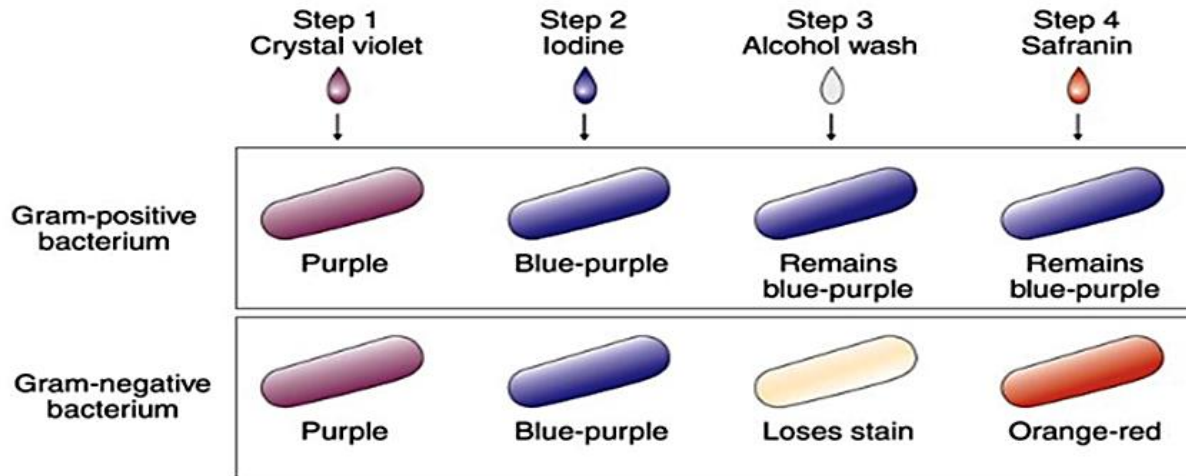
Safranin

Bacteria



(a) Simple stain technique

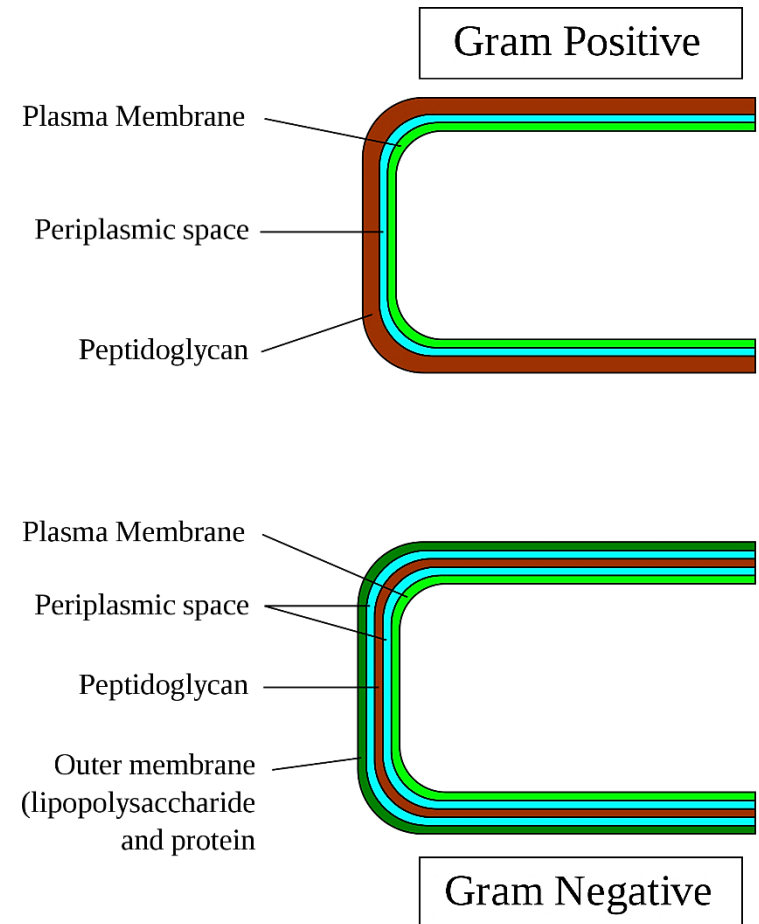
(b) Negative stain technique



(c) Gram stain technique

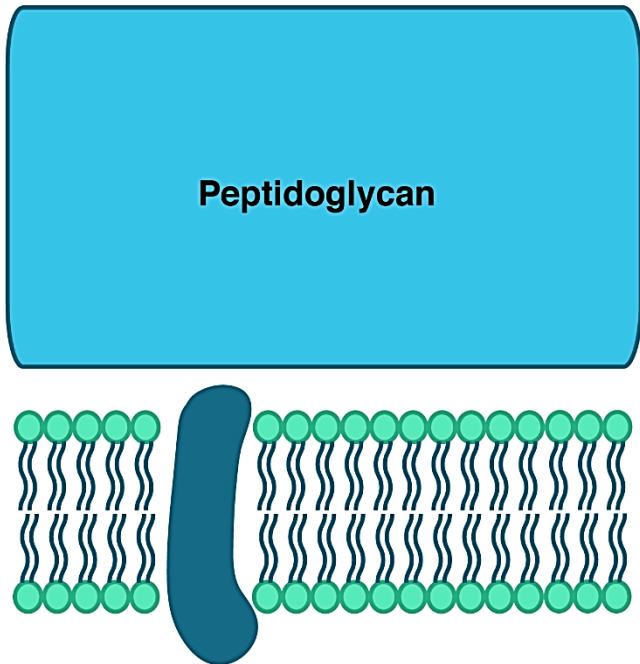
Bacteria

- The test differentiate two distinct types of bacteria based on the structural differences of their bacterial cell walls.
- Gram – bacteria are more resistant against antibiotics, despite their thinner peptidoglycan layer, because of their additional lipid membrane.

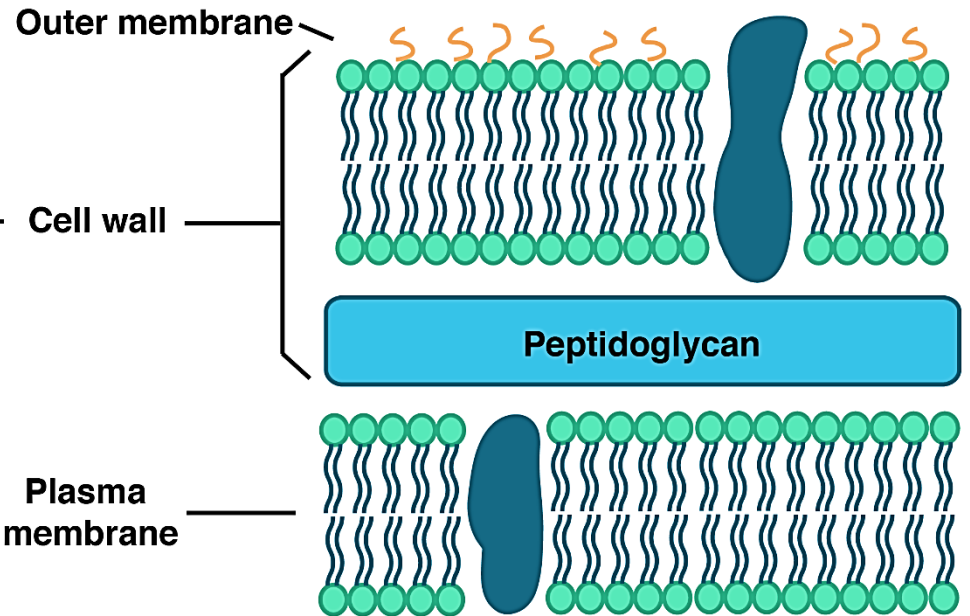


Bacteria

Gram-positive bacteria



Gram-negative bacteria



Bacteria

- Bacterial diseases are contagious and can result in many serious or life-threatening complications.
- *Escherichia coli* cause 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).

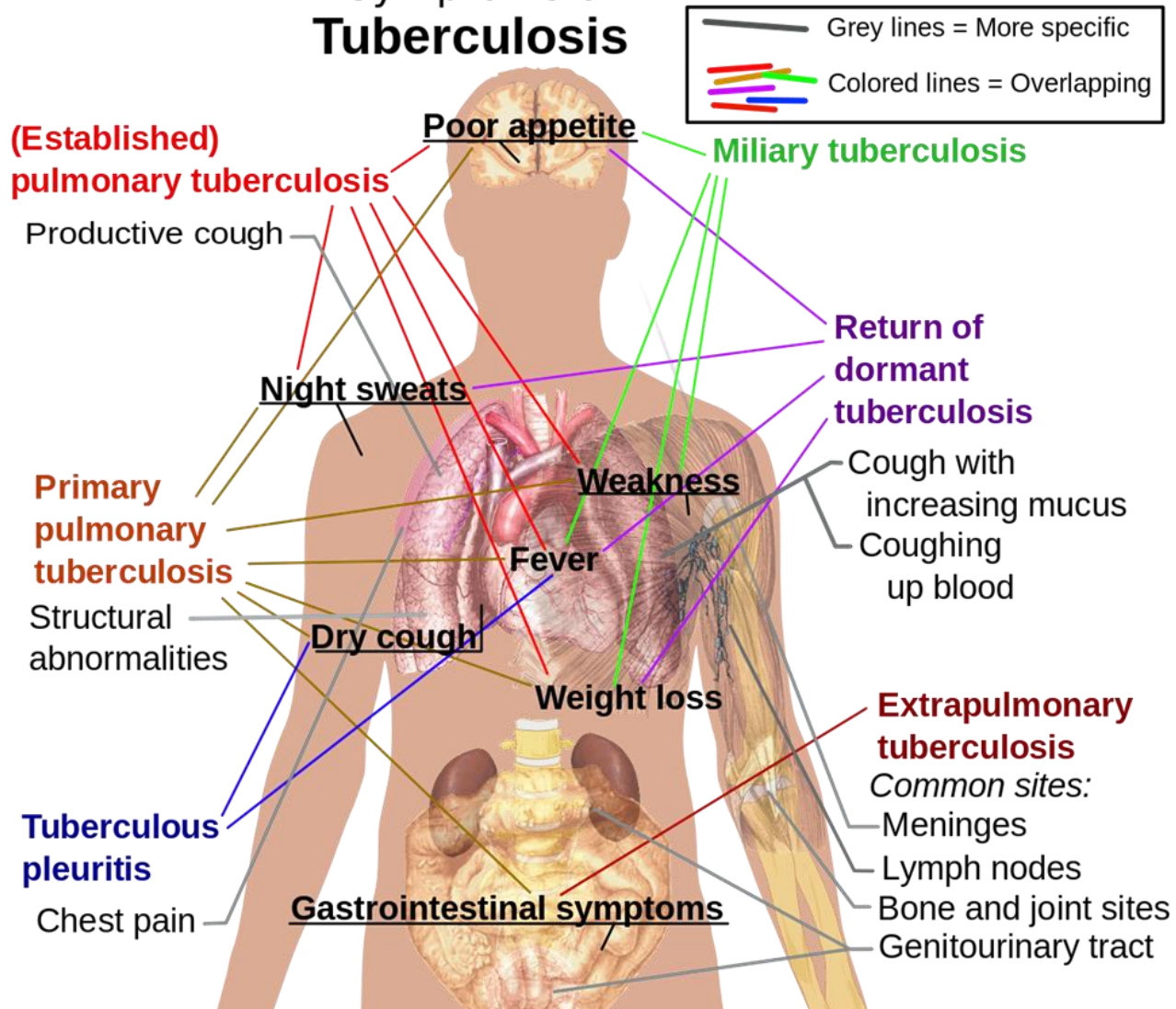


Tuberculosis

- **Tuberculosis** (TB) is a bacterial infection that can spread 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.

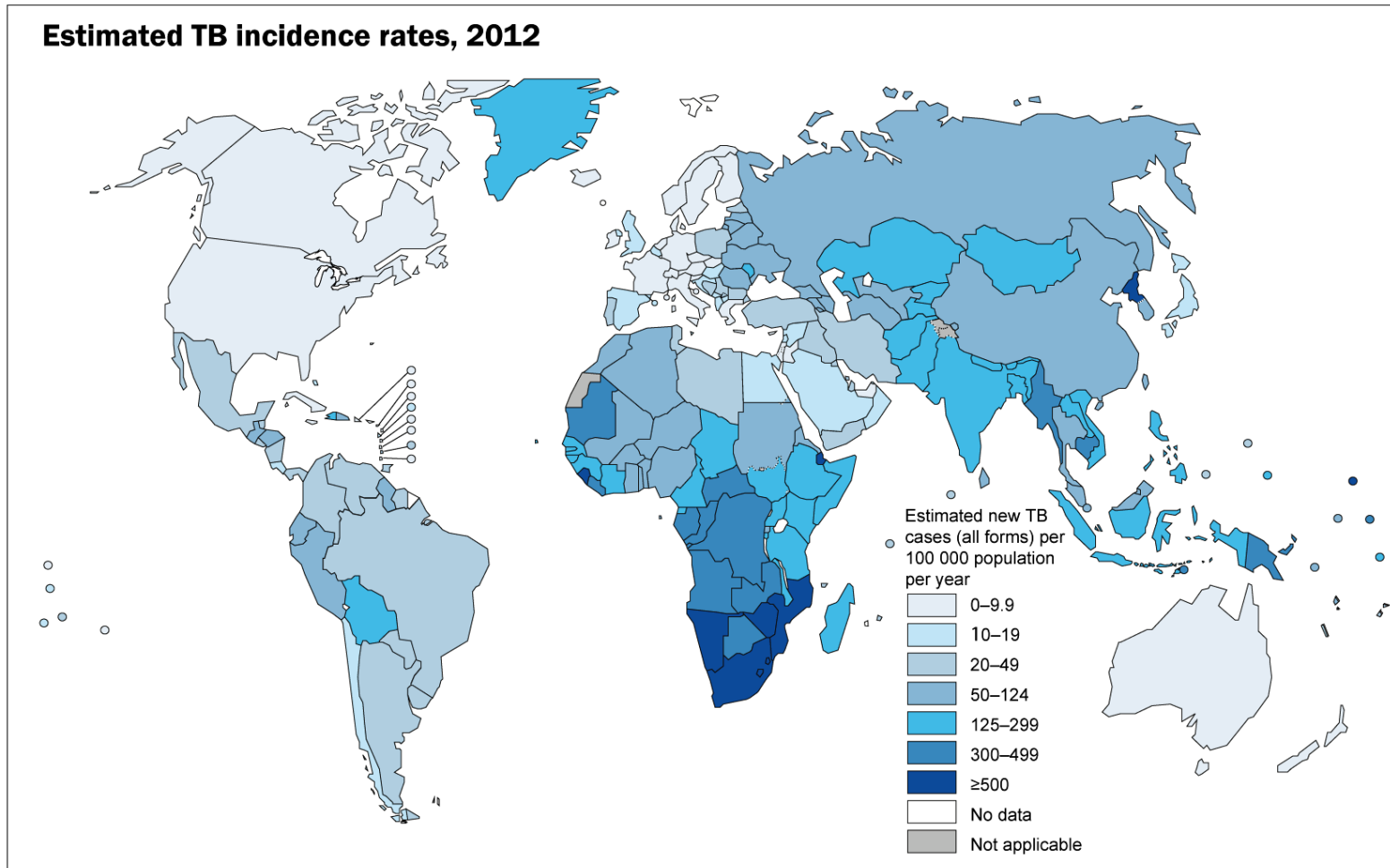
Tuberculosis

Symptoms of Tuberculosis



Tuberculosis

Estimated TB incidence rates, 2012



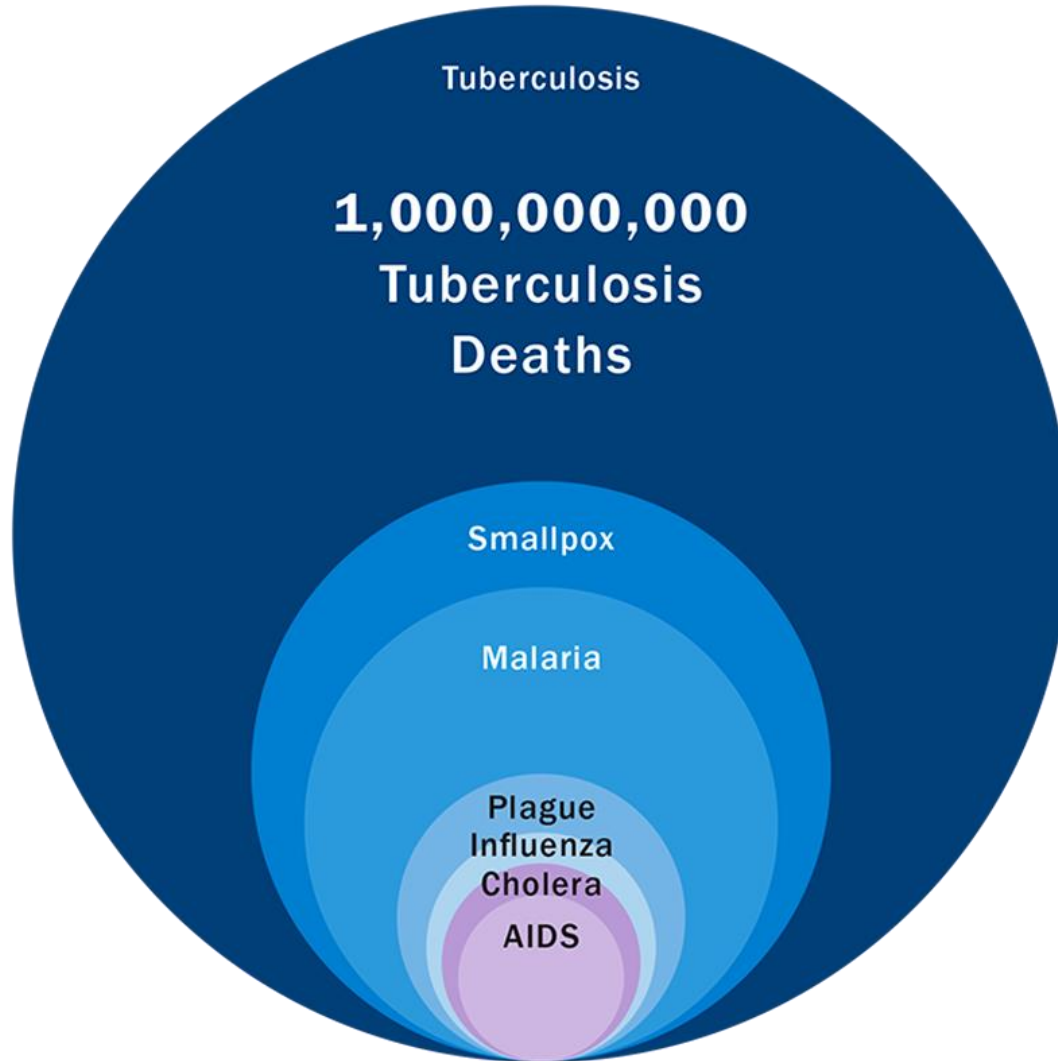
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: *Global Tuberculosis Report 2013*. WHO, 2013.

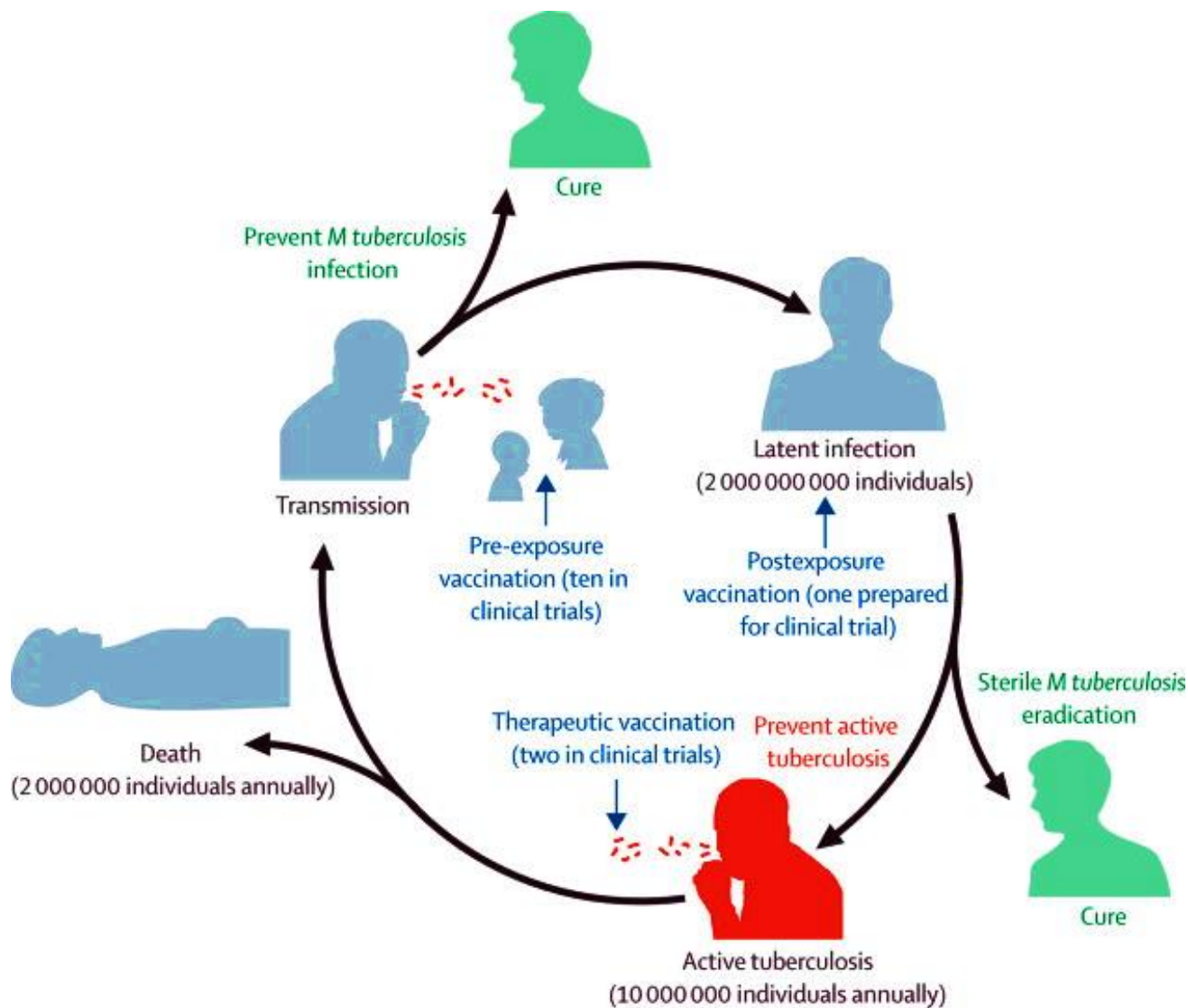


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Tuberculosis

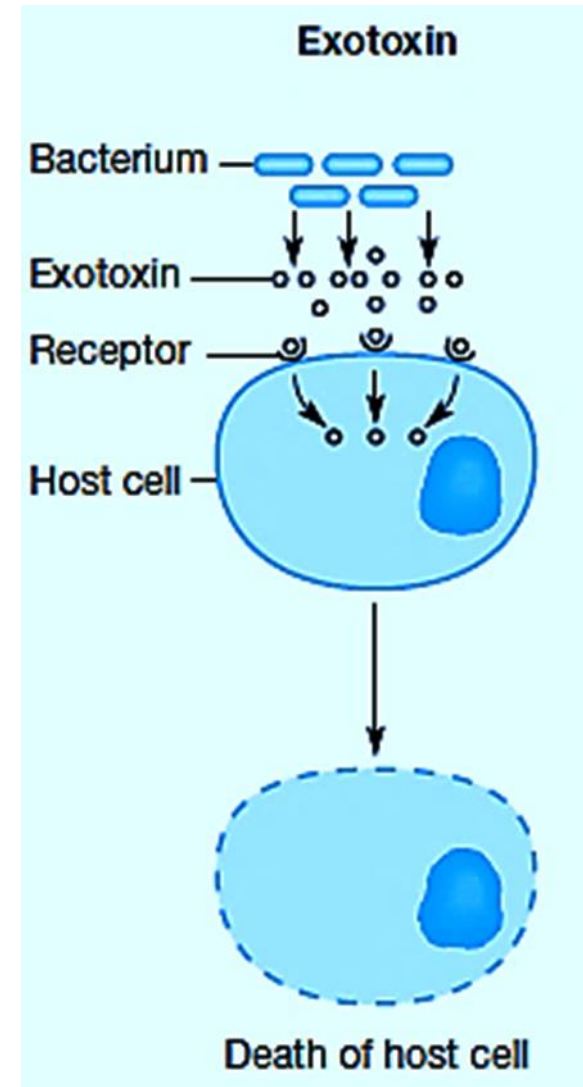


Tuberculosis



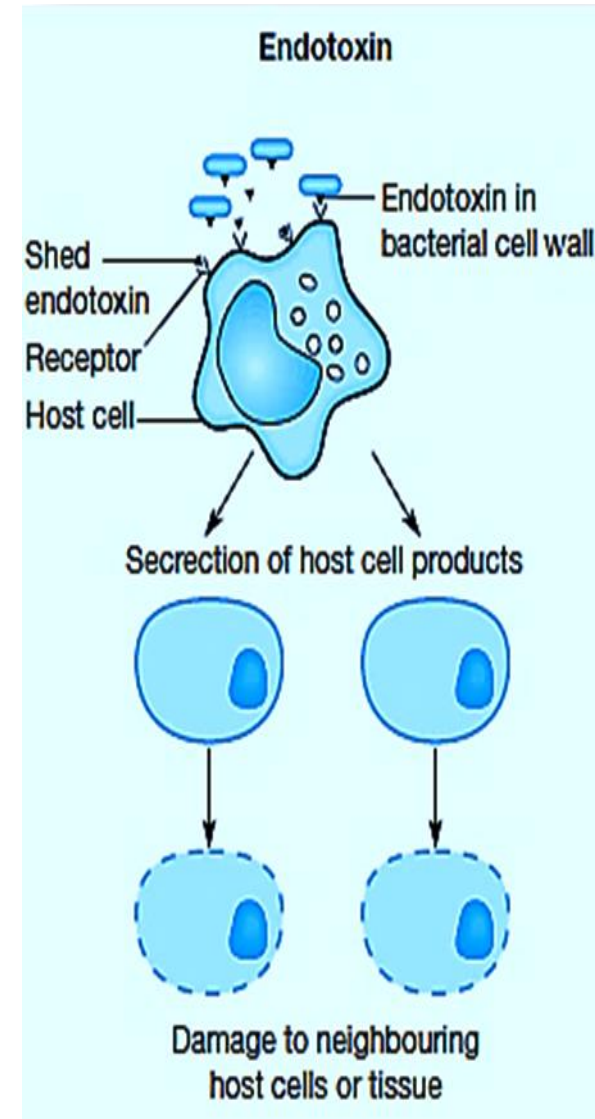
The Production of Toxins

- 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 –ve bacteria.
- **Endotoxins** released when Gram –ve bacteria die and the cell wall undergoes lysis.
- Antibiotics used to treat Gram –ve diseases can lyse the bacterial cells, releasing the endotoxin.

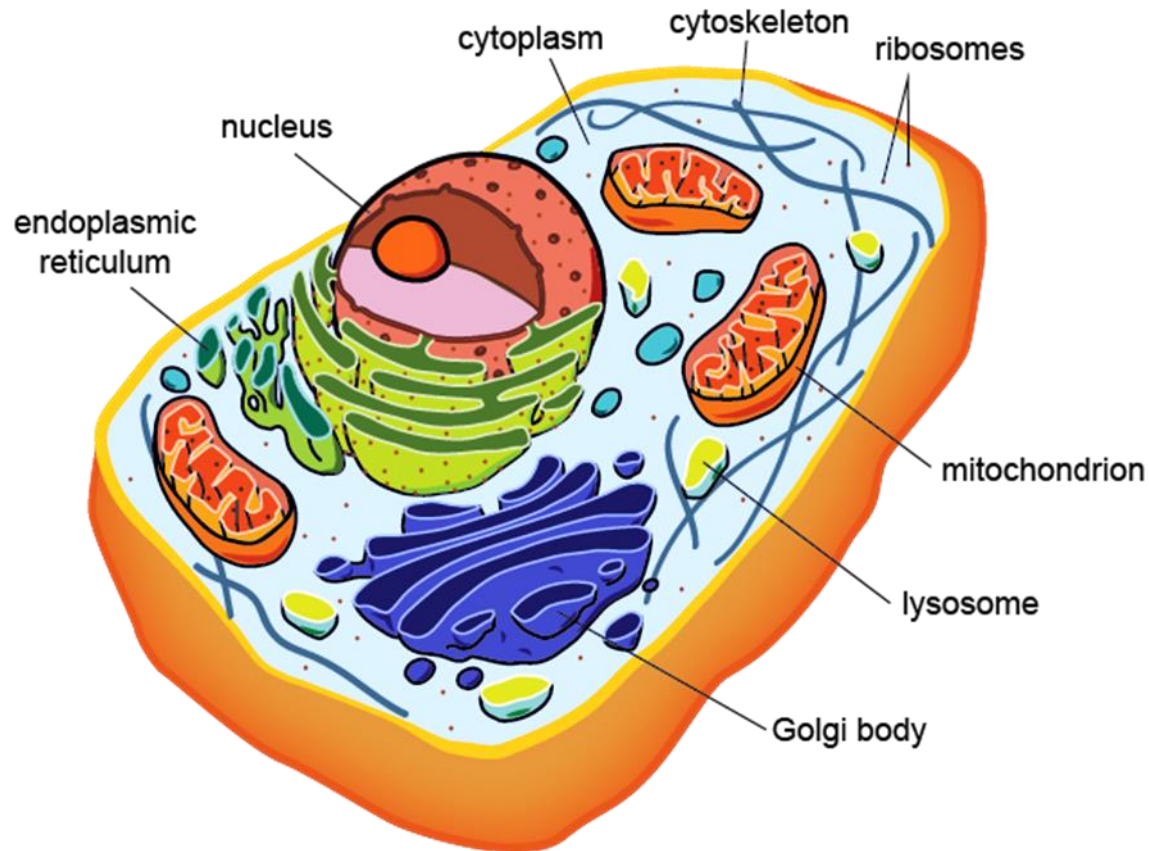


Fungi

- 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, carries out the genetic material.
- Fungi classified as a kingdom.
- Fungi cell walls are made of sugar.
- Fungi cause various diseases.

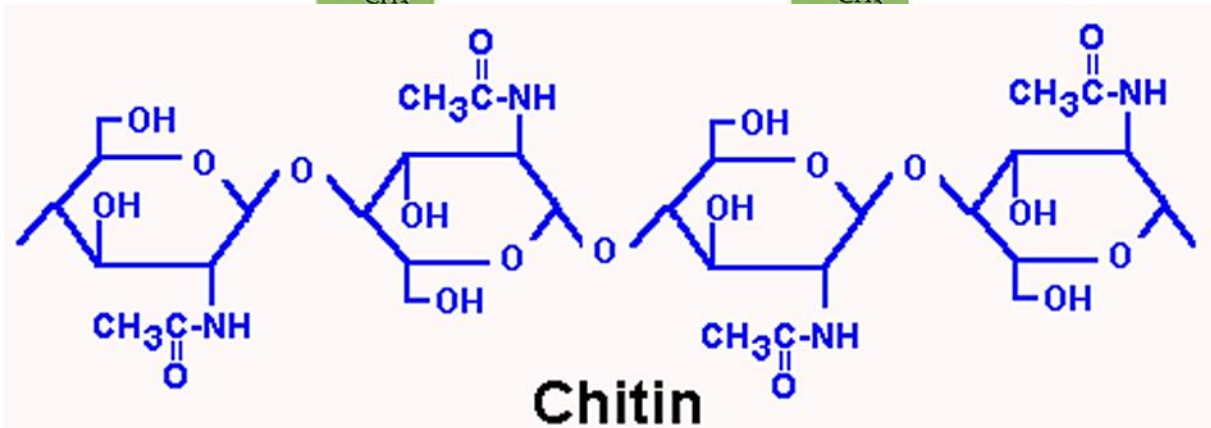
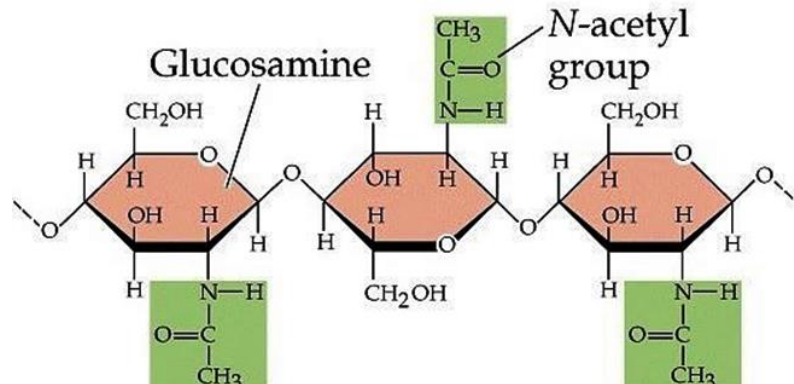
Fungi

- Eukaryotic Fungi Structure: Humans are categorically eukaryotic organisms.



Fungi

- Fungi have cell walls contain chitin.
- Chitin is a long-chain homopolymer of *N*-acetyl-*D*-glucosamine units (β -1,4 linkage).



Fungi

- Fungi include:
 - Yeasts
 - Moulds
 - Mushrooms



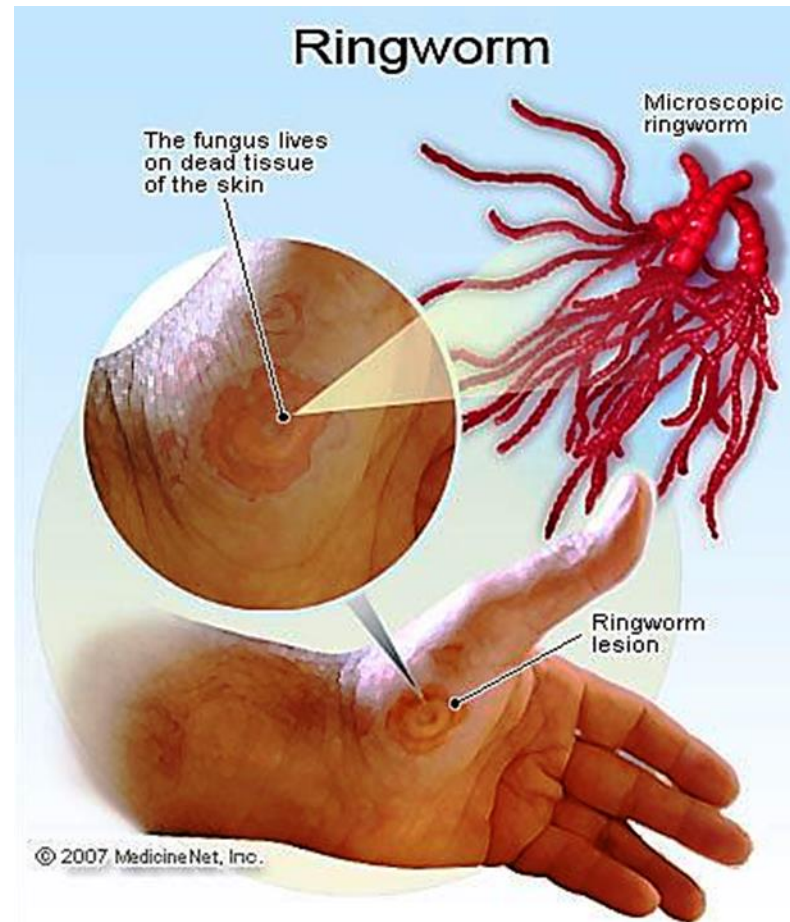
Fungi

- Fungi include:
- A **plant-like organism** that lives on dead matter and contribute to illness.



Fungi

- Fungi include:
- **Ringworm**, a condition caused by fungal infection of the skin in humans and pets such as cats.



Fungi

- Fungi include:
- Athlete's foot (tinea pedis)
- Yeast infections



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