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

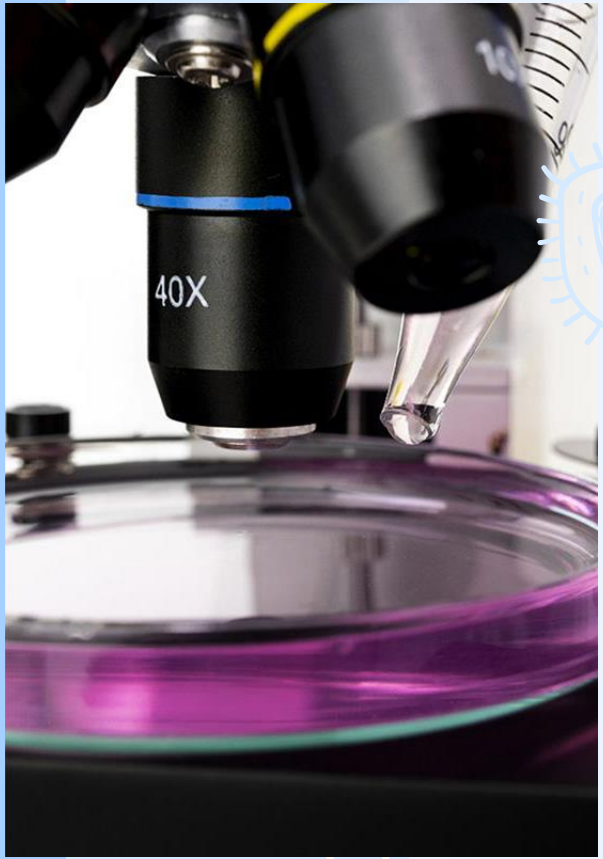
Micro bio logy

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.

- **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.

Portal of entry

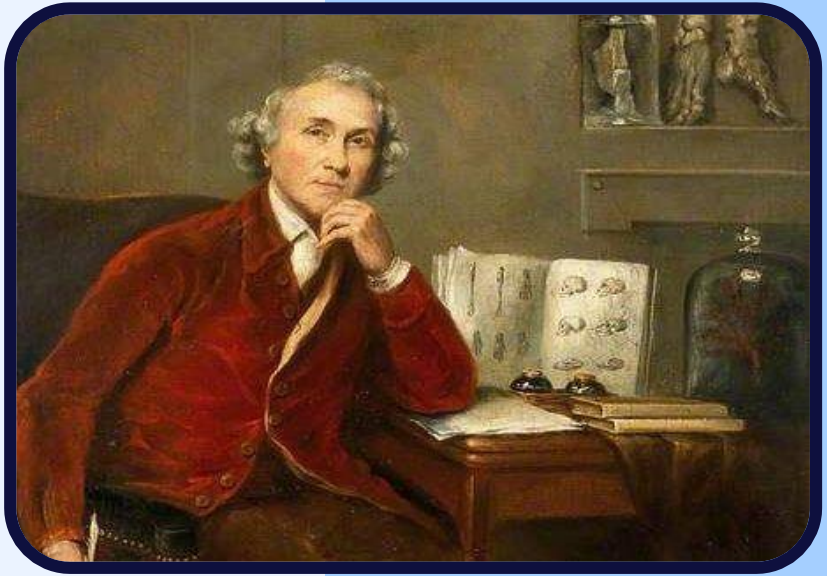
Microorganisms that cause disease are said to be pathogenic.

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

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

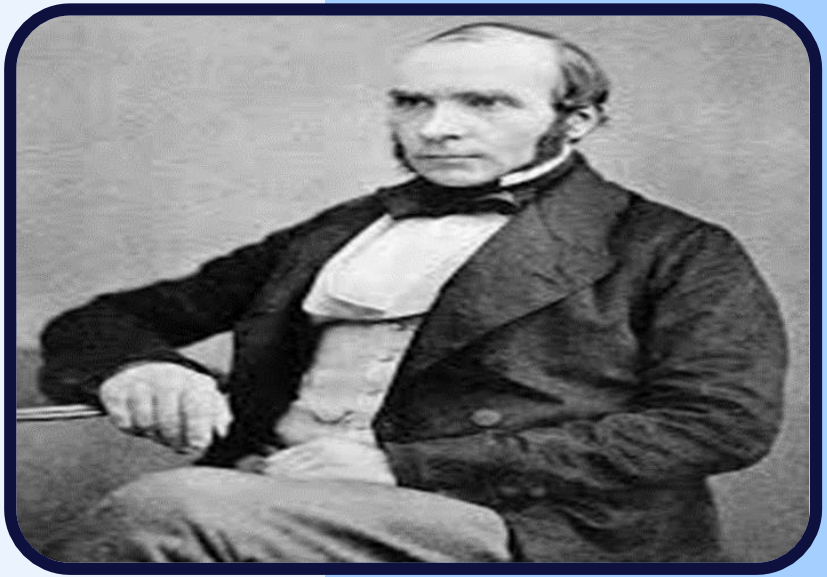
Antony van Leeuwenhoek 17th c: (father of microbiology), Dutch microscopist who was the first to observe live microorganisms in water mud and saliva.

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



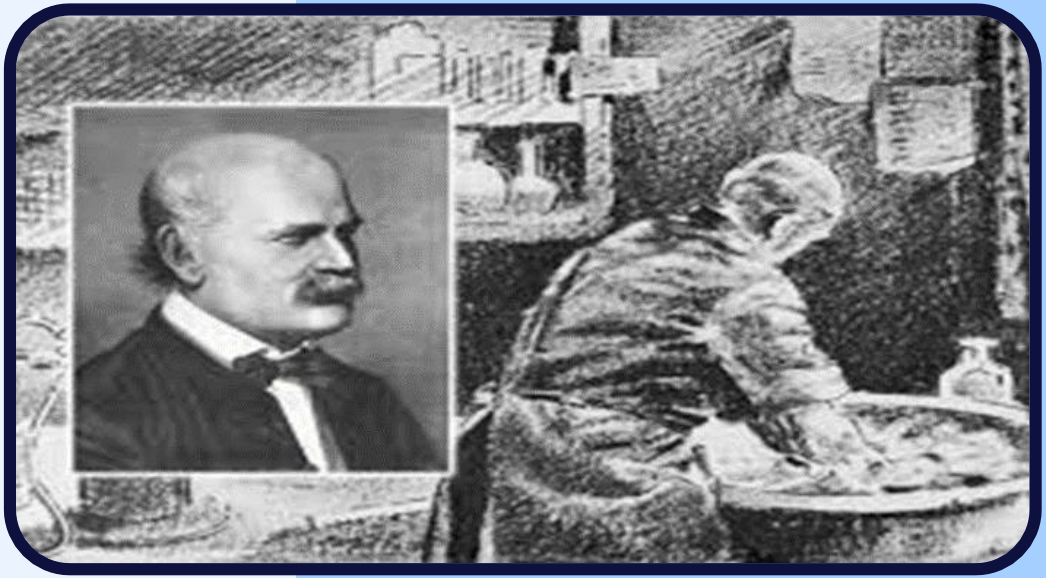
Edward Jenner 18th-19th c: An English physician and scientist who pioneered the concept of vaccines including creating the smallpox vaccine, the world's first vaccine.

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.



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

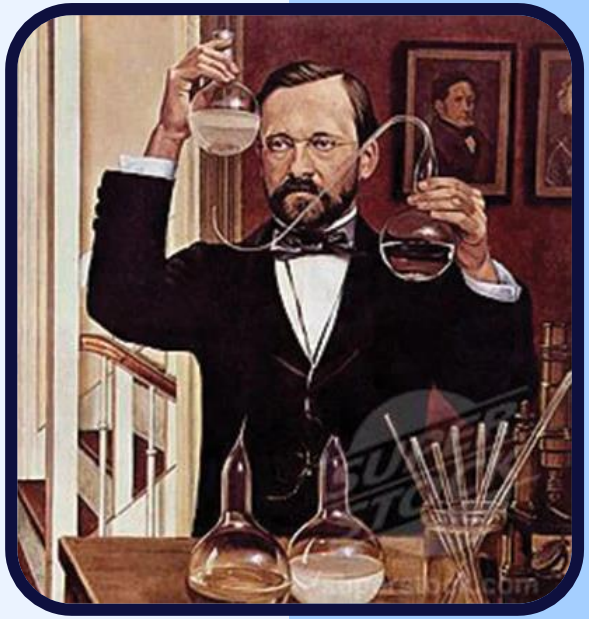


Louis Pasteur 19th c: French biologist, microbiologist , and chemist.

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***.**

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.

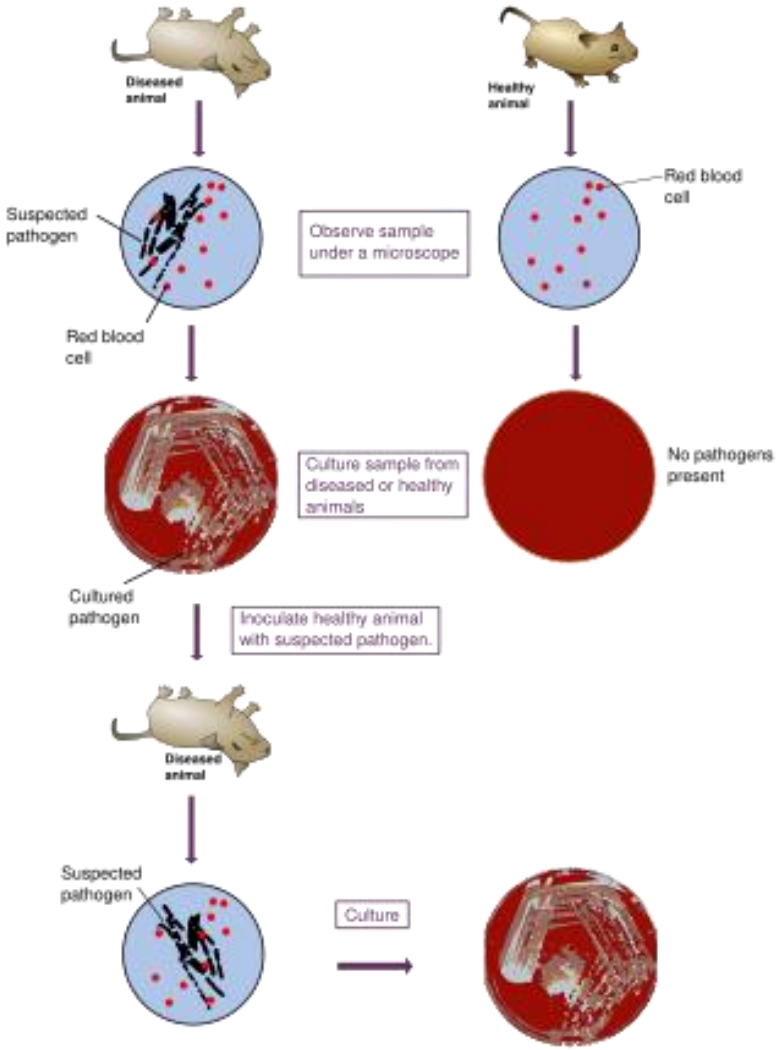
Koch's Postulates:

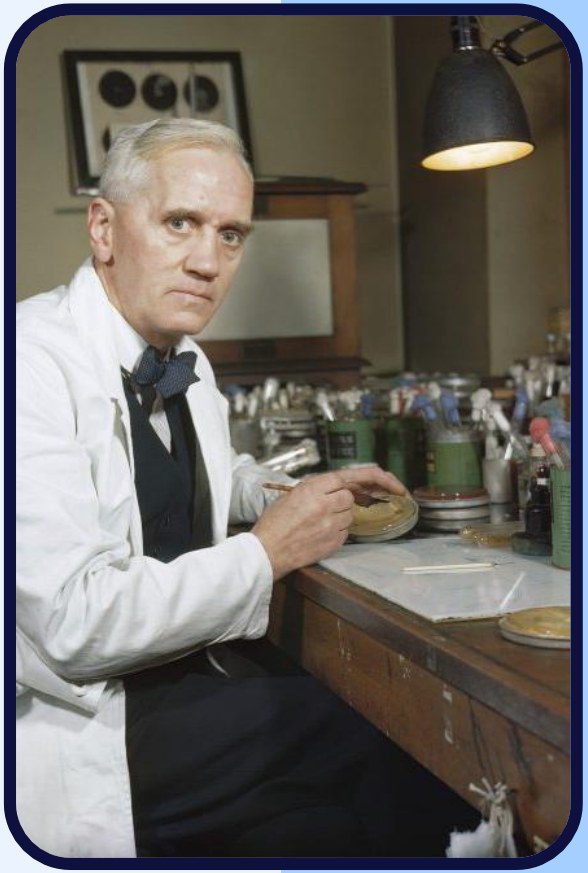
① The microorganism must be found in abundance in all organisms suffering from the disease, but should not be found in healthy organisms.

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

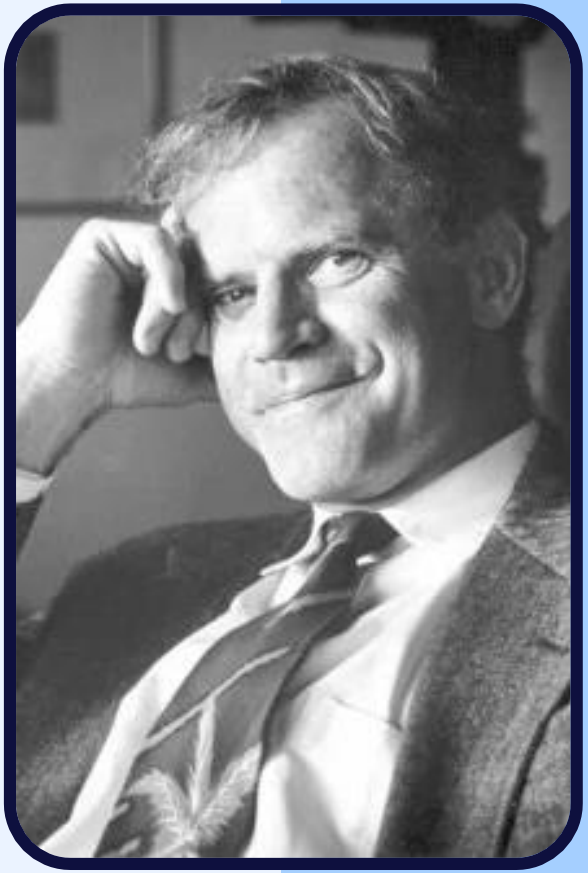
③ The cultured microorganism should cause disease when introduced into a healthy organism.

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

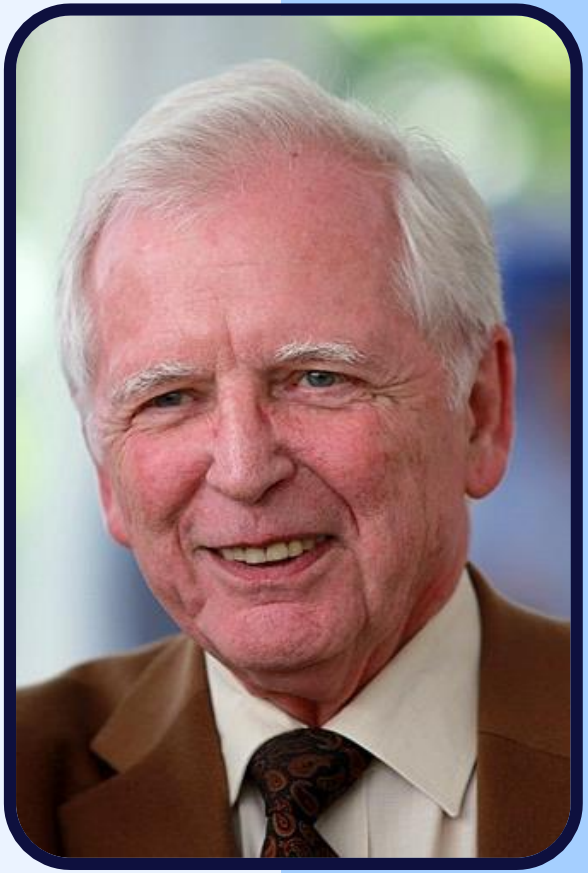




Alexander Fleming – 1928 – A Scottish physician and microbiologist, his best known discovery the world's first broadly effective antibiotic (Penicillin G) from the mould *Penicillium rubens* in 1928.



Kary Mullis 1986: An American biochemist , invent Polymerase Chin 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.

** 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.

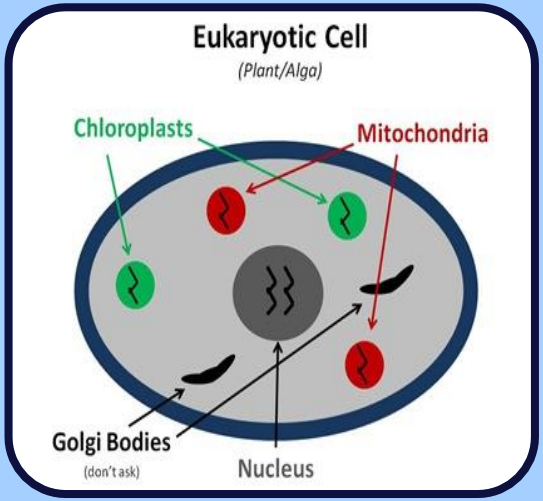
4- Parasites: these can be of two classes:

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.

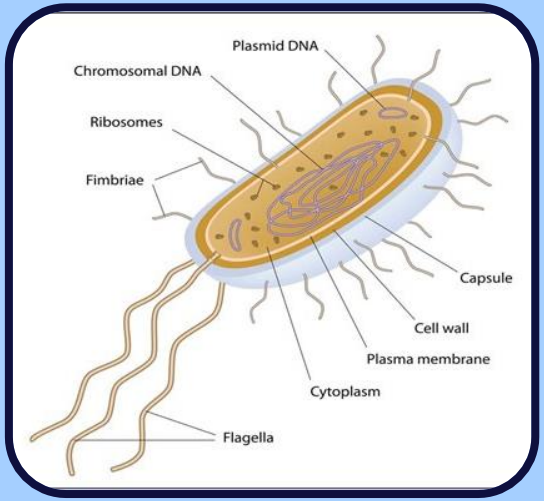
b- Helminthes, these are multicellular and can reach several meters in lengths.

Classification of Microorganisms

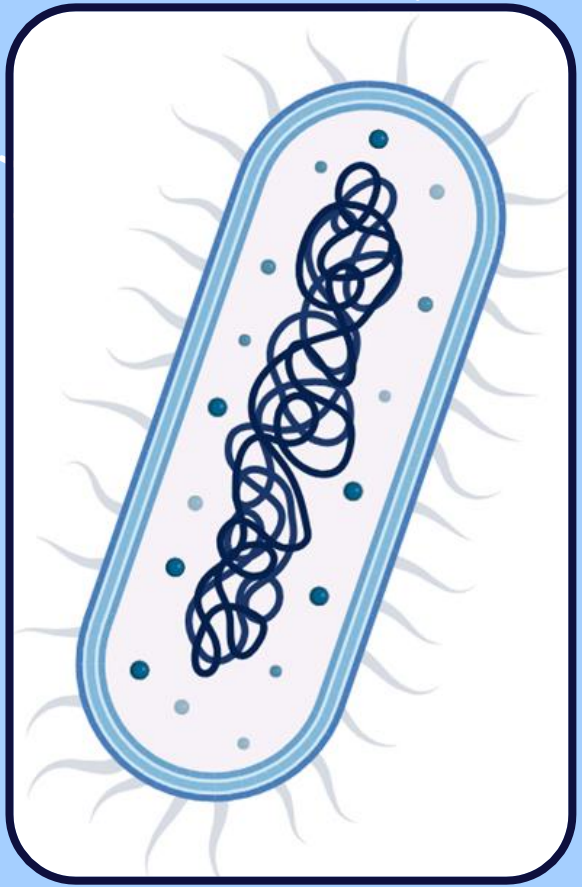
A) Eukaryotic



B) Prokaryotic



C) Viruses



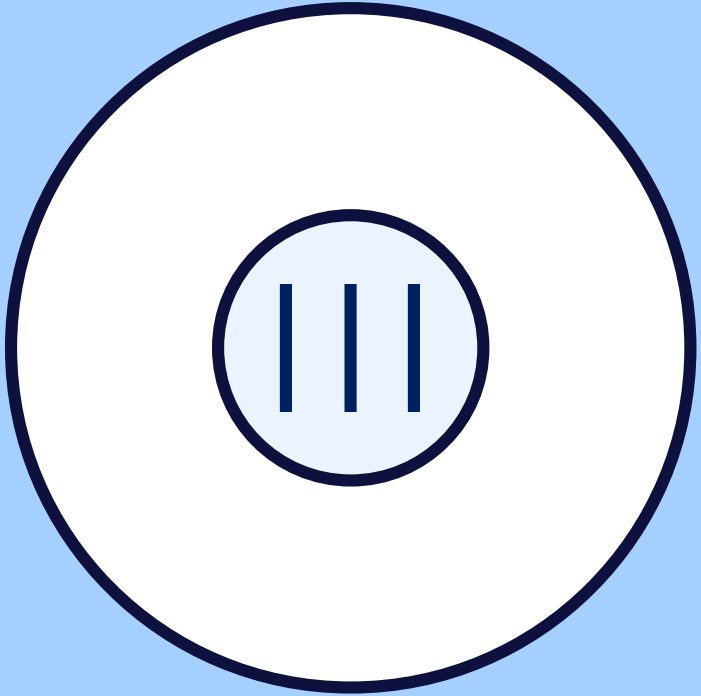
Uni cellular

One Cell

Classification of Microorganisms

Eu karyotic

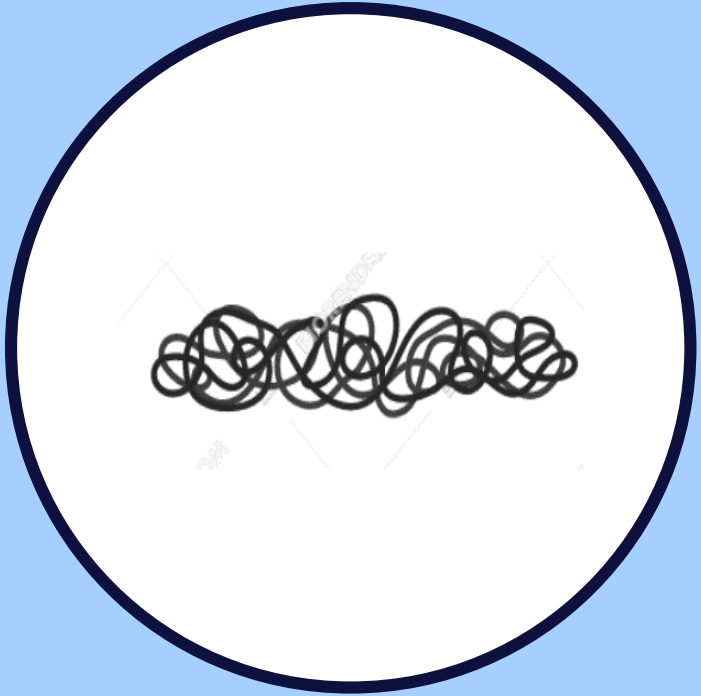
True **Nucleus**



Classification of Microorganisms

Pro karyotic

Primitive Nucleus



Single chromosome Suspended

(Nucleoid)

A) Eukaryotic

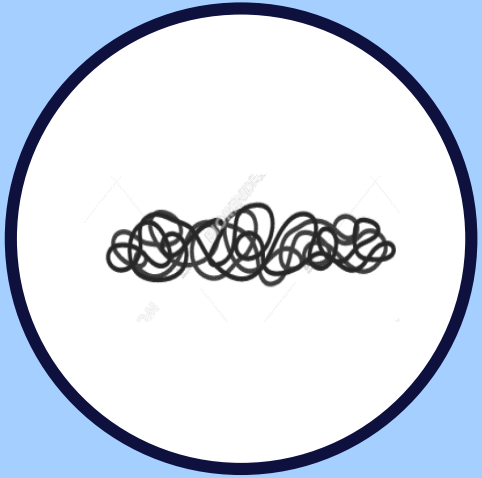
(True nucleus)

membrane-bound

organelles present

B) Prokaryotic

(Not True nucleus)



Membrane bound

organelles Absent

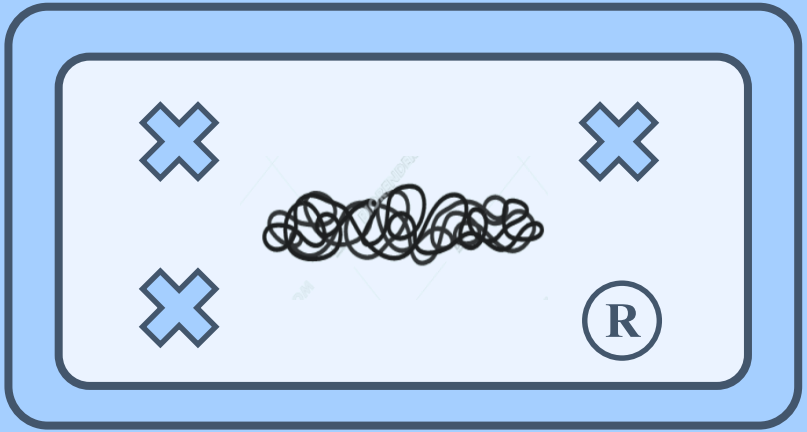
A) Eukaryotic

Fungi

Protozoa

Algae

B) Prokaryotic



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

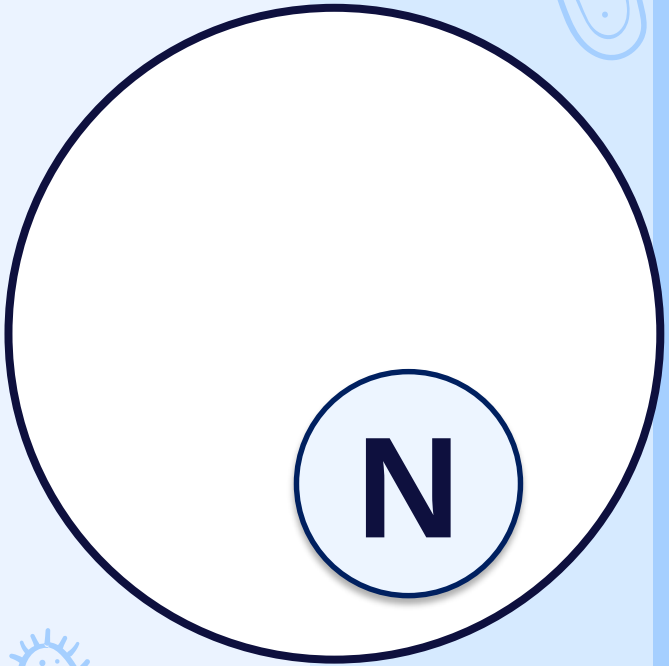
(Infectious agent)

One of the smallest infectious agent

Viruses

No cell structure

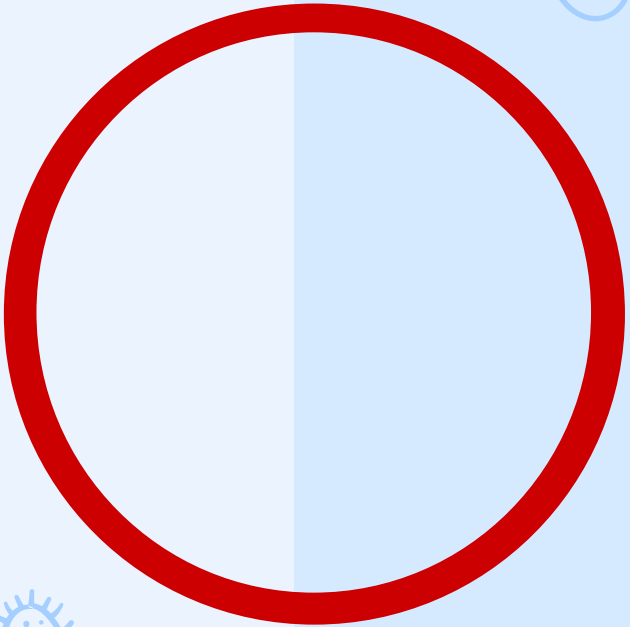
Viruses



Obligate Intracellular

Directed host cell for replication

Viroids



ssRNA, circular Without protein coat

Infect Plants!!

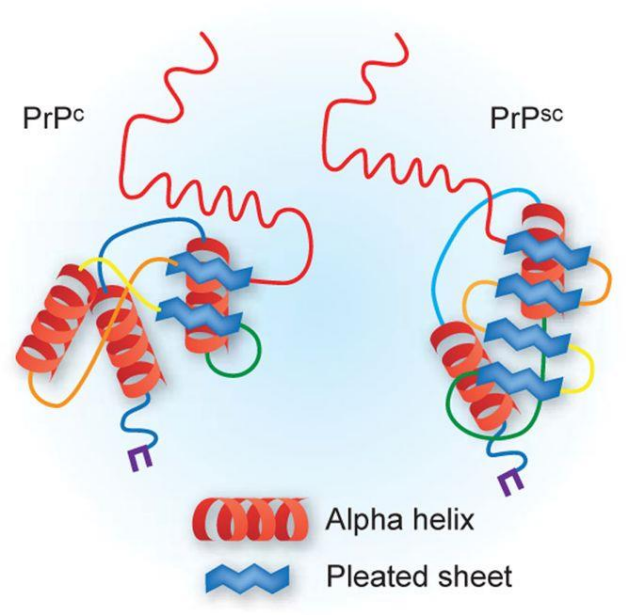
Smaller than virus

Prion

Protein without nucleic acid

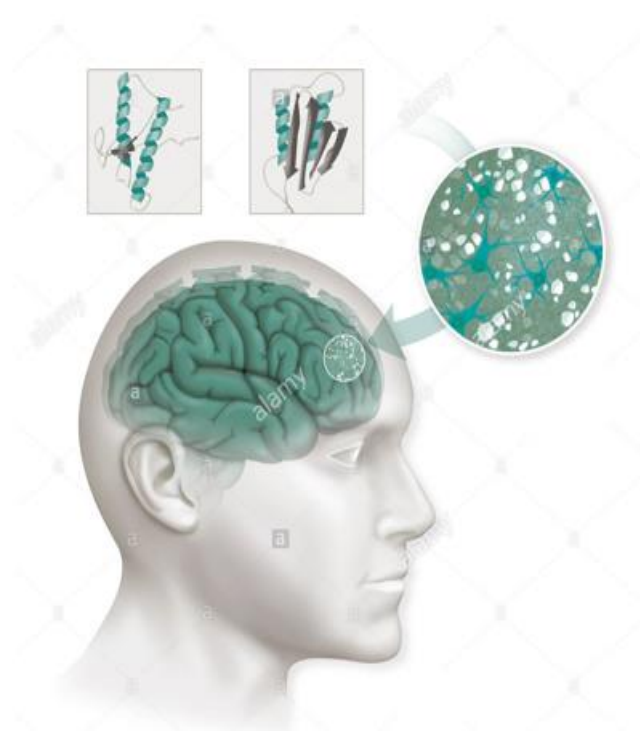
(Infectious)

Prion



Misfolded protein

Prion



Aggregation of

Prion in CNS

Spongiform in the brain

Creutzfeldt-Jakob disease (CJD)

seen in humans

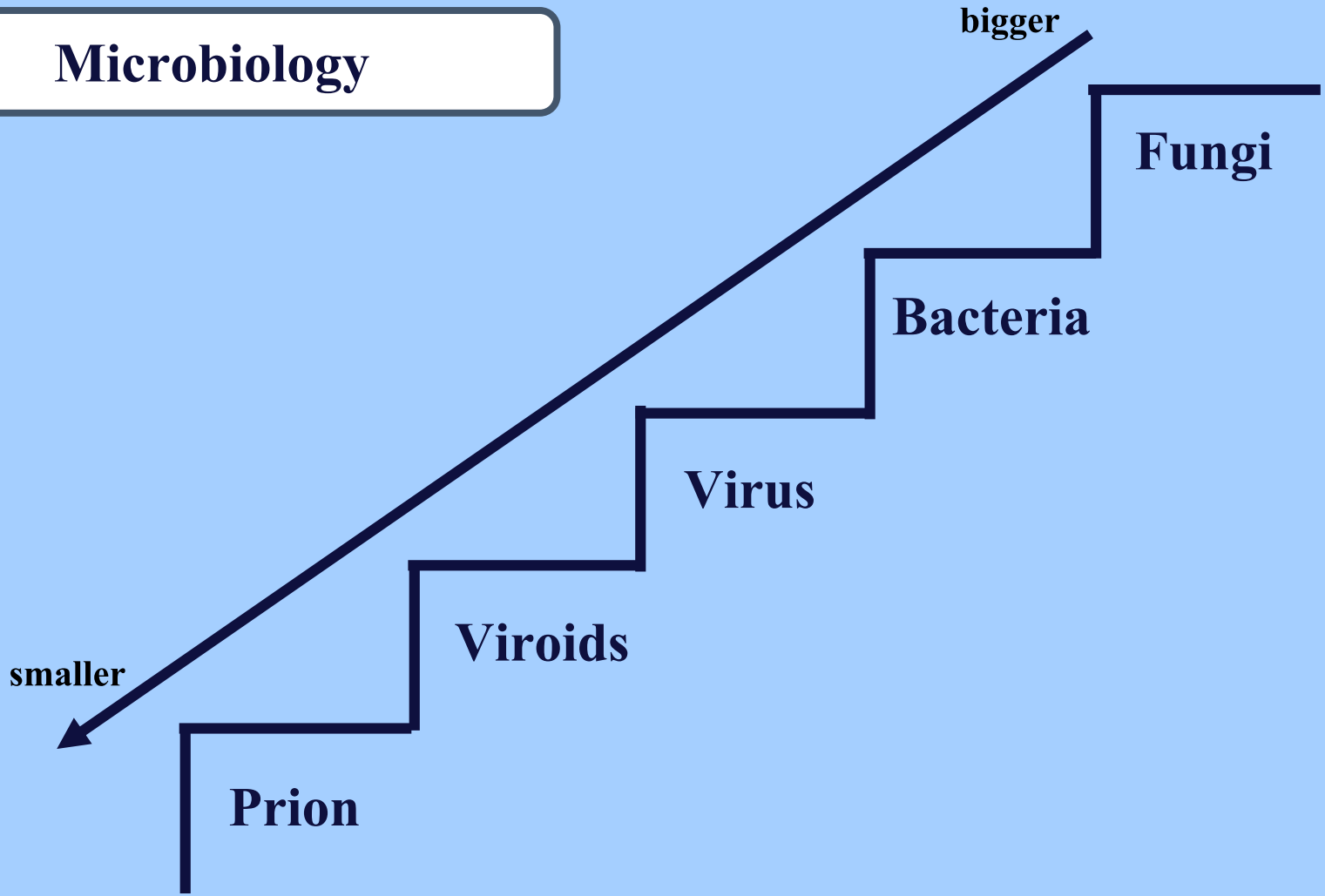
Prion

Mad cow disease

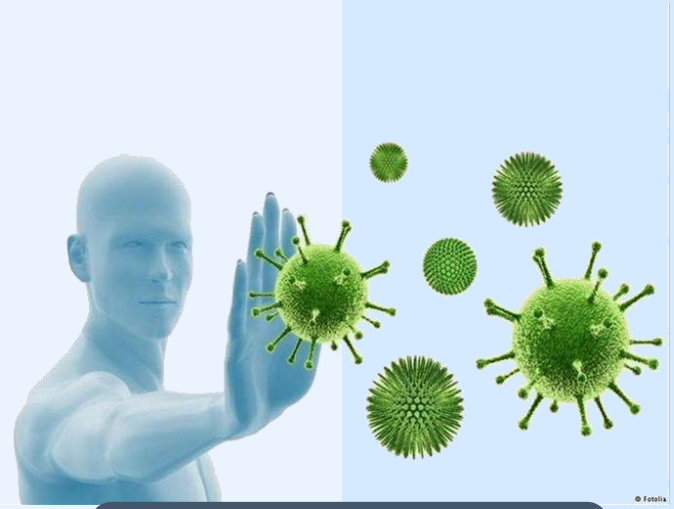
Bovine spongiform encephalopathy

(BSE or mad cow disease) seen in cattle,

Microbiology



Microbiology



Immunology

Fungi

Bacteria

Virus

Parasites