



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
الَّذِي عَلَّمَ بِالْقَلَمِ ۖ عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ



MICROBIOLOGY

MID | Lecture 2

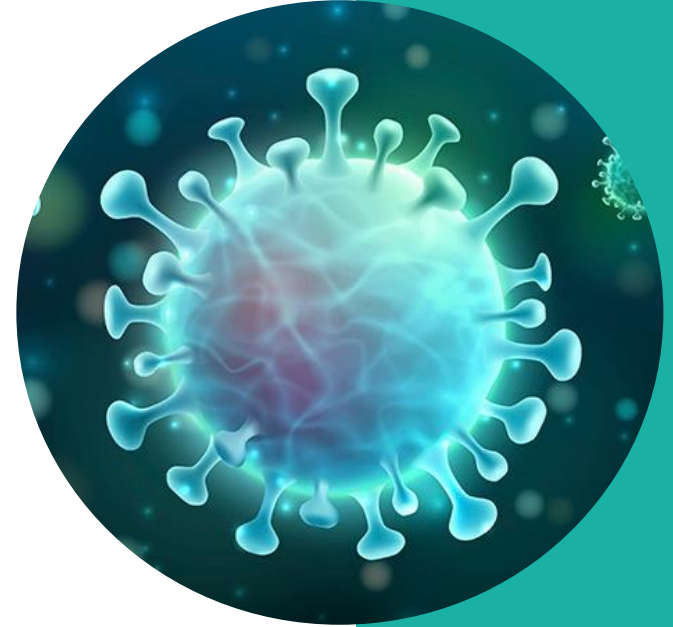
Introduction to microbiology

Written by :

NST

Reviewed by:

Raghad Farraj



Color coding used in the modified:



Black: the original slides



Teal: the doctor's explanation/words



Gray: additional information and explanation



Red: important information



LECTURE 1

Introduction to medical Microbiology



Objectives

- 1) Definition of Microbiology/ Medical Microbiology**
- 2) Effects of Microorganisms on human beings**
- 3) Contribution of the scientist in the field of Microbiology**
- 4) Classification of Microorganisms**
 - Eukaryotic**
 - Prokaryotic**
 - Viruses**

I) Definition of Microbiology

Micro bio logy

↓ ↓ ↓

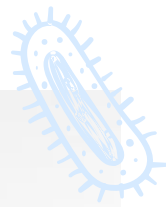
small Life Science



Medical Microbiology:

is a science of studying micro-organisms (too small to be seen by naked eye) which associated with human disease, their activities and their influences on different aspects of life.

Microbiology has many fields such as agricultural, environmental, and industrial microbiology , but in this course we will focus on medical microbiology.



- **The organisms are widely distributed in nature.**
- **Some of them are beneficial to man and some are harmful. Medical microbiology deals with microbes that are harmful to man.**





Beneficial:

Food industry: Fermentation of some products; Bread, Wine, Cheese, Yoghurt, Vinegar

Industrial applications: Bacteria is used in modern biotechnology such as genetic engineering, insulin, Enzymes, Amino acids, Vitamins, Antibiotics, Vaccines, Pharmaceutical industries.

Sewage treatment: recycling water

Recycling vital elements in the environment of elements: such as nitrogen, carbon, oxygen, sulfur, phosphorus, etc.

Harmful

Food spoilage, Diseases.

Bread is produced using yeast, which is a type of fungus and fungi are microorganisms.

Yogurt is a fermented milk product made by beneficial bacteria, such as *Lactobacillus*, giving yogurt its characteristic taste and texture

The doctor talked about the Normal flora.

Normal flora are the microorganisms that live naturally inside our body, such as *Staphylococcus epidermidis*, *Candida albicans*, *E. coli*, and others.

These microorganisms can be bacteria or fungi that coexist with us naturally.

They have benefits, such as being **the first line of defense!**

Microorganisms are considered part of the normal flora as long as they remain in their usual locations in the body. However, if the immune system is weakened or they enter a different body site, they may cause disease. In this case, they are called opportunistic microorganisms.

Portal of entry

Microorganisms that cause disease are said to be
pathogenic.

How did it enter our body ?

- Respiratory: via inhalation.
- Alimentary (GIT): by ingestion. Contaminated food
- Genital tract: sexual contact.
- Skin: abrasions, bites...
- Others: Conjunctiva, blood transfusion, injections and organ transplants.
- Congenital infections (vertical transmission) .

Congenital infection means that the mother is infected with a virus or bacteria, which is transmitted to the fetus but not all infections are transmitted.

Short History: Contribution of the scientists in the field of microbiology

Before we start with the scientists, the doctor said that she isn't interested in the dates or nationalities, what's important is the name of each scientist and their achievements!

We'll write the main achievement under each scientist's name the one the doctor focused on to help you study for the exam easily.

Take a deep breath and dive in ;)



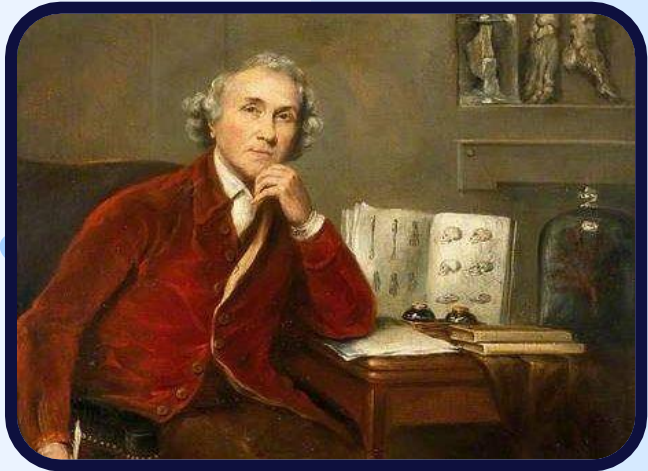
Antony van Leeuwenhoek 17th c: (father of microbiology), Dutch microscopist who was the first to observe live microorganisms in water mud and saliva.

The father of microbiology





John Hunter 18th c: Scottish surgeon he was considered the leading authority on venereal diseases, and believed that Syphilis and Gonorrhea were caused by a single pathogen

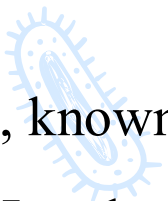


But later, it was discovered that syphilis and gonorrhea are caused by two different pathogens not by single pathogen.

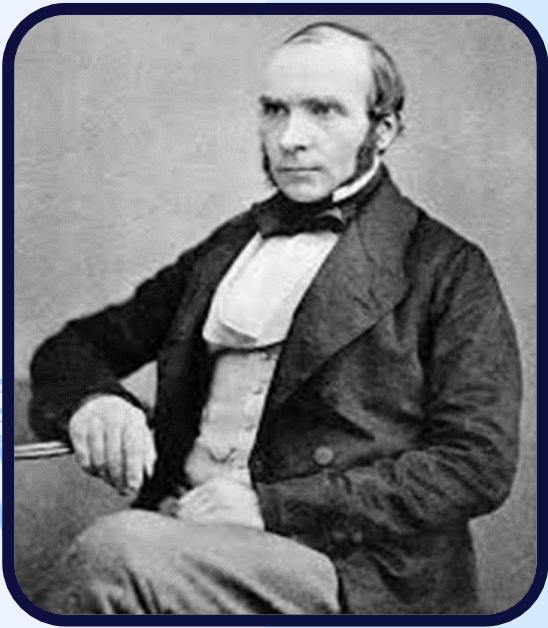
Edward Jenner 18th-19th c: An English physician and scientist who pioneered the concept of vaccines including creating the smallpox vaccine, the world's first vaccine.



Edward Jenner was the first to introduce the concept of the vaccine.



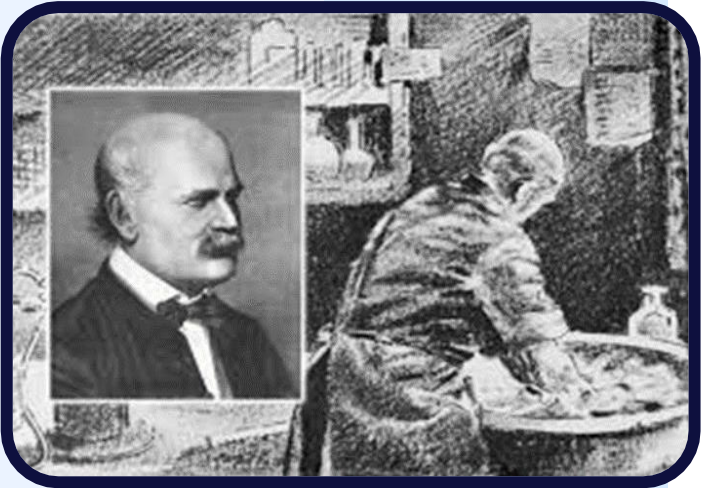
John Snow 19th c: An English physician, known for locating source of cholera outbreak in London (thus establishing the disease as water-borne), also he is considered one of the founders of modern epidemiology.



Proved that cholera is a water-borne disease.
Considered one of the founders of modern epidemiology.

Ignaz Semmelweis 19th c: A Hungarian physician and scientist, known as early pioneer of antiseptic procedures . Described as the "savior of mothers“, he discovered that the incidence of Puerperal sepsis can be prevented if the attending nurses apply hygienic measures.

Hand washing stops infections!



Hand washing tips

- 
Wet hands with running water.
- 
Apply soap or liquid soap.
- 
Rub your hands together for at least 20 seconds.
- 
Wash all areas, including the back of your hands and between fingers.
- 
Rinse hands, making sure you remove all soap.
- 
Dry your hands thoroughly with a paper towel.

It is the process of heating and cooling liquids to kill bacteria without changing the product

Louis Pasteur 19th c: French biologist, microbiologist , and chemist.

1. Discovered the principle of Fermentation of alcohol by microorganisms.
2. Invent a technique of treating milk and wine to stop bacterial contamination, a process called pasteurization.
3. Created the first Vaccines of *rabies*, *Bacillus anthrax*.



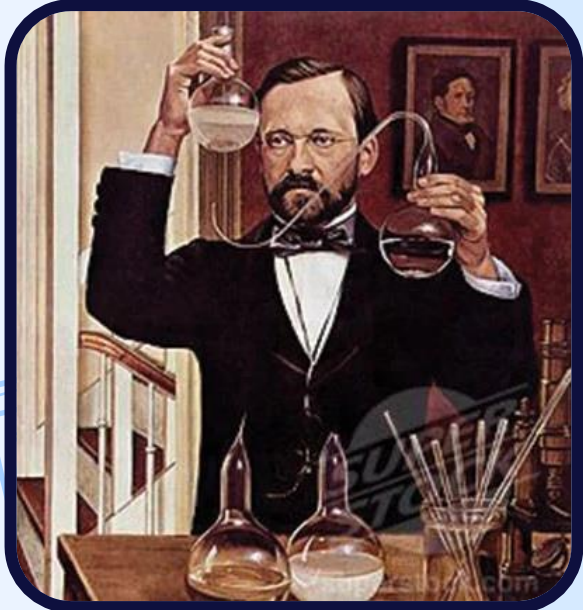
الجمرة الخبيثة (Anthrax): مرض تسببه بكتيريا *Bacillus anthracis*، وينتقل عن طريق ملامسة الحيوانات المصابة أو منتجاتها، أو استنشاق الأوباع أو تناول طعام ملوث. تشمل أعراضه قرحة جلدية ذات مركز أسود أو أعراضاً تنفسية وهضمية، وقد يكون قاتلاً إذا لم يُعالج.

داء الكلب (Rabies): مرض فيروسي يسببه *Rabies virus*، وينتقل غالباً عن طريق عضه حيوان مصاب أو لعابه. تشمل أعراضه الحمى والصداع وصعوبة البلع والخوف من الماء، وهو قاتل تقريباً دائماً بعد ظهور الأعراض، لكن يمكن الوقاية منه بالعلاج الفوري بعد التعرض.

Louis Pasteur and the germ theory.

Louis Pasteur worked in the middle and late 1800s. He performed numerous experiments to discover why wine and dairy products became sour, and he found that bacteria were to blame. Pasteur called attention to the importance of microorganisms in everyday life and stirred scientists to think that if bacteria could make the wine “sick,” then perhaps they could cause human illness.

Pasteur's attempts to prove the germ theory were unsuccessful. However, the German scientist **Robert Koch** provided the proof by cultivating anthrax bacteria apart from any other type of organism.





Robert Koch 19th c:

Developed microbiological media & streak plates for pure culture.



Germ theory (Koch's postulates):

- Microorganism must be present in every case of the disease.
- Organism must be grown in pure culture from the diseased host.
- Inoculation of above into host must give same disease.
- Organism must be recovered from experimentally infected host.

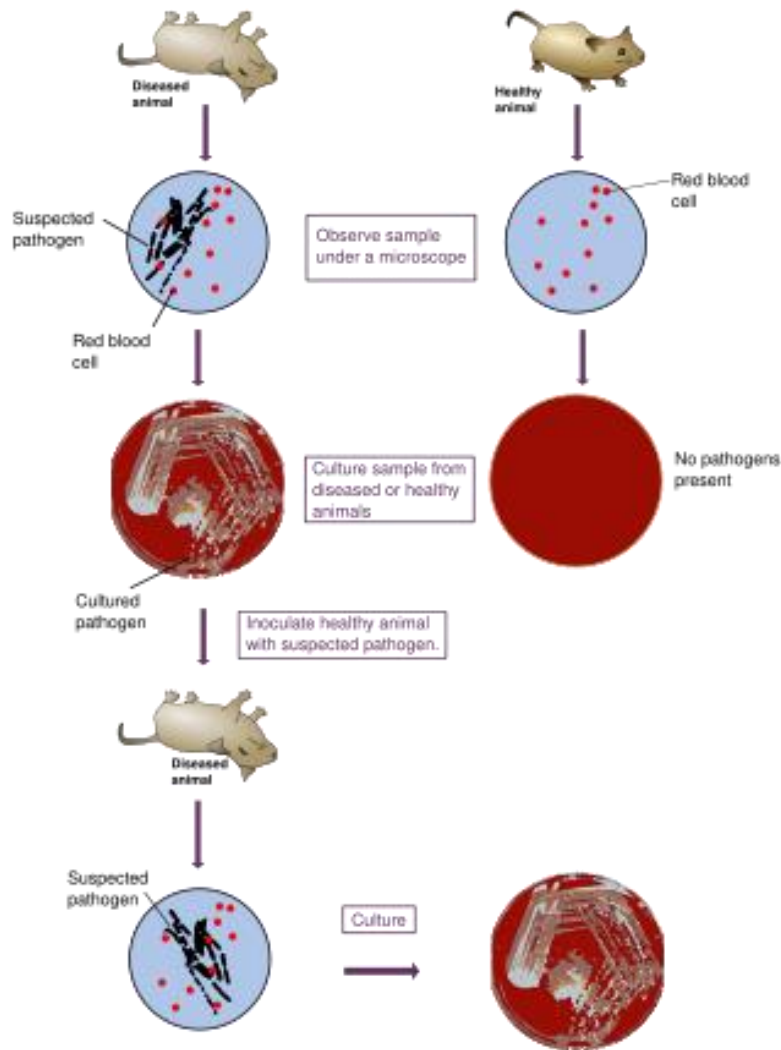
Koch's Postulates:

① The microorganism must be found in all organisms suffering from the disease, but should not be found in healthy organisms.

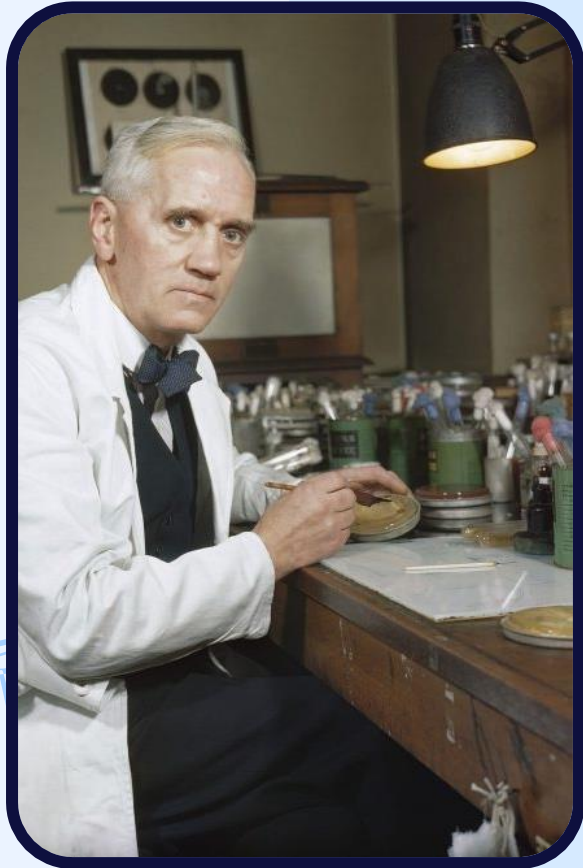
② The microorganism must be isolated from a diseased organism and grown in pure culture.

③ The cultured microorganism should cause disease when introduced into a healthy organism.

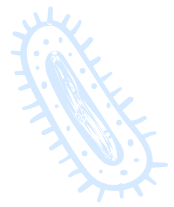
④ The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

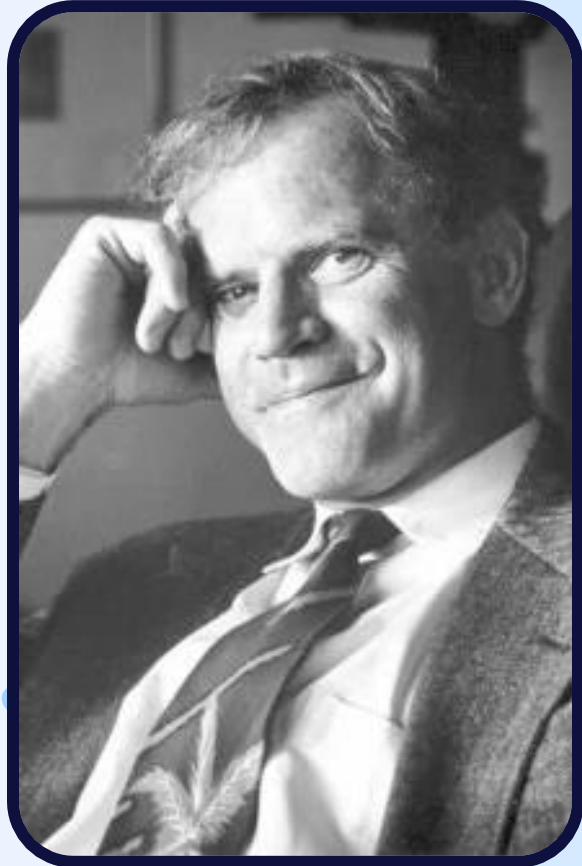


1. **Presence:** The microorganism must be found in all diseased organisms but not in healthy ones.
2. **Isolation:** The microorganism must be isolated and grown in pure culture.
3. **Inoculation:** The cultured microorganism should cause the same disease when introduced into a healthy organism.
4. **Re-isolation:** The same microorganism must be re-isolated from the newly infected host.



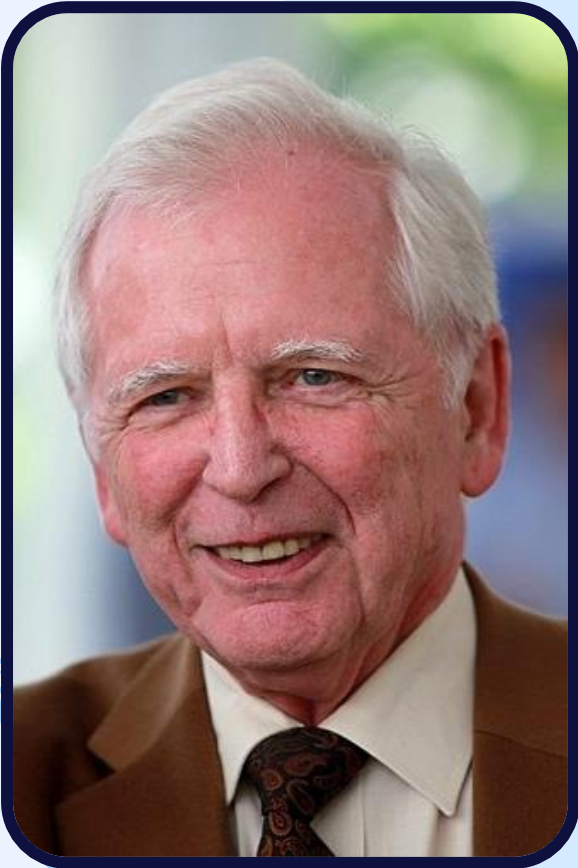
Alexander Fleming – 1928 – A Scottish physician and microbiologist, his best known discovery the world's first broadly effective antibiotic (Penicillin G) from the mould *Penicillium rubens* in 1928.





**Kary Mullis 1986: An American biochemist, invent
Polymerase Chain Reaction (PCR) technique.**

PCR (Polymerase Chain Reaction) is a laboratory technique used to amplify a specific DNA sequence, producing millions of copies so it can be detected and studied.



Zur Hausen : A German virologist, He has done research on cancer of the cervix, where he discovered the role of Papilloma viruses, This research directly made possible the development of a vaccine HPV.

If it infects a woman, it causes changes and leads to cancer of the cervix

We took the HPV (Human papilloma virus) in pathology which causes Warts disease and cervix cancer in females.

**** There are four classes of organisms that can cause disease:**

1- Viruses

2- Bacteria

3- Fungi, these can be of two varieties:

a- Yeasts are unicellular organisms

b- Molds are large multicellular organisms.

4- Parasites: these can be of two classes:

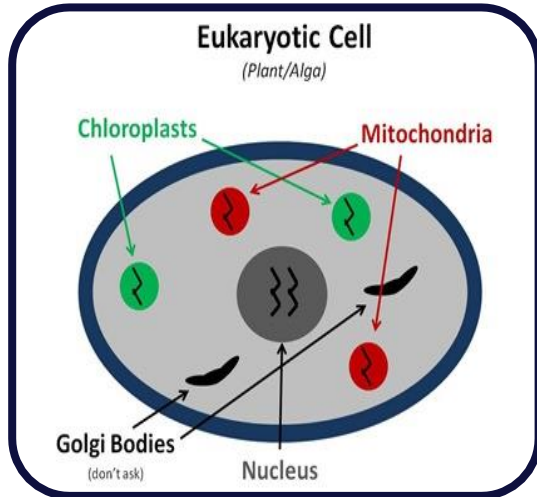
a- Protozoa, these are unicellular organisms that vary in size, some are very small and can cause intercellular infection. Others are large and cause extracellular infection.

b- Helminthes, these are multicellular and can reach several meters in lengths.

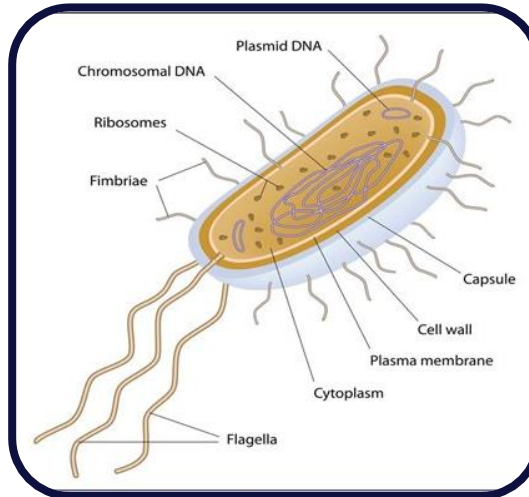
Helminthes are also called Metazoa because they are multicellular

Classification of Microorganisms

A) Eukaryotic

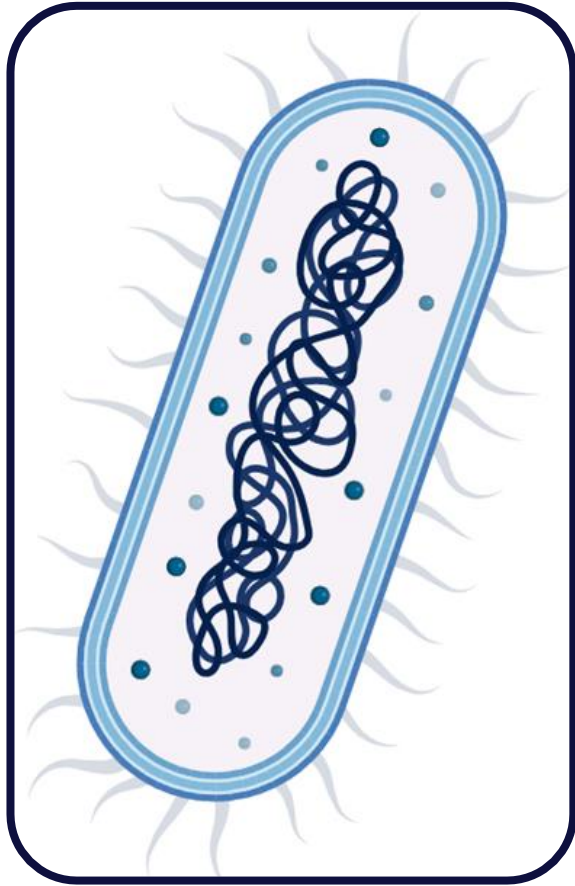


B) Prokaryotic



C) Viruses





Unicellular

↓ ↓

One Cell

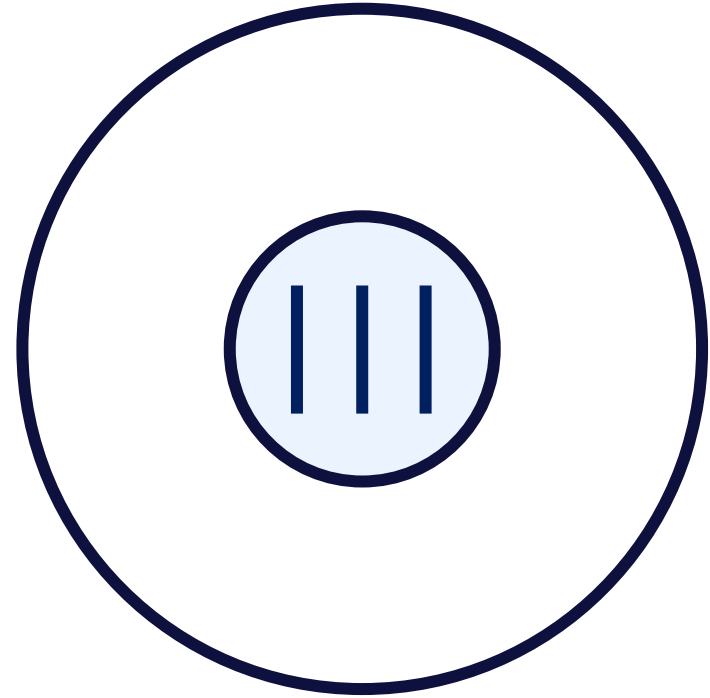
Systems, organs, tissues, cells, all to perform life processes yet bacteria are unicellular and are capable of performing respiration, reproduction, secretion and digestion! سبحان الله

Classification of Microorganisms

Eu **karyotic**

↓ ↓

True **Nucleus**



Classification of Microorganisms

Prokaryotic

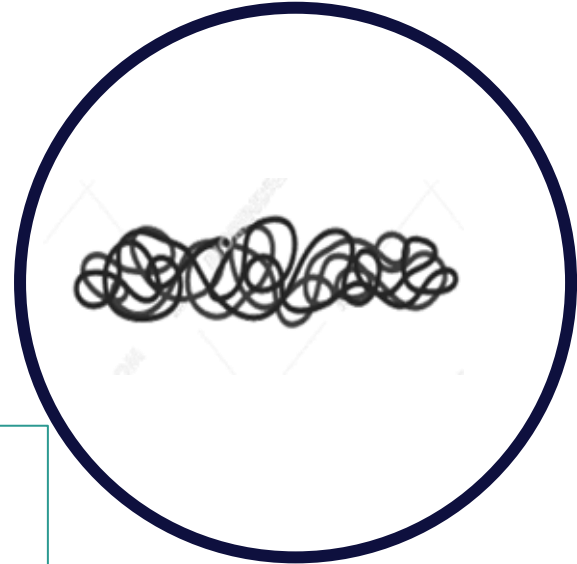
↓
Primitive

↓
Nucleus

Single chromosome

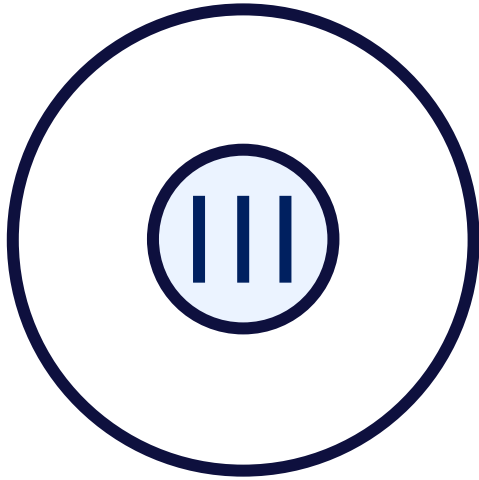
Suspended (Nucleoid)

This genetic material (a single chromosome) is suspended in the cytoplasm and is not surrounded by a nuclear membrane; that's why we consider it a nucleoid



A) Eukaryotic

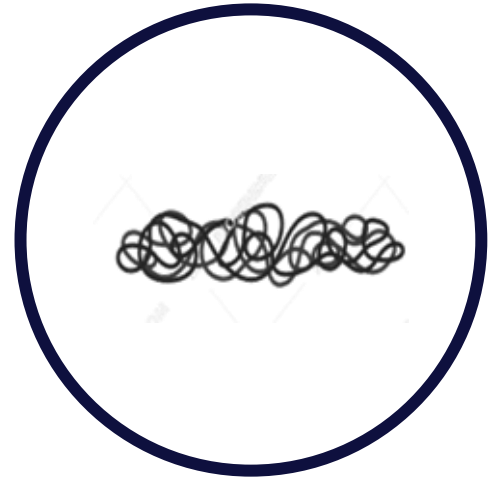
(True nucleus)



**membrane-bound
organelles present**

B) Prokaryotic

(Not True nucleus)



**Membrane bound
organelles Absent**

A) Eukaryotic

Contains: Ribosomes, Mitochondria, Golgi apparatus, Endoplasmic reticulum



Fungi

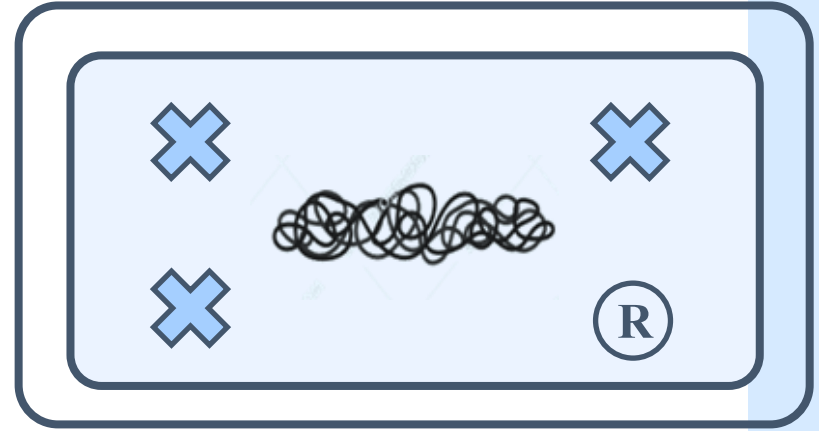
The Only one that has a cell wall, made from chitin.

Protozoa

Algae

B) Prokaryotic

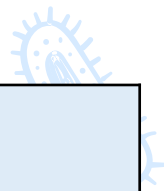
Contain: other type of ribosomes.



Bacteria

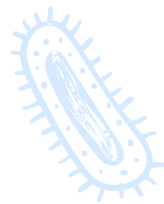


Characteristic	Prokaryotic	Eukaryotic
1) Nucleus	No	Yes
2) Size	0.05-10μm	10-100μm
3) Nuclear membrane	No (Nucleoid)	Yes (Nucleus)



Characteristic	Prokaryotic	Eukaryotic
4) Membrane-bound organelles Mitochondria Golgi apparatus Endoplasmic reticulum	Absent	Present

Characteristic	Prokaryotic	Eukaryotic
5) Chromosome Number	One (circular)	Multiple (linear)
6) Ribosome	70S (30S-50S)	80S (40S -60S)
7) Cell wall	Present EXCEPT Mycoplasma	Absent Fungi (Chitin)
8) Cell membrane	No sterols EXCEPT in mycoplasma	Has sterols



Characteristic	Prokaryotic	Eukaryotic
9) Division	Binary fission	Mitosis

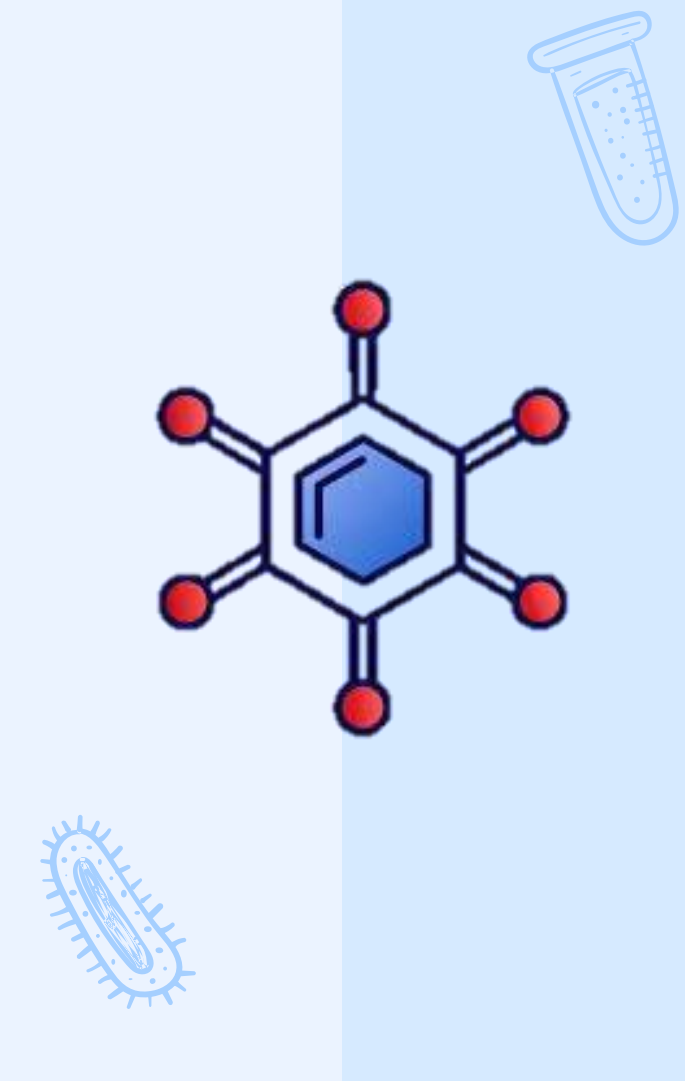


Viruses

Acellular

(Infectious agent)

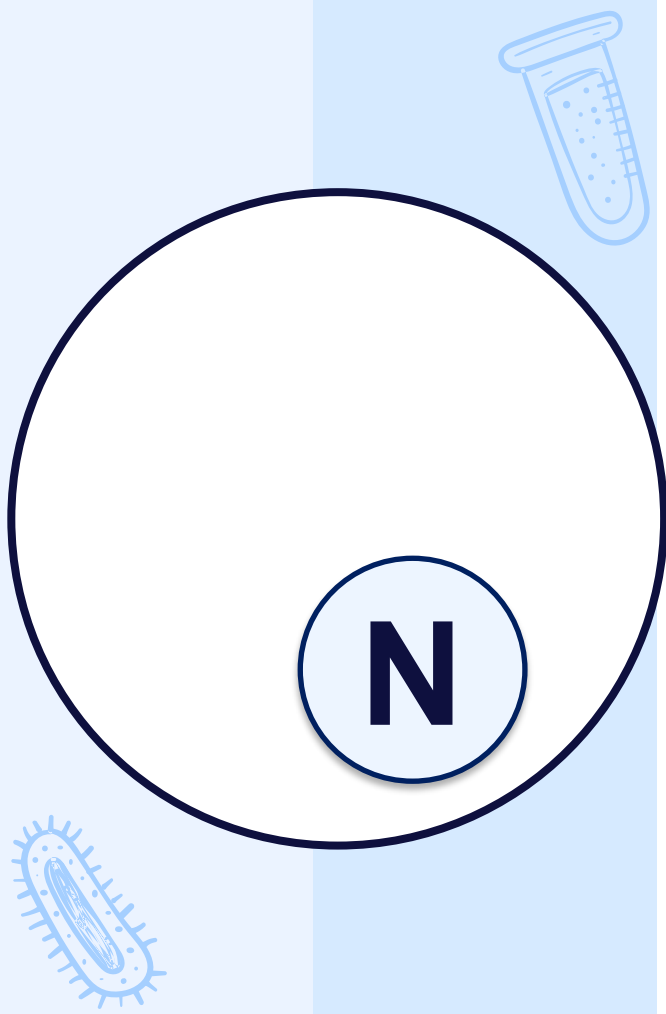
One of the smallest infectious agent



Viruses

No cell structure

Not a cell, It has only one genetic material DNA or RNA never both, and few enzymes.

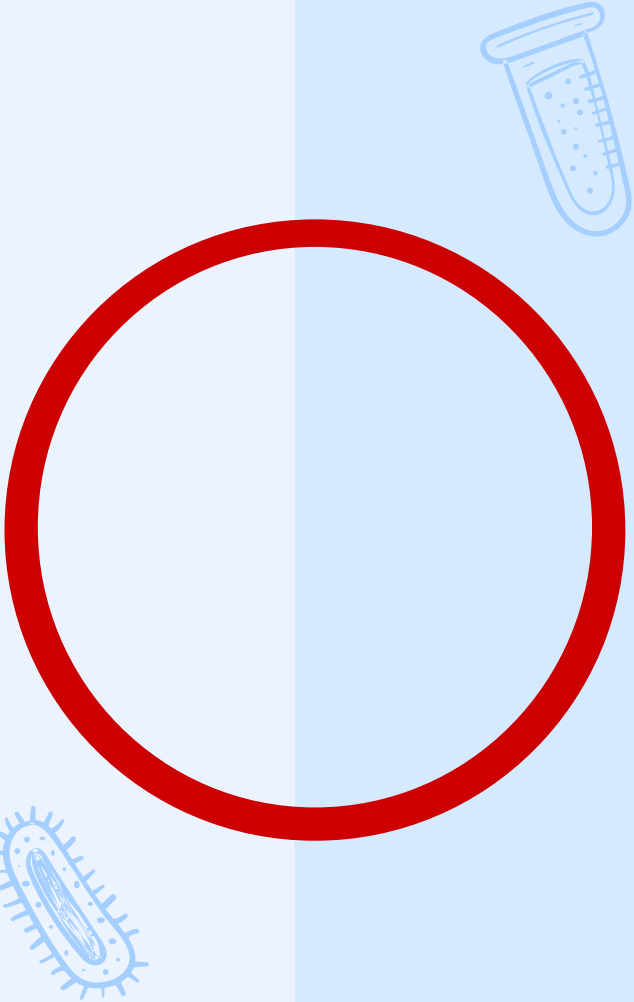


Viruses

Obligate Intracellular

Directed host cell for replication

It has to enter the host cell and take control of the machinery process in there and inject its genetic material to replicate itself.



Viroids

ssRNA, circular Without protein coat

Infect Plants!!

Smaller than virus

Viroids are not known to infect humans because human cells lack the compatible cellular machinery and conditions that viroids need to replicate and cause disease.

Prion

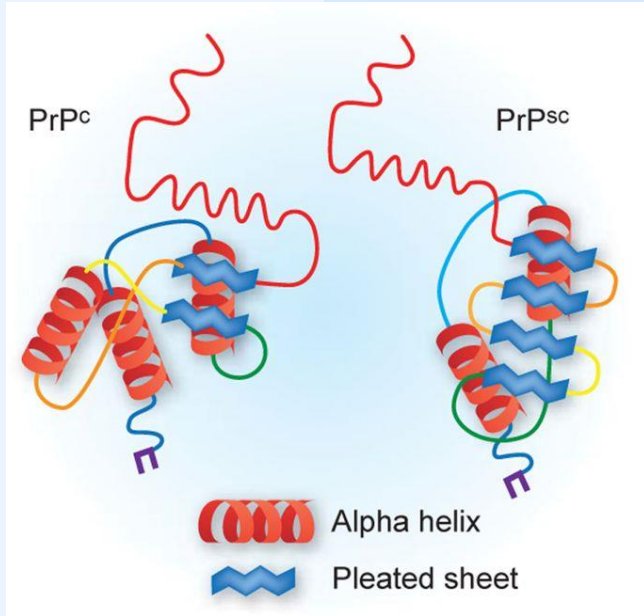


**Protein without nucleic acid
(Infectious)**

Prion

Misfolded protein

converts protein from Alpha helices to pleated sheets



Prion

**Aggregation of
Prion in CNS**



**Spongiform in the brain
Creutzfeldt-Jakob disease (CJD)
seen in humans**





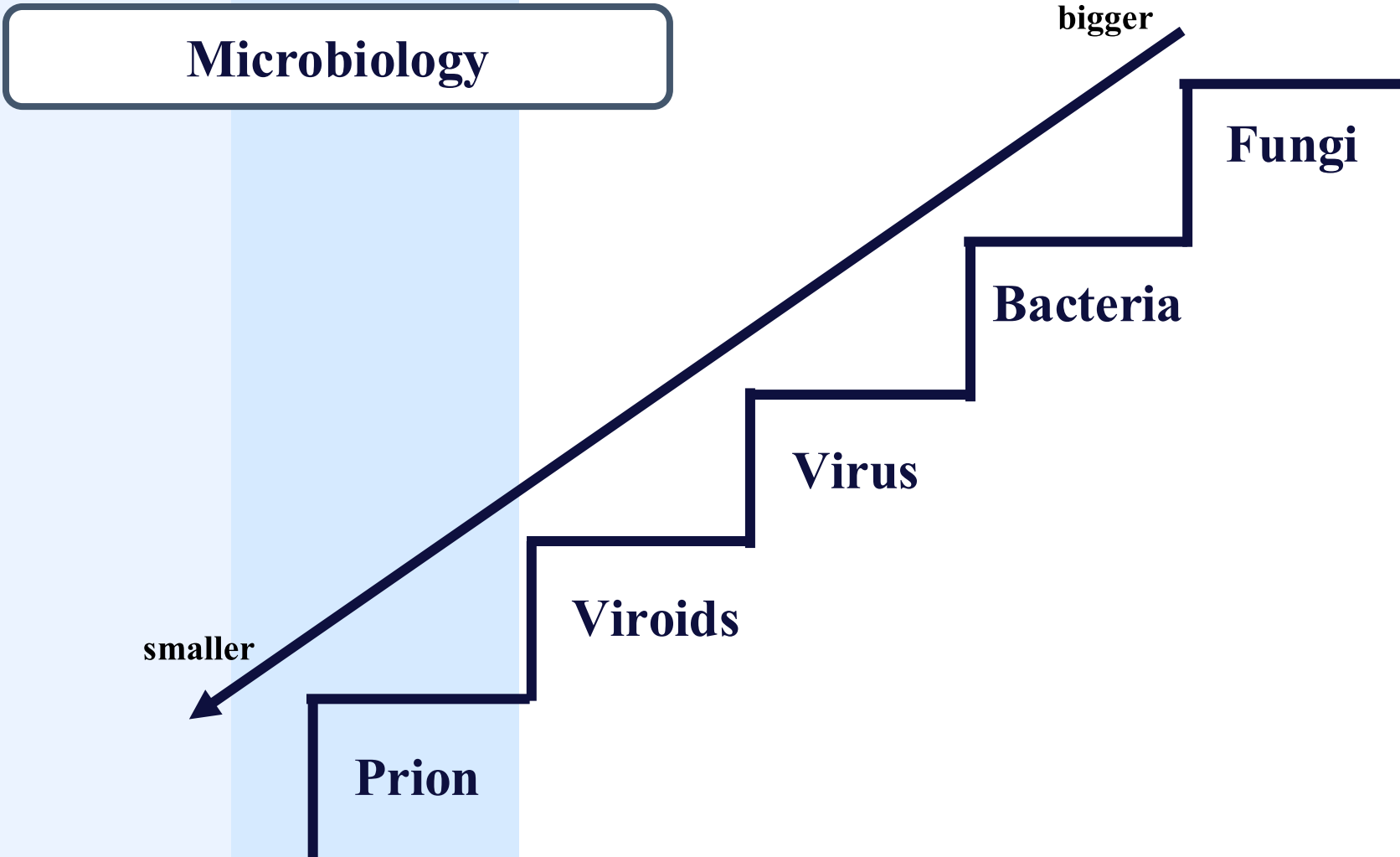
Prion

Prion infecting the brain of
cow make a disease called:

Mad cow disease

**Bovine spongiform encephalopathy
(BSE or mad cow disease) seen in cattle,**

Microbiology



Prion

Viroids

Virus

Bacteria

Fungi

smaller

bigger

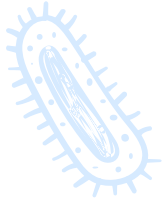
Microbiology

Fungi

Bacteria

Virus

Parasites



Immunology

Microbiology studies several microorganisms which are foreign things that can insert to our body and make an immune response to defend against these microbes by a science called immunology.

Additional resources:

Reference Used:

Extra References for The Reader to Use:

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لَا إِلَهَ إِلَّا اللَّهُ رَبُّ السَّمَاوَاتِ
وَرَبُّ الْأَرْضِ وَرَبُّ الْعَرْشِ الْكَرِيمِ-

رسالة من الفريق العلمي:

For any feedback, scan the code or click on it.



Versions	Slide # and Place of Error	Before Correction	After Correction
V0 □ V1	Slide 27	Sentences were referring to prokaryotes	The sentences were moved to the next side
V1 □ V2			