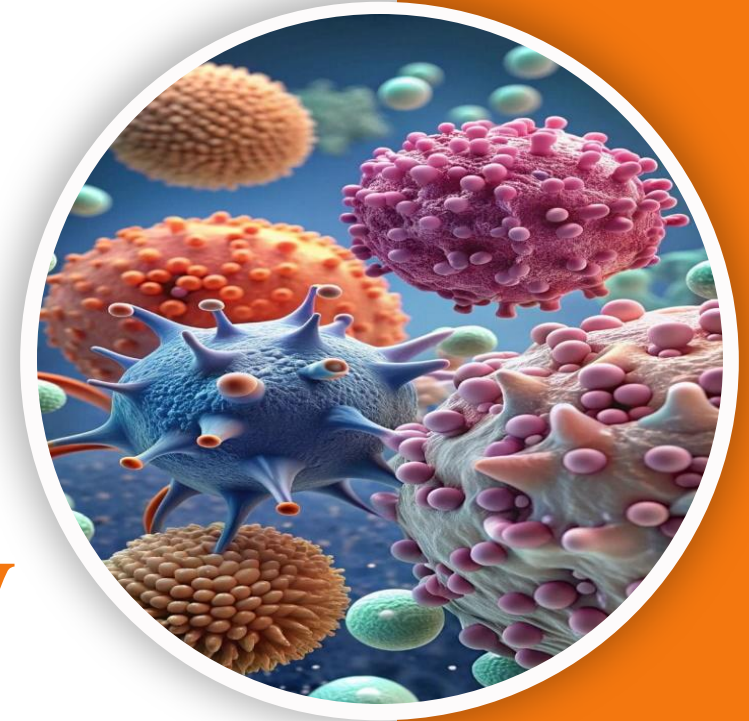


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
(وَفَوْقَ كُلِّ ذِي عِلْمٍ عَلِيمٌ)



Microbiology | Lecture 3

Introduction to Medical Microbiology



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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



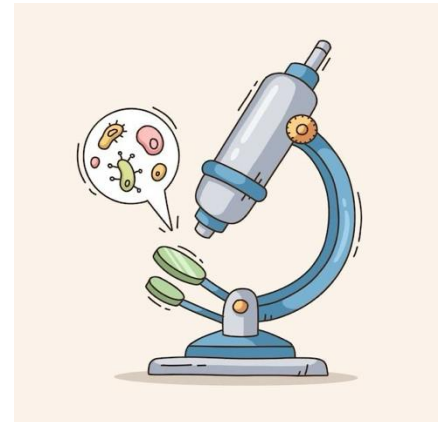
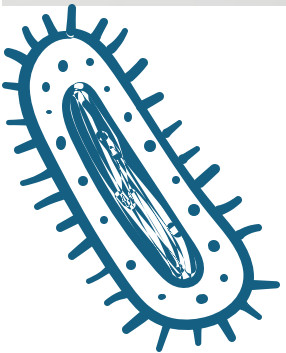
I) Definition of Microbiology

Micro bio logy

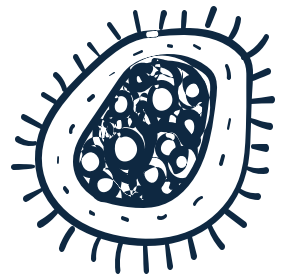
small

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:

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

Yogurt is basically milk that contains beneficial bacteria called (Lactobacillus) which convert the milk into yogurt.

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 (for daily use not for drinking)

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

Harmful

Food spoilage, Diseases.

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. As long as they are in their specific location in our body, they are considered normal, but if there is any disturbance in immunity, they may move from their place and cause disease, In this case ,we call them opportunistic microorganisms (انتهازيون)

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.

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

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

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

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

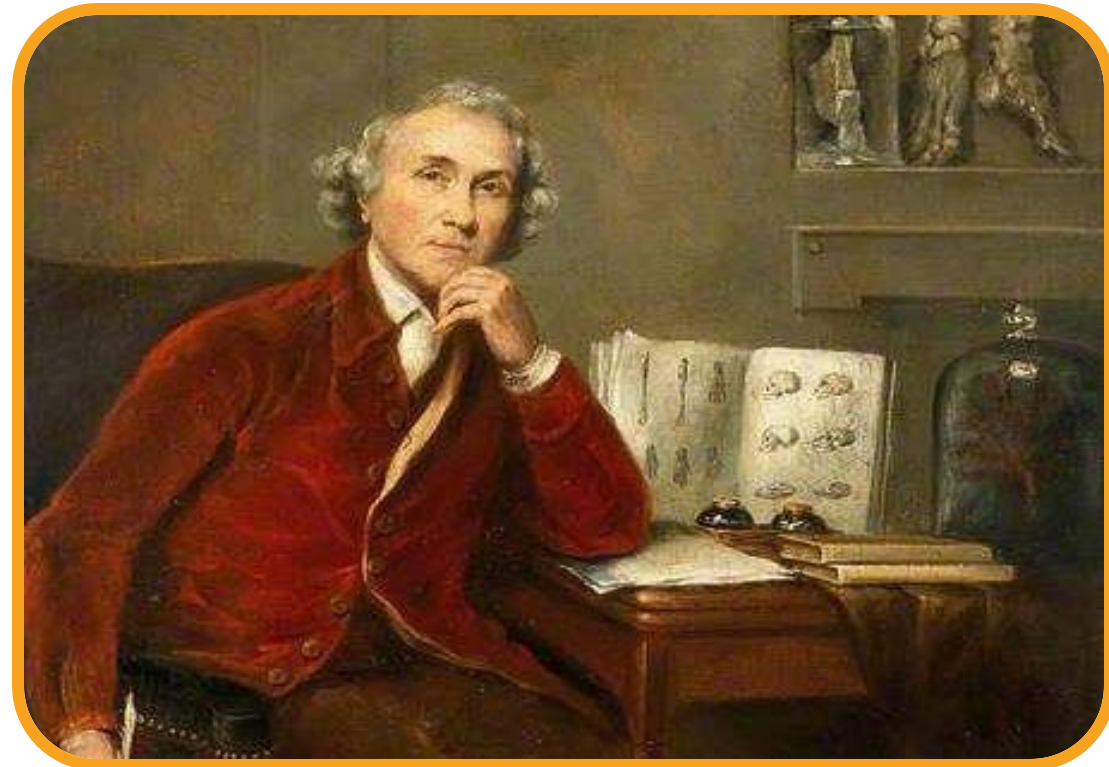


The father of microbiology



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.

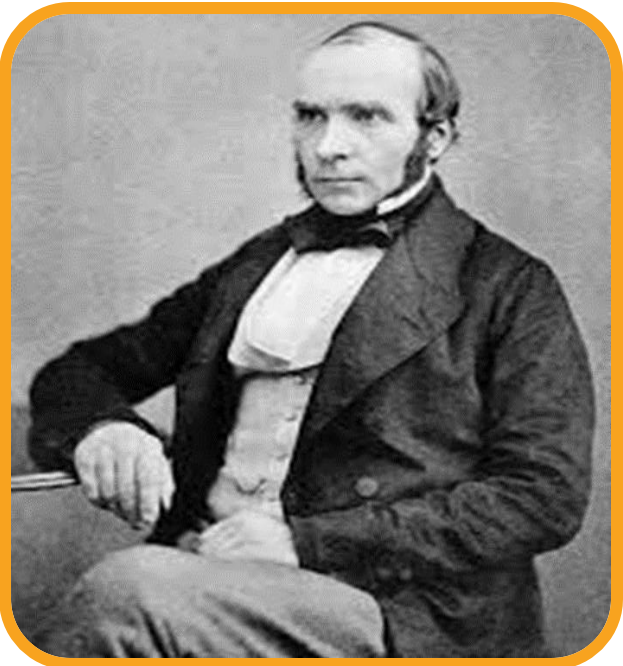


Edward Jenner 18th-19th c: An English physician and scientist who pioneered the concept of vaccines including creating the smallpox vaccine, the world's first vaccine.



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.

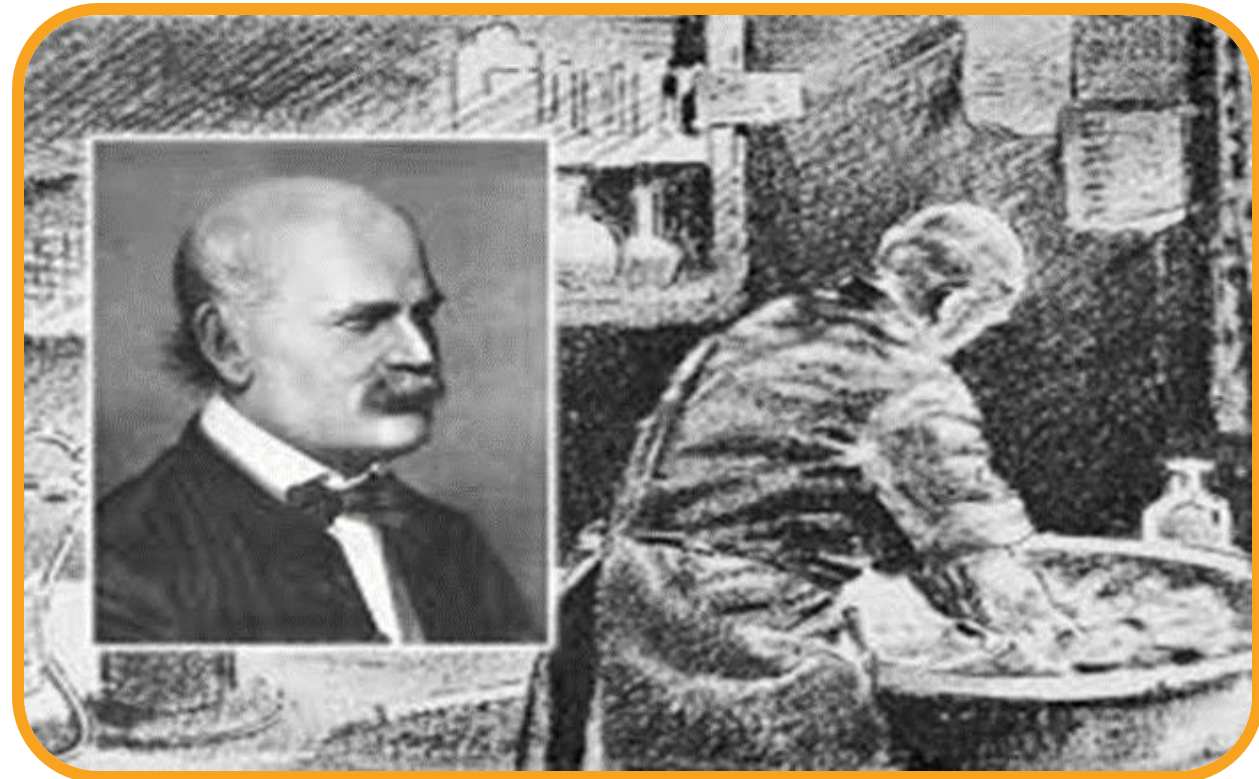
Considered one of the founders of modern epidemiology.

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

Known as the “savior of mothers.

Introduced the practice of hand washing to stop infections



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**.
It is the process of heating and cooling liquids to kill bacteria without changing their taste or nutrients.

3. Created the first Vaccines of *rabies*, *Bacillus anthrax*.

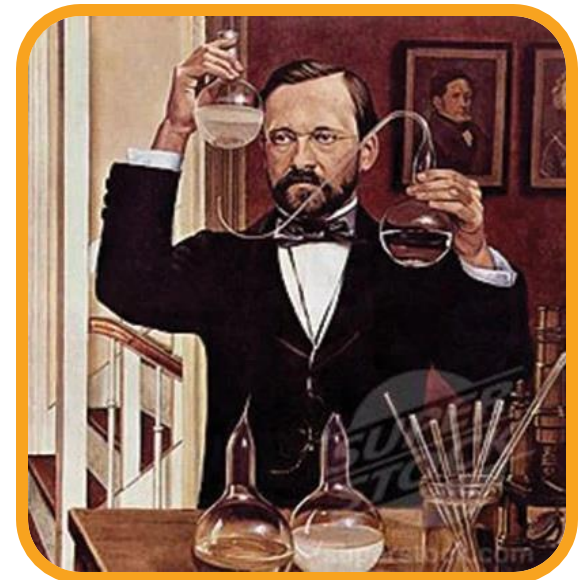
داء الكلب

الجمرة الخبيثة



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.

(Koch's postulates):

- Microorganism must be present in every case of the disease.
- Organism must be grown in pure culture from the diseased host. It is a sample that contains only one type of microorganism, without any other bacteria or microbes.
- Inoculation of above into host must give same disease.
- Organism must be recovered from experimentally infected host.



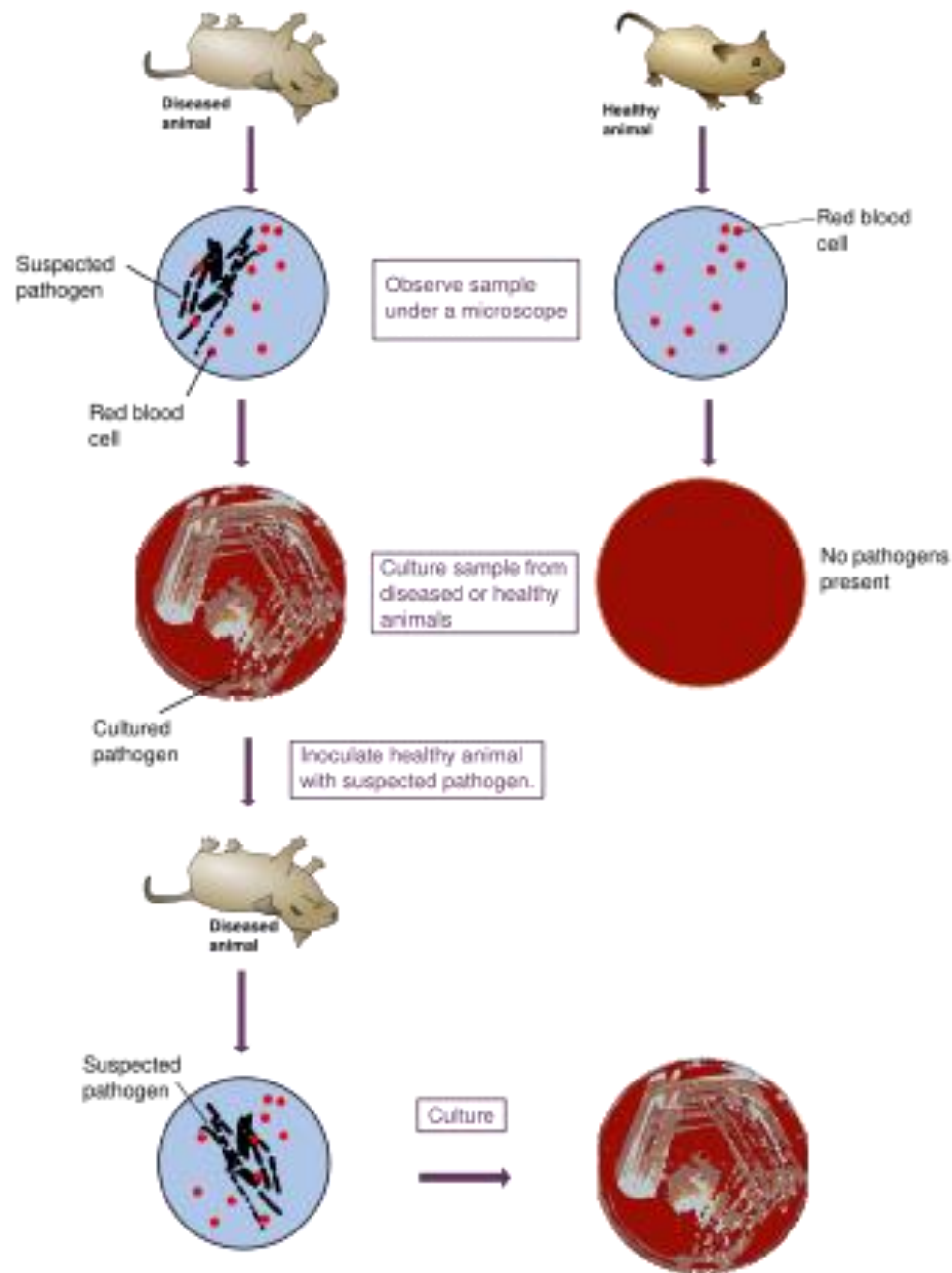
Koch's Postulates:

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

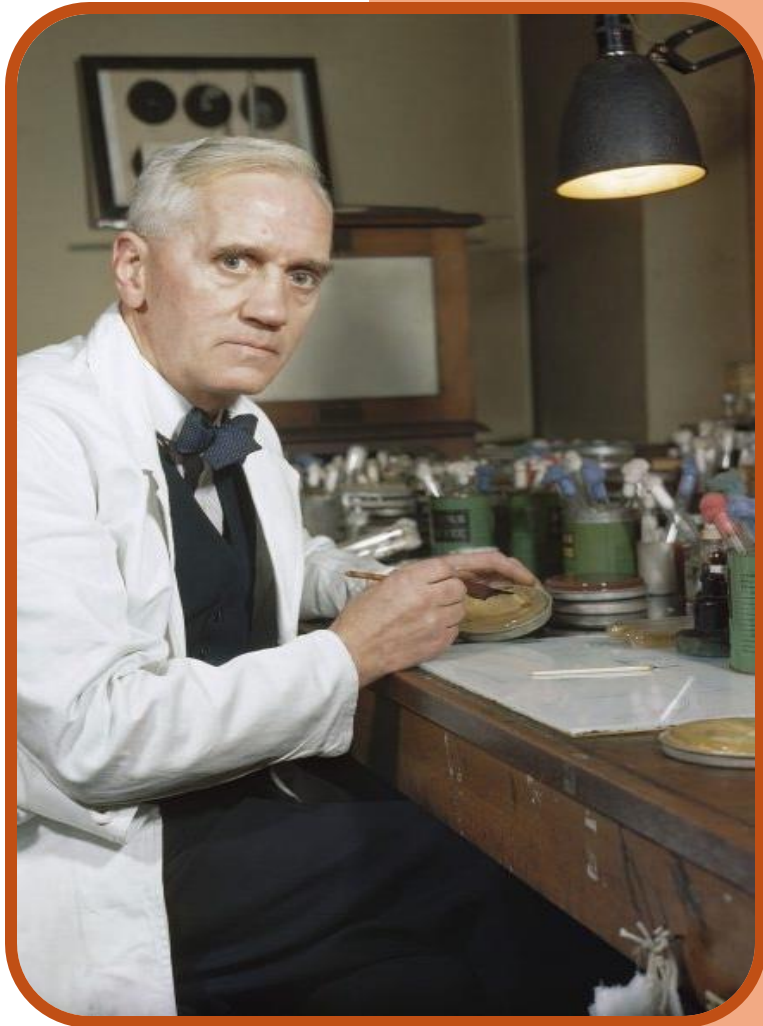
② The microorganism must be isolated from a diseased organism and grown in pure culture.

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

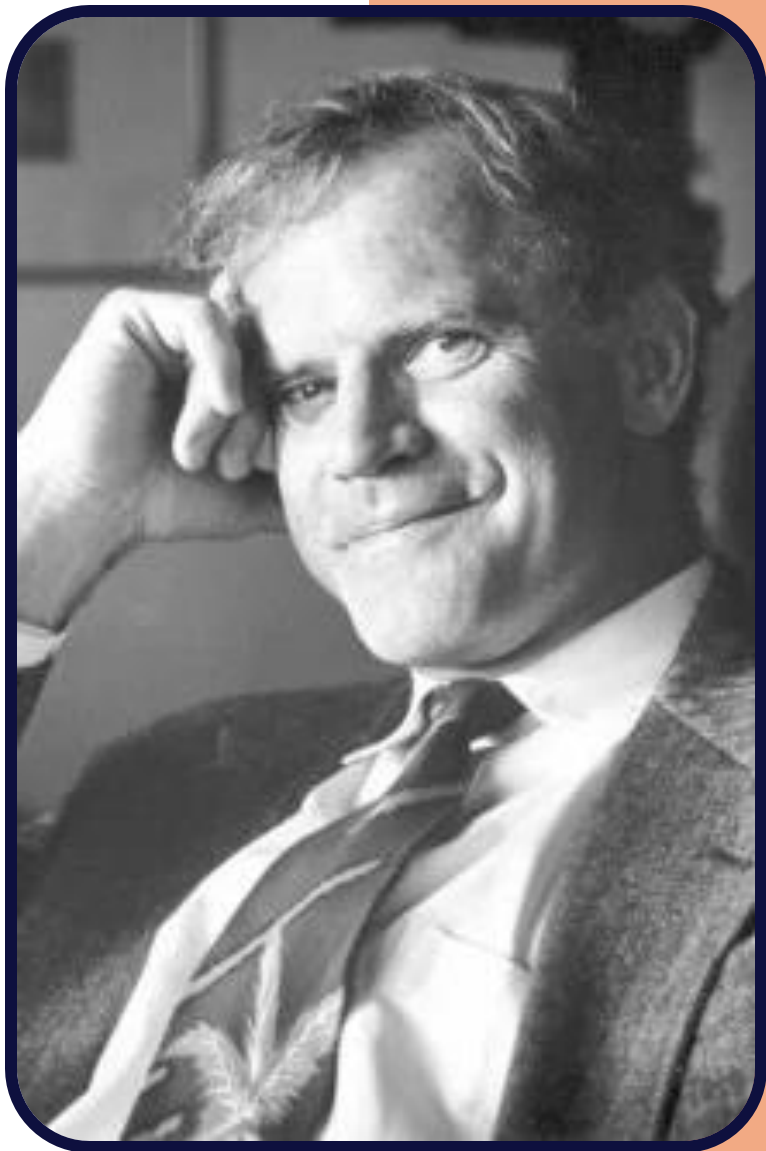
④ The microorganism must be reisolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.



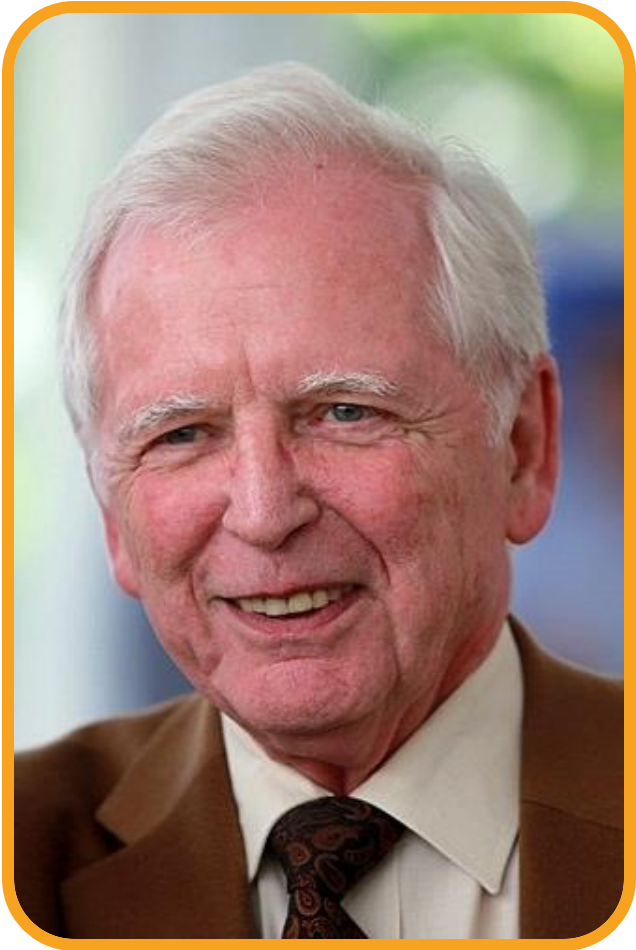
1. **Presence:** The microorganism must be found in all diseased organisms but not in healthy ones.
2. **Isolation:** The microorganism must be isolated and grown in pure culture.
3. **Inoculation:** The cultured microorganism should cause the same disease when introduced into a healthy organism.
4.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



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

**** 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 عفن are large multicellular organisms.

4- Parasites: these can be of two classes:

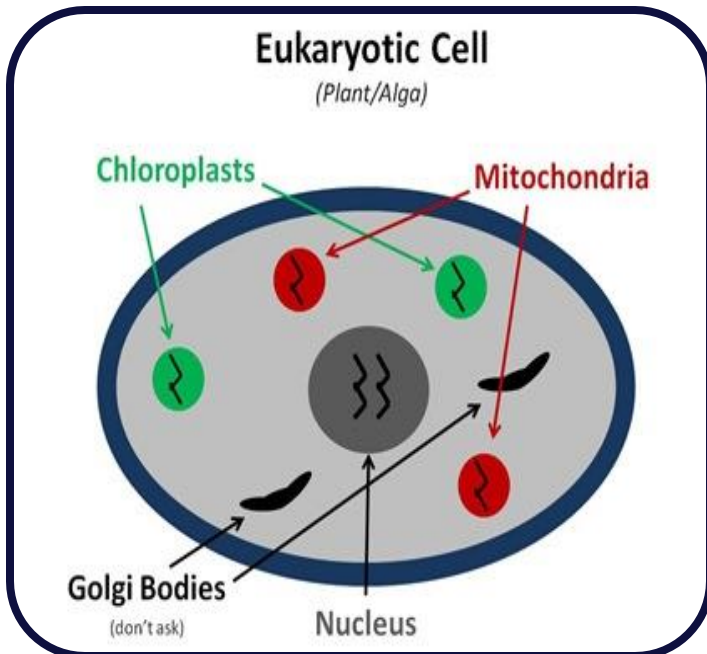
a- Protozoa, these are unicellular organisms that vary in size, some are very small and can cause intercellular infection. Others are large and cause extracellular infection.

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

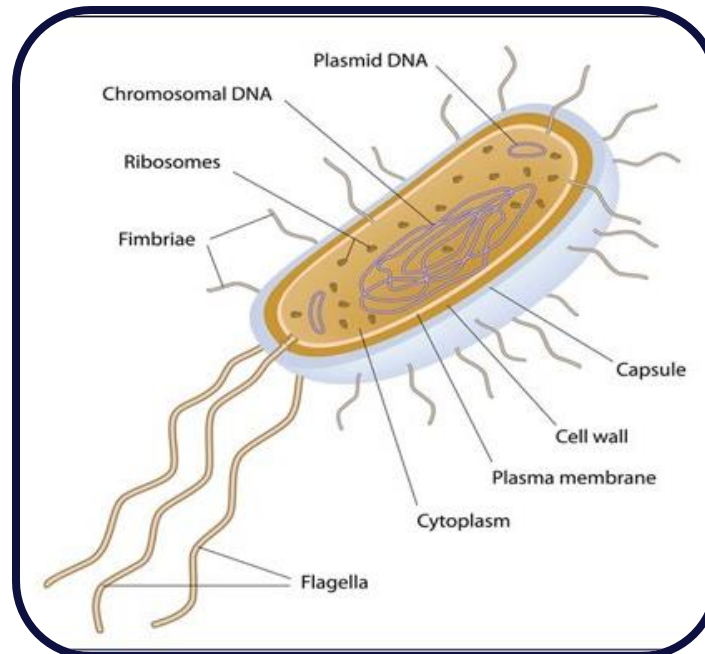
Helminthes are also called Metazoa because they are multicellular

Classification of Microorganisms

A) Eukaryotic



B) Prokaryotic



C) Viruses



System –organ –tissue–cells

Specialized

Structural Functional

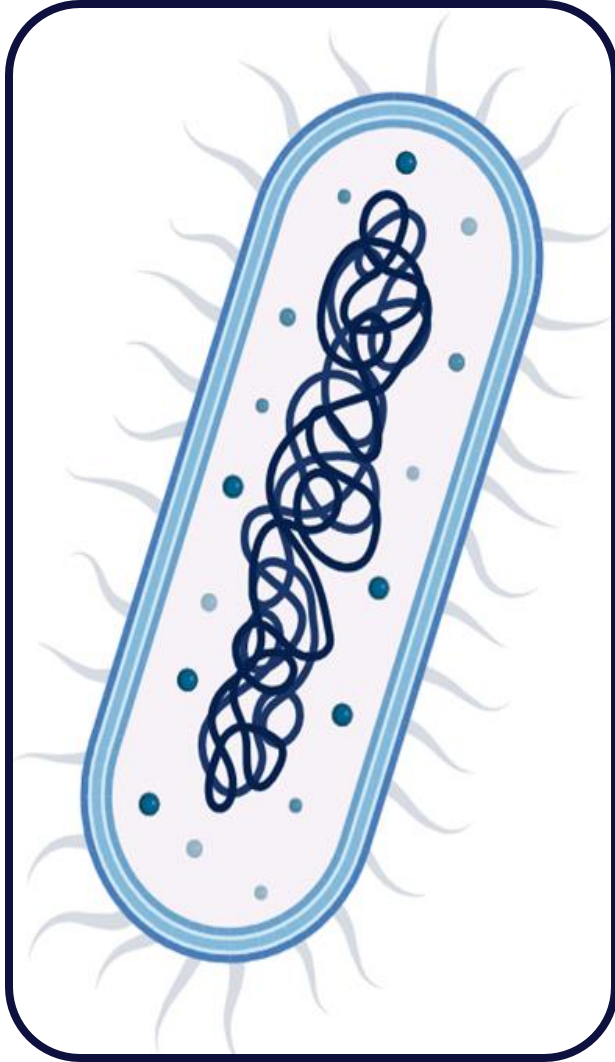
To perform all life processes

Unicellular

One

Cell

But this bacteria are unicellular ,yet they are capable of performing respiration ,reproduction ,secretion and digestion

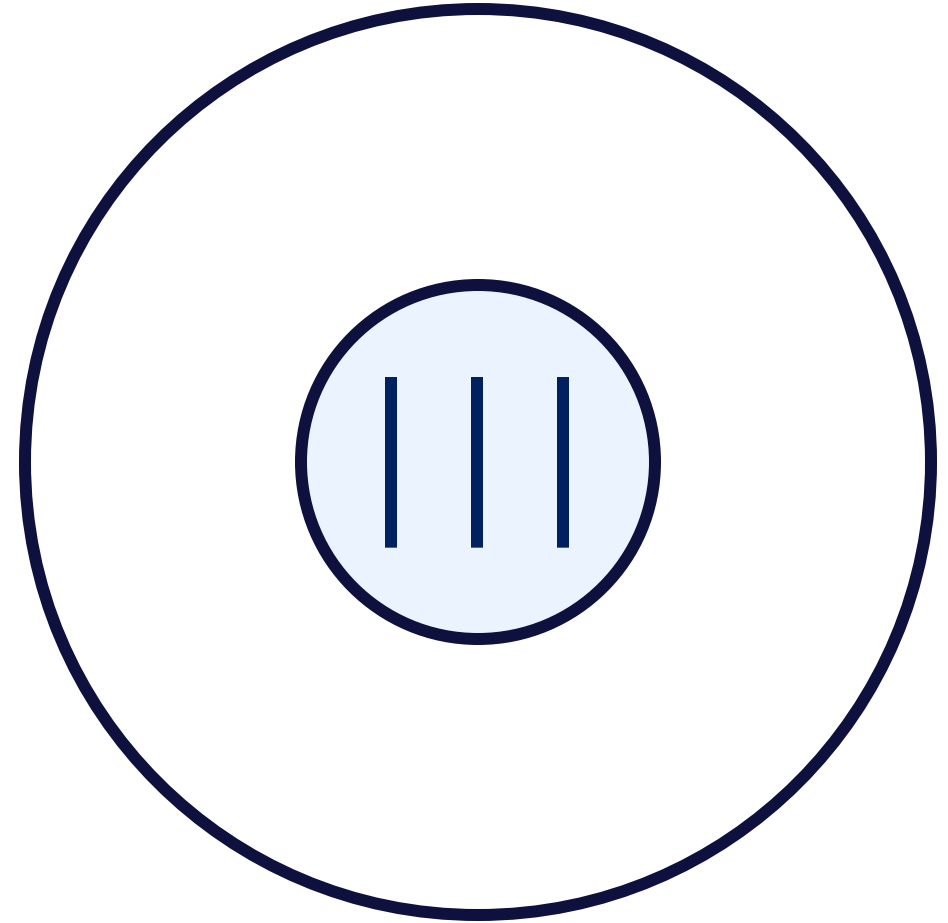


Classification of Microorganisms

Eu **karyotic**

↓ ↓

True **Nucleus**



Classification of Microorganisms

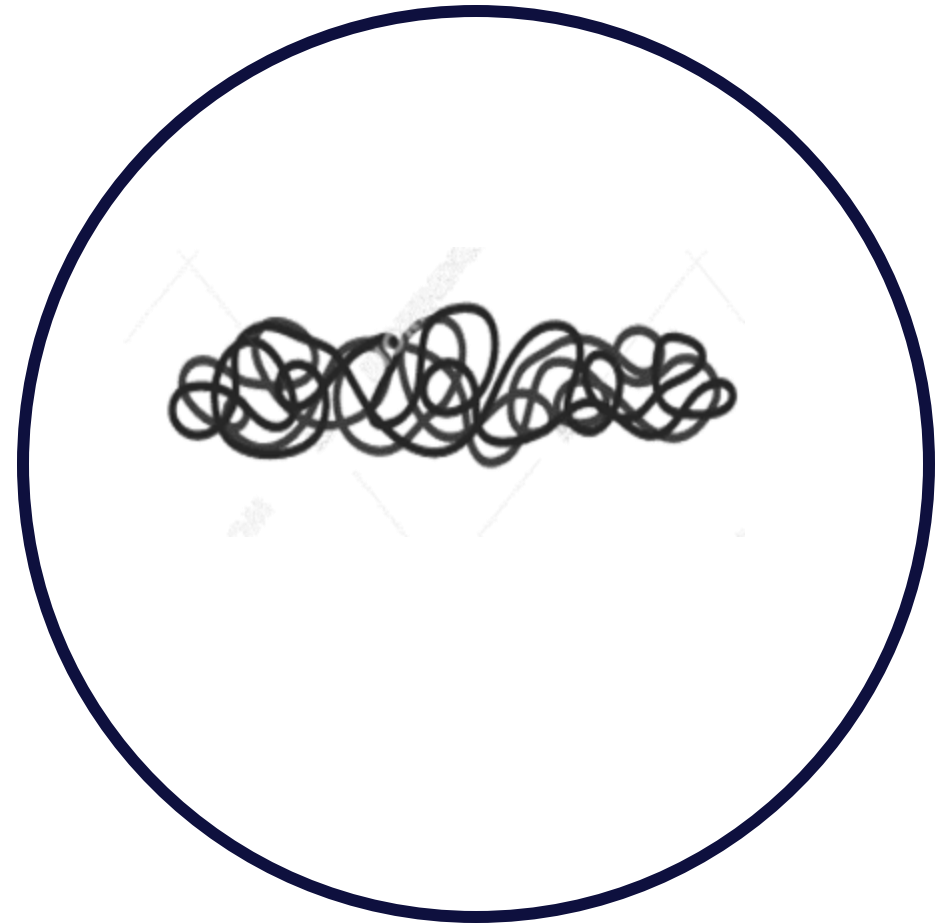
This genatic material (a single chromosome) is suspended in the cytoplasm and is not surrounded by a nuclear membrane ; that's why we consider it a nucleoid

Prokaryotic

↓
Primitive

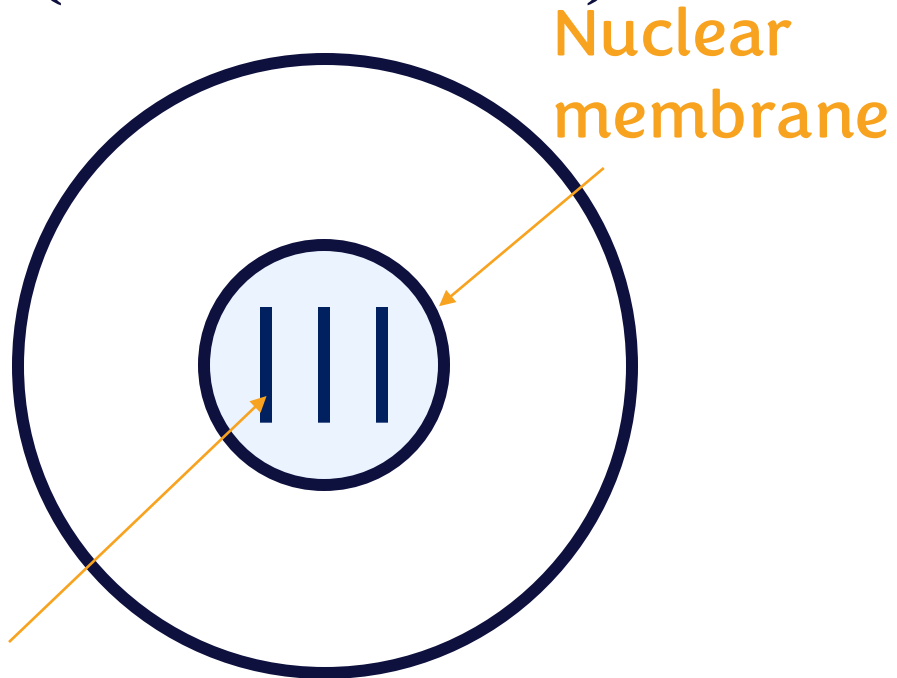
↓
Nucleus

**Single chromosome Suspended
(Nucleoid)**



A) Eukaryotic

(True nucleus)

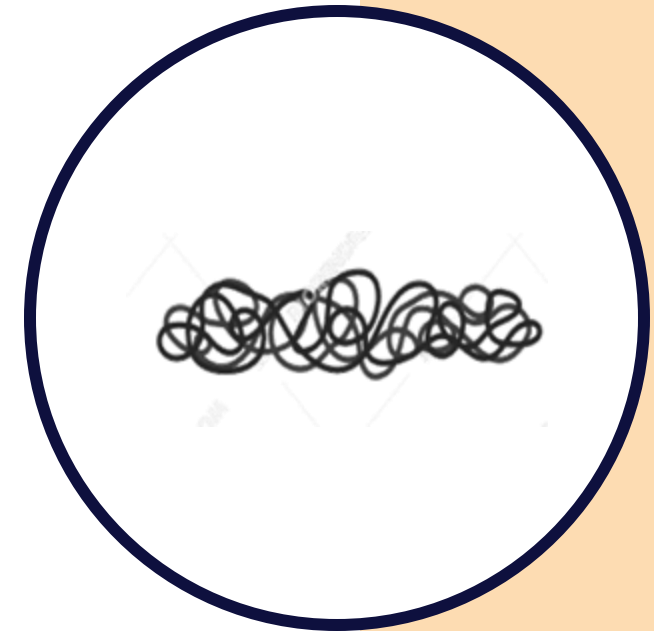


Chromosomes

**membrane-bound
organelles present**

B) Prokaryotic

(Not True nucleus)



**Membrane bound
organelles Absent**

A) Eukaryotic

Contain : Ribosomes, Mitochondria, Golgi apparatus, Endoplasmic reticulum



Fungi →

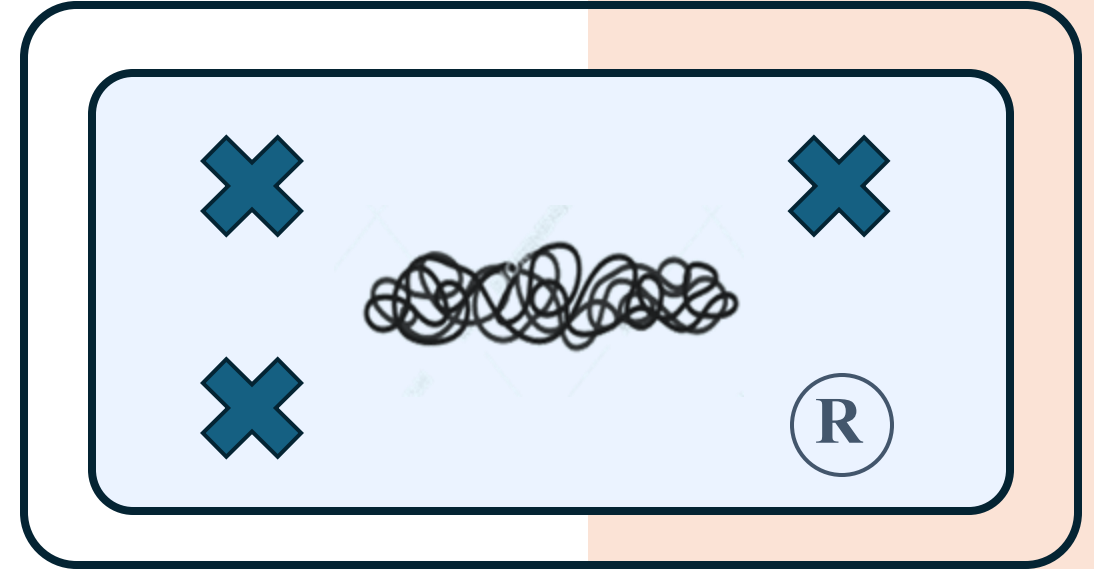
The Only one
that has cell
wall, made from
chitin.

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

Chromosome Number	One (circular)	Multiple (linear)
Ribosome	Small subunit Large subunit This type of ribosome does not undergo subunits assembly 70S (30S-50S)	80S (40S -60S)
Cell wall	In all bacteria Present EXCEPT <u>Mycoplasma</u>	Absent In a Exc Fungi (Chitin)
Cell membrane	No sterols EXCEPT in	Has sterols

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	Eukaryot
9) Division	Binary fission	Mitosis

Characteristic	Prokaryotic	Eukaryotic
9) Division	Binary fission	Mitosis

انشطار ثنائي

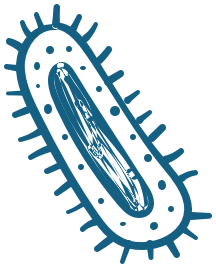


Viruses

Acellular

(Infectious agent)

One of the smallest infectious agent



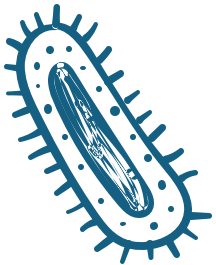


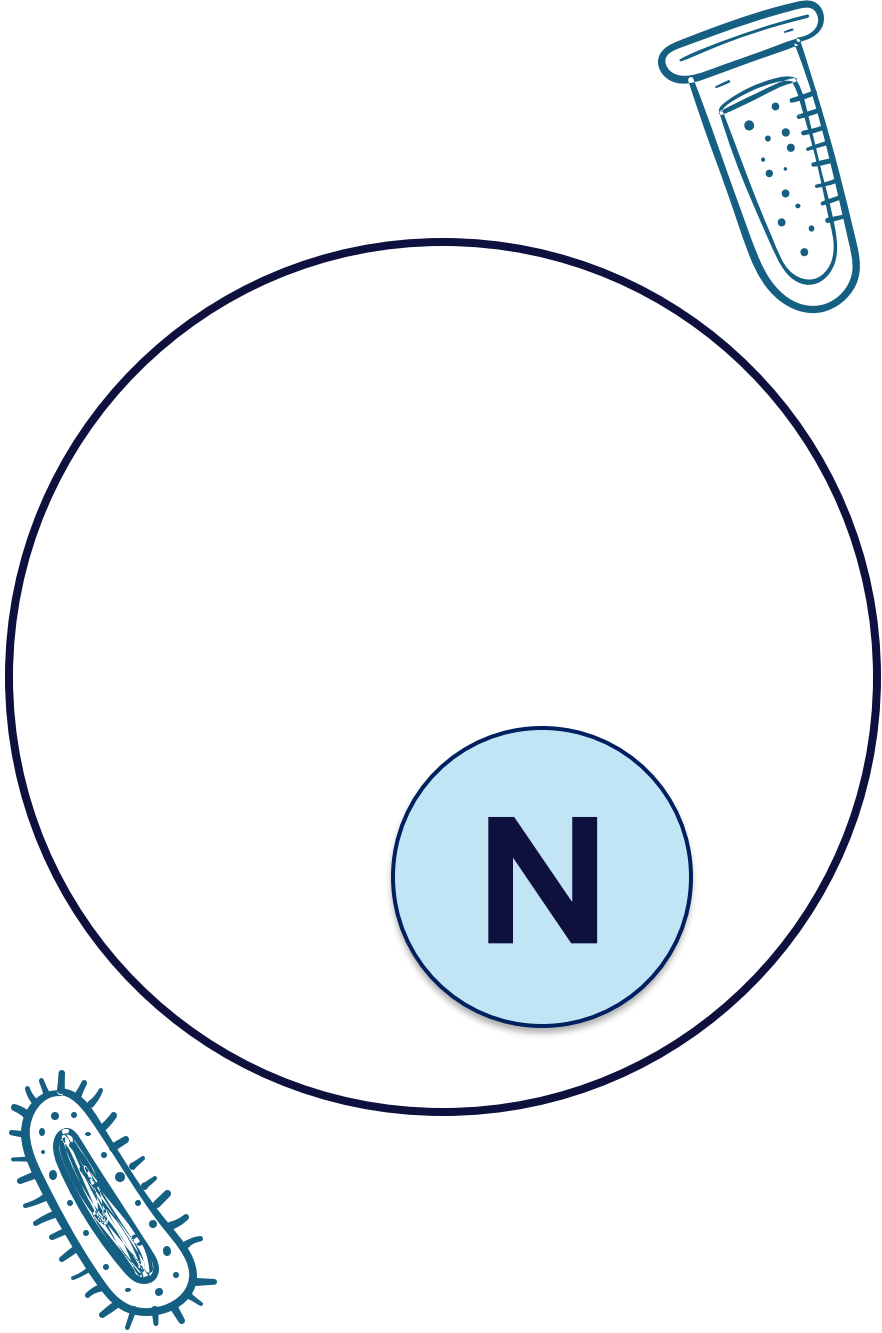
Viruses



No cell structure

Not a cell because don't have any organelles,
It has only one genetic material DNA or RNA and
few enzymes .





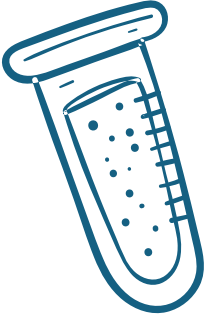
The diagram illustrates a host cell as a large circle with a smaller blue circle labeled 'N' (nucleus) in the center. A test tube containing small dots (representing viruses) is positioned at the top right. A single virus particle, depicted as an oval with a tail and spikes, is located at the bottom left.

Viruses

Obligate Intracellular

Directed host cell for replication

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



Viroids

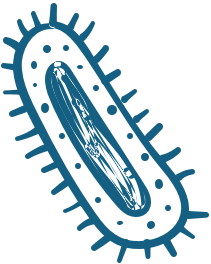
Single stranded RNA

ssRNA, circular Without protein coat

Infect Plants!!

can't infect human ,
because we have a
nucleus that break it.

Smaller than virus



Prion

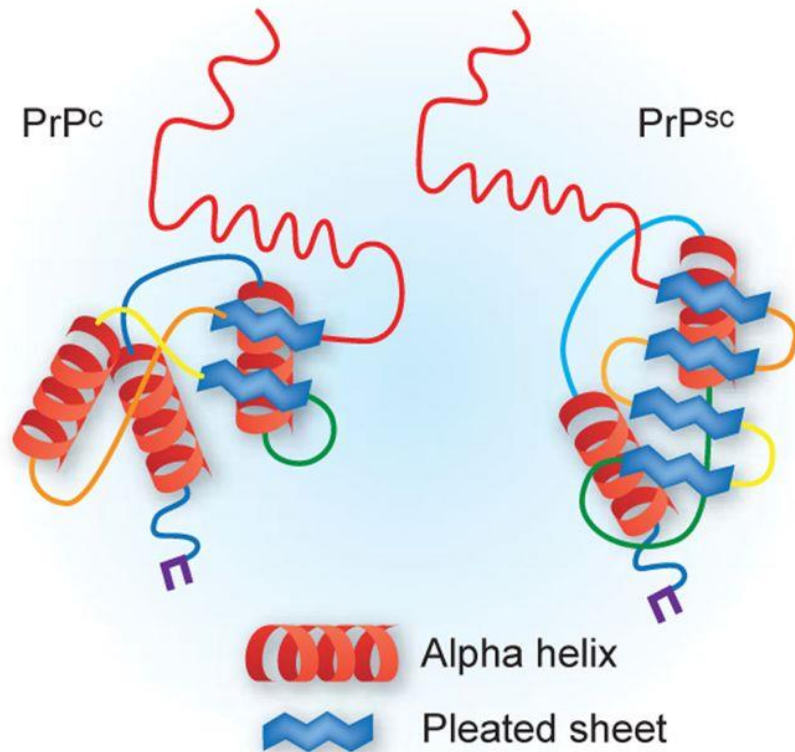
Protein without nucleic acid
(Infectious)



Prion

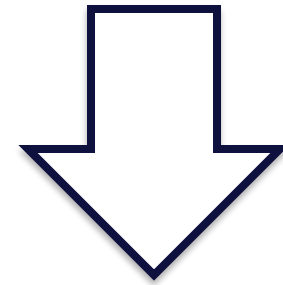
Misfolded protein

by convert protein from Alpha helix to pleated sheet .



Prion

Aggregation of Prion in CNS



Spongiform in the brain

Creutzfeldt-Jakob disease (CJD)

seen in humans





Prion

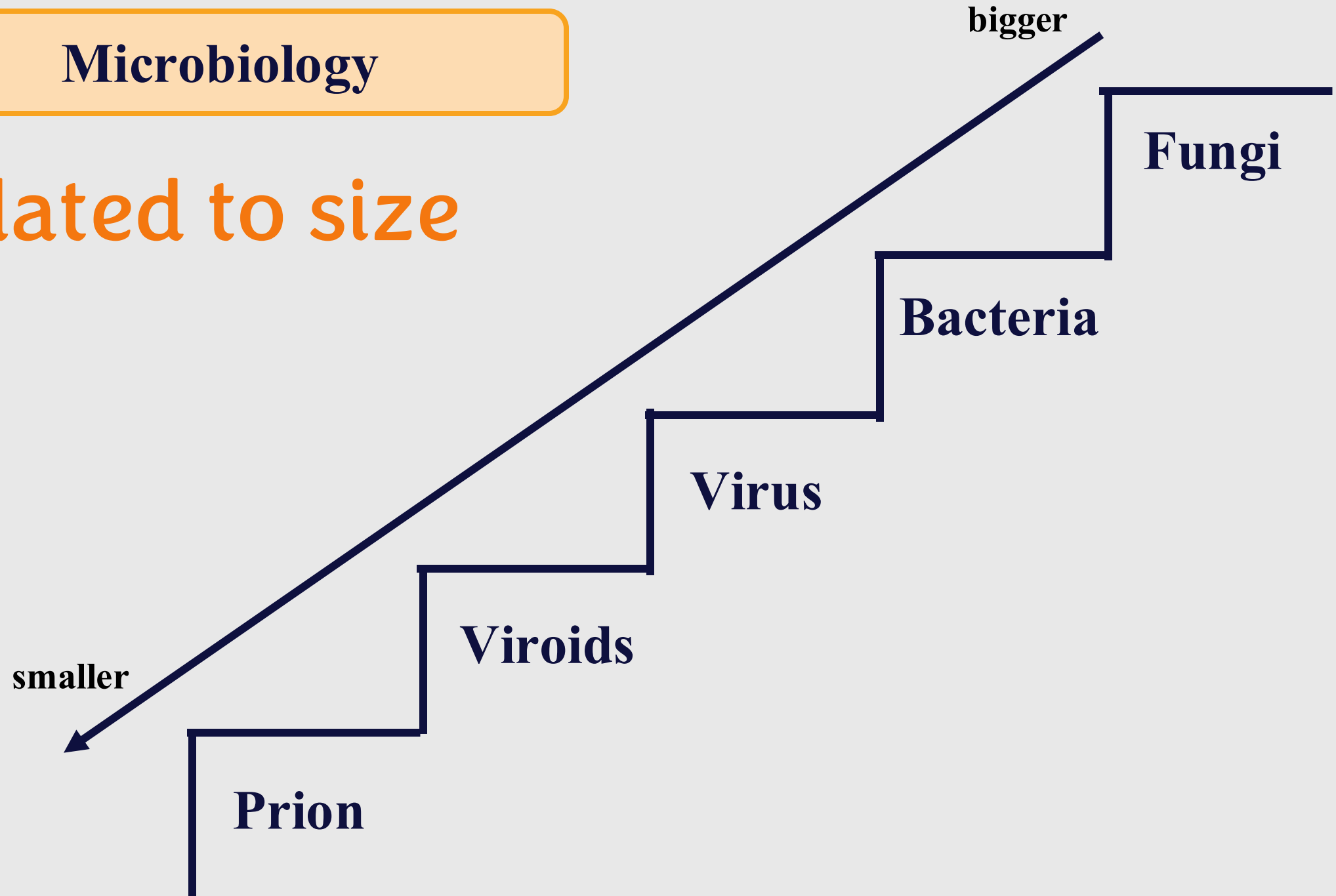
Prion infect the brain of cow
make a disease called:

Mad cow disease

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

Microbiology

Related to size



Microbiology



Immunology

Fungi

Bacteria

Virus

Parasites

Microbiology study several microorganisms which it is A foreign things can insert to our body make an immune response to defends against these microbes by a science called immunology.



Additional Resources:

رسالة من الفريق العلمي:



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



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			