SREE NARAYANA
NURSING COLLEGE

Ms.Ribka priyaranjani M.Sc(N).,
Assistant Professor Department of
Mental health Nursing
Sree Narayana Nursing College

UNIT-I
INTRODUCTION
TO
MICROBIOLOGY

Introduction

- Microbiology is the study of organisms or agents too small to be seen with naked eyes.

- Microorganisms are present everywhere, as their presence can be marked in geothermal vents in the ocean depths to the person’s skin.

- They are also present in soil, air and water.

- Microorganisms are involved in production of 50% of Carbon and 90% of Nitrogen.

- They are involved in different processes like biodegradation, process of photosynthesis, process of digestion and in production of vitamins B and 12.

- Society gets benefit from microorganisms by their use in bread, cheese, beer, vaccines and antibiotics production.

So we can say that…….

"Modern Biotechnology rests upon a microbiological foundation"

IMPORTANCE & RELEVANCE TO NURSING

- **Microbiology is a subject which deals with microbes and their related concepts**
- **Nurses are involved in controlling infection in hospital, so nurses must know about microbiology.**
- **To know about harmful and harmless microorganisms to human being.**

- **Nurses apply the microbiology knowledge in health care for drug production, diagnosis and sterilization methods and cleanliness.**
- **Nurses use hot water or anti-septic as a measure to sterilize the surgical knives, needles, scissors and other metals instruments**
- **Microbiology also gives knowledge to nurses on how to handle a patient and his samples infected with communicable diseases. to free from microbes.**

- **It also helps detect diseases like Tuberculosis by simple skin test namely the Mantoux test.**
- **Also diagnostic tests like Elisa, electrophoreis and radioimmuno assay also use principles of microbiology for identification of disease.**

What is Microbiology?

Microbes, or microorganisms are minute living things that are usually unable to be viewed with the naked eye.

What are some examples of microbes?

Bacteria, fungi, protozoa, algae, viruses are examples!

Some are pathogenic

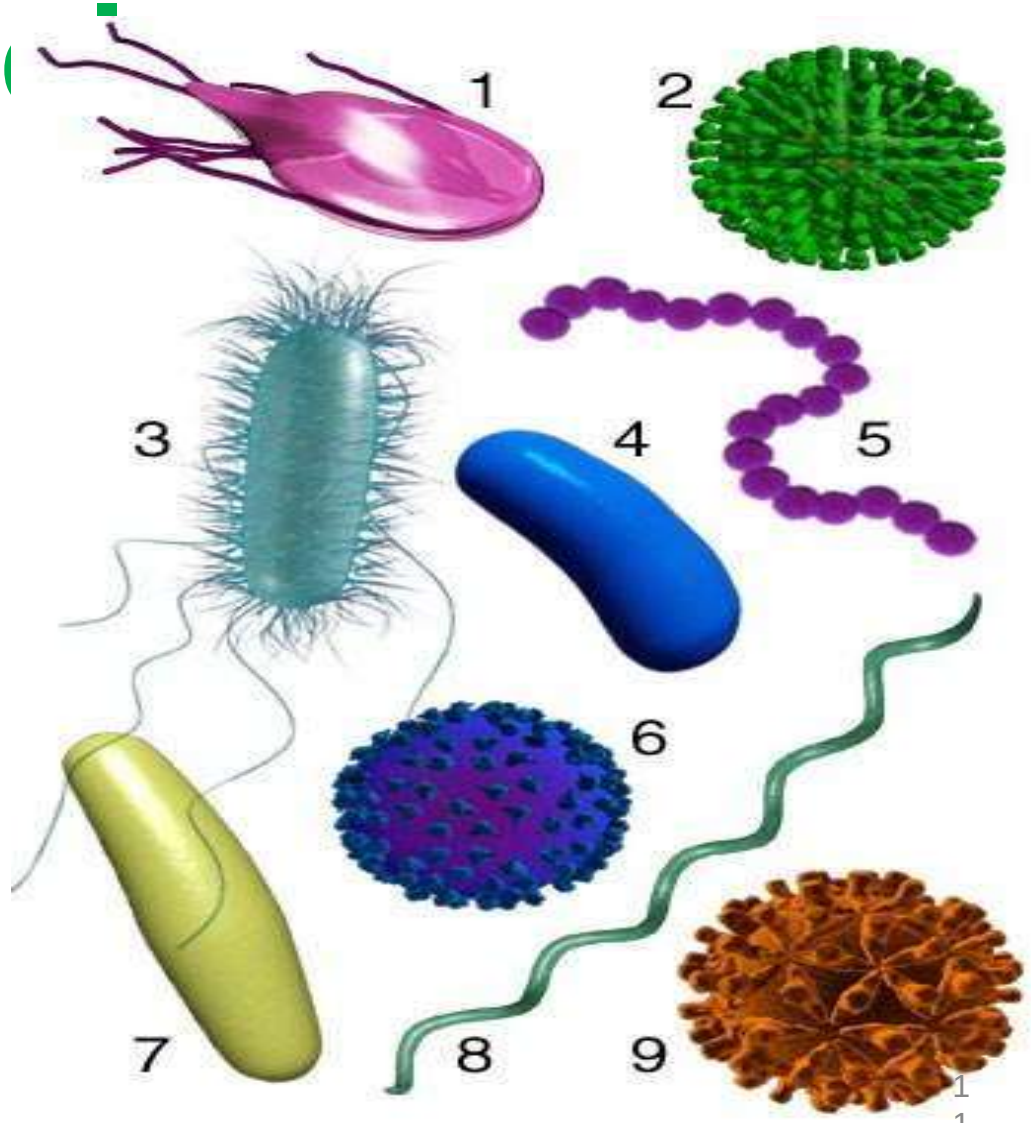
Many are beneficial

Defining Microbiology

Microbiology defined as the study of organisms too small to be seen with the naked eye. These organisms include viruses, bacteria, algae, fungi, and protozoa. Microbiologists are concerned with characteristics and functions such as ecology, taxonomy, genetics, physiology, and

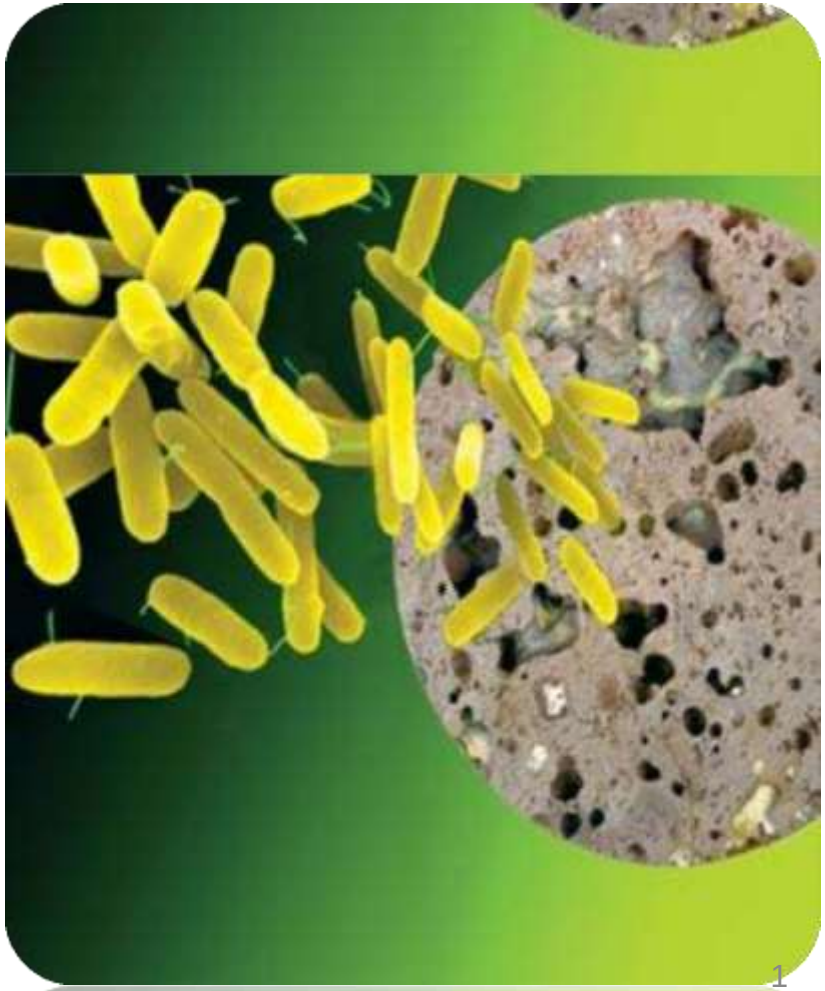
What is Microbi

- Study of different Microorganisms
- Can be
  - Bacteria
  - Viruses
  - Parasites
  - Fungus



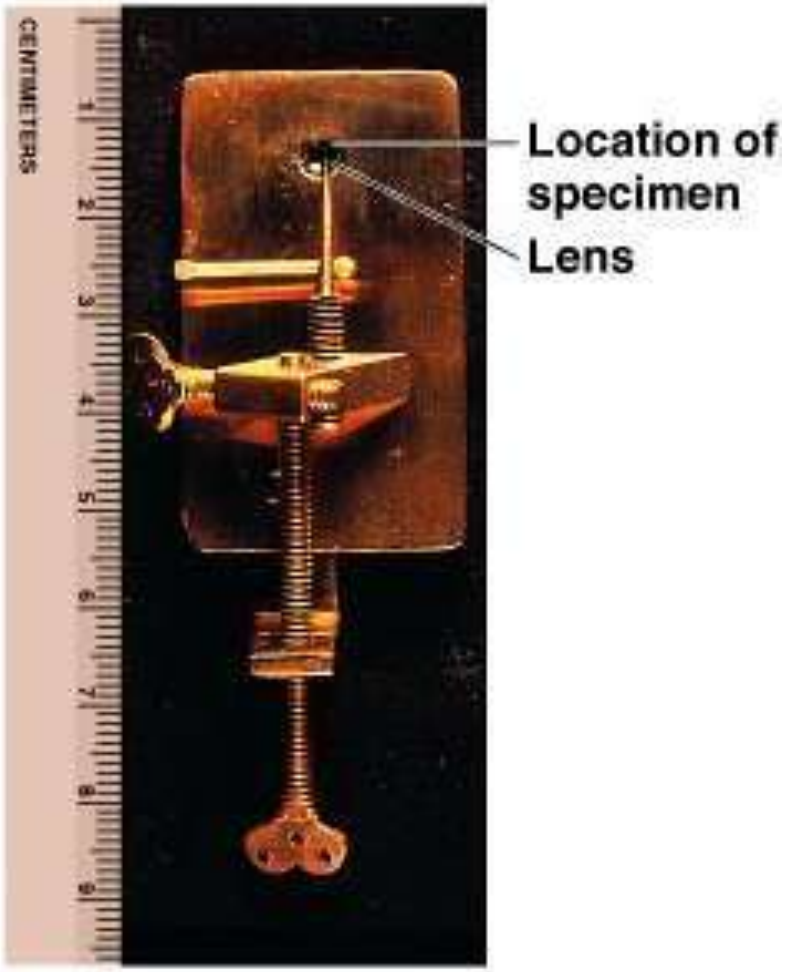
What are Microorganisms

- Microbes are products of evolution, Consequence of Natural selection operating upon vast array of genetically diverse organisms



History of Microbiology

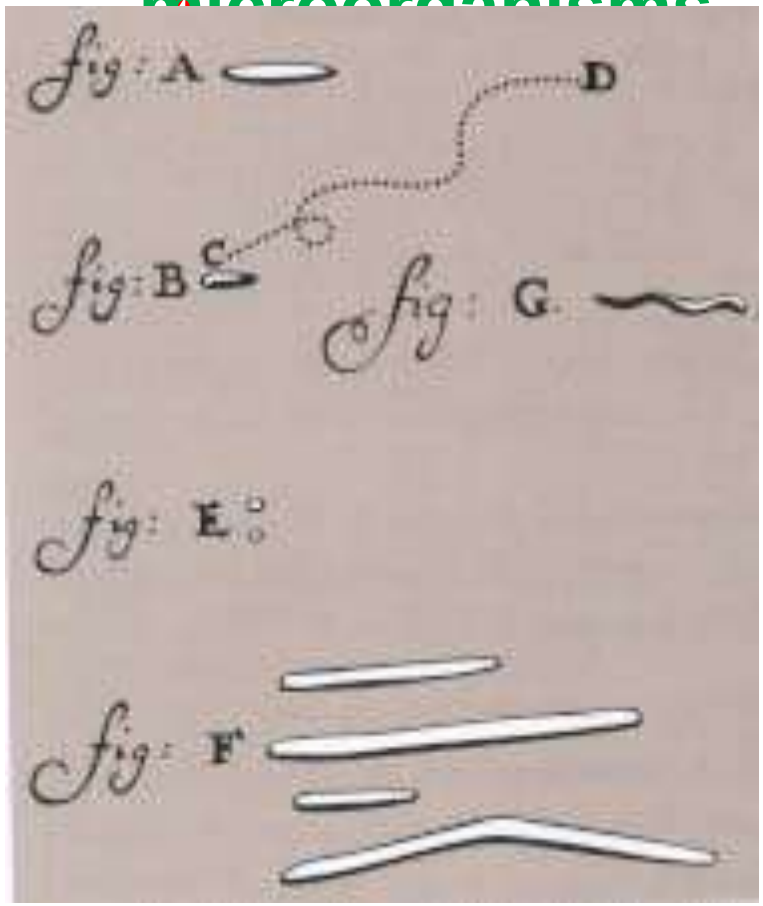
1673-1723, Antoni van Leeuwenhoek (Dutch) described live microorganisms that he observed in teeth scrapings, rain water, and peppercorn infusions.



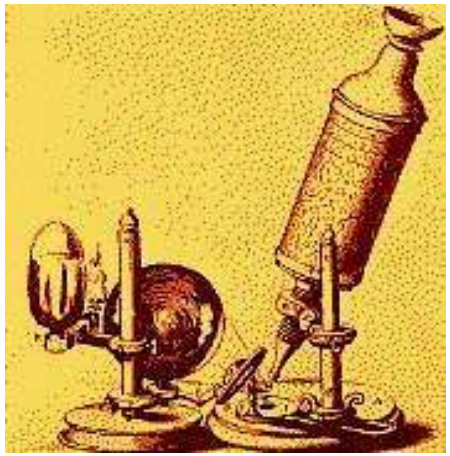
(b) Microscope replica

Anton van Leeuwenhoek

- 1st person to actually see living 167 microorganisms



"wee animalcules"



荷兰人吕文虎克
（Leeuwenhoek）1632-1723

History of Microbiology

The Germ Theory of Disease

1835: Agostino Bassi showed a silkworm disease was caused by a fungus.

1865: Pasteur believed that another silkworm disease was caused by a protozoan.

1840s: Ignaz Semmelweis advocated handwashing to prevent transmission of puerperal fever from one OB patient to another.

The Germ Theory of Disease

- **1860s: Joseph Lister used a chemical disinfectant to prevent surgical wound infections after looking at Pasteur's work showing microbes are in the air, can spoil food, and cause animal diseases.**

History of microbiology

- **Anton van Leeuwenhoek (1632–1723):** was the first microbiologist and the first person to observe bacteria using a single-lens microscope of his own design.

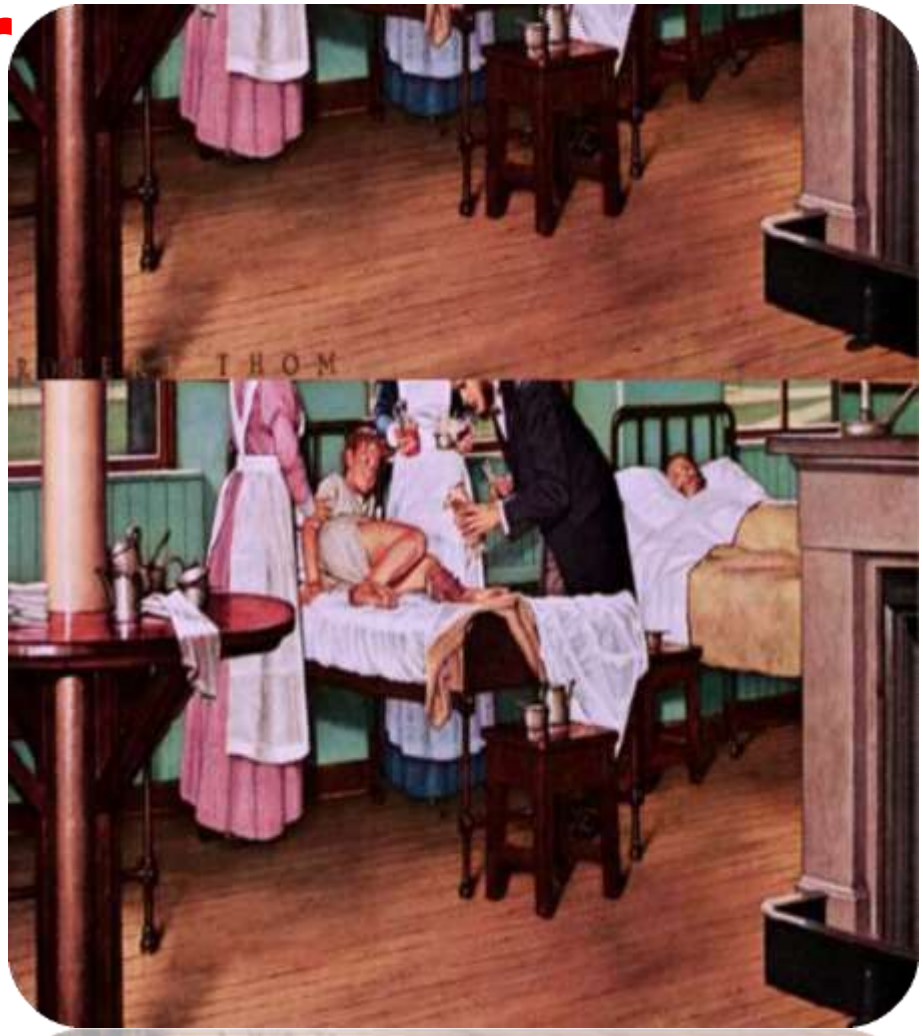
- **Louis Pasteur (1822–1895):** Pasteur developed a process (today known as pasteurization) to kill microbes. pasteurization is accomplished by heating liquids to 63 to 65 C for 30 minutes or to 73 to 75 C for 15 seconds.

- **Robert Koch (1843–1910):** was a pioneer in medical microbiology and worked in cholera, anthrax and tuberculosis. He was awarded a Nobel prize in 1905 (Koch's postulates) he set out criteria to test.

- **Alexander Fleming (1929):** Discovered penicillin.

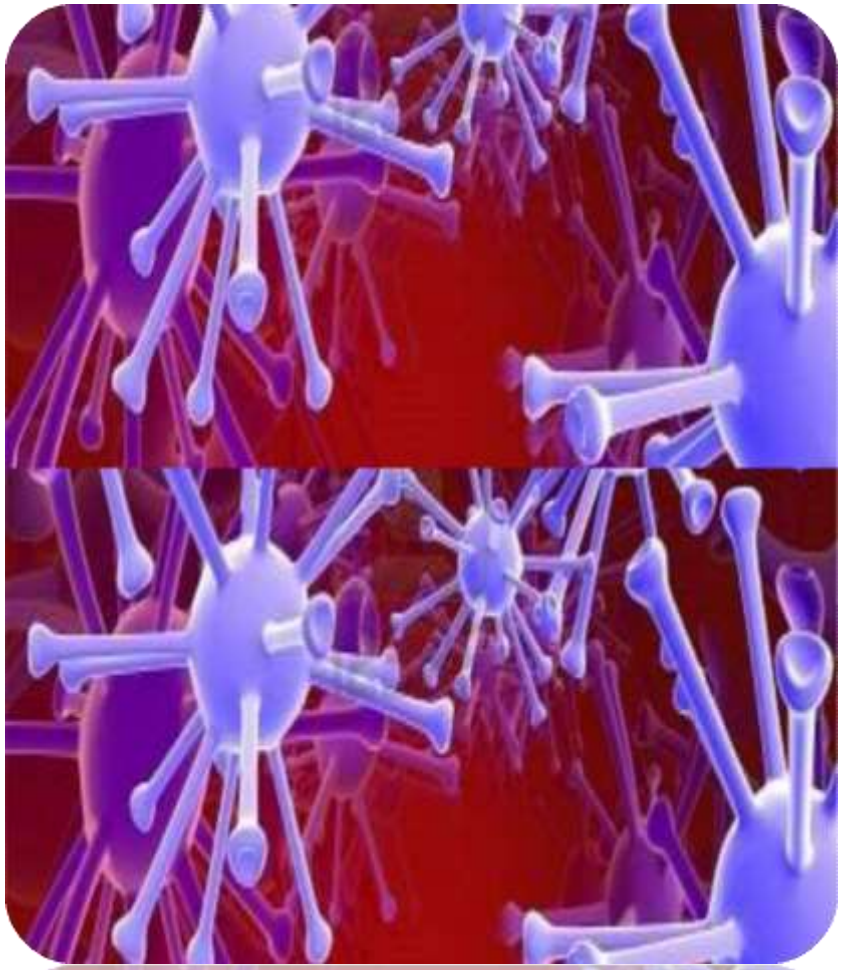
Joseph Lister

- **1860s: Joseph Lister used a chemical disinfectant to prevent surgical wound infections after looking at Pasteur's work showing microbes are in the air, can spoil food, and cause animal diseases.**



Microbes in Our Lives

- Microorganisms are organisms that are too small to be seen with the unaided eye.
- “Germ” refers to a rapidly growing cell.



OUR MICROBIAL PLANET

MICROBES—life forms too tiny to see—play a surprisingly large role in life on Earth. Microbes are everywhere, and they do a lot of good for human health and our planet. In fact, disease-causing microbes make up only a very tiny fraction of the millions of types of microbes. Microbes. . .

Think microbes are bad guys? Think again

Keep us healthy. Amazingly, only about 1 out of 10 cells in the human body is actually a human cell; most of the cells in our bodies are microbes! Some of the microbes living in our bodies actually help us fight disease-causing microbes by competing against them for space. This mutually beneficial relationship helps to protect us from getting diseases while giving the "good" microbes a place to live.

Make air breathable. Without microbes, we wouldn't have oxygen to breathe. This is because many microbes are photosynthetic—like plants, they harvest their energy from the sun, releasing oxygen into the air. Billions of years ago, photosynthetic microbes gradually added oxygen to Earth's atmosphere, making it possible for larger forms of life—including humans—to live.

Provide sources of new medicines. Hundreds of medicines available today were derived from chemicals first found in microbes. Microbes naturally produce an amazing variety of chemicals, which scientists can use to create new medicines.

Help us digest food. Many of the foods we eat would be indigestible without the 10-100 billion microbes living within our guts. Microbes also play a major role in creating many of the foods we love, such as cheese, yogurt and bread.

Keep our environment clean. Because of their special adaptations, some microbes can help clean up gasoline leaks, oil spills, sewage, nuclear waste, and many other types of pollution.

Support and protect crops. Microbes living in soil help protect plants from pests and diseases. They also are essential for converting nitrogen and other nutrients into forms that plants can use to grow.

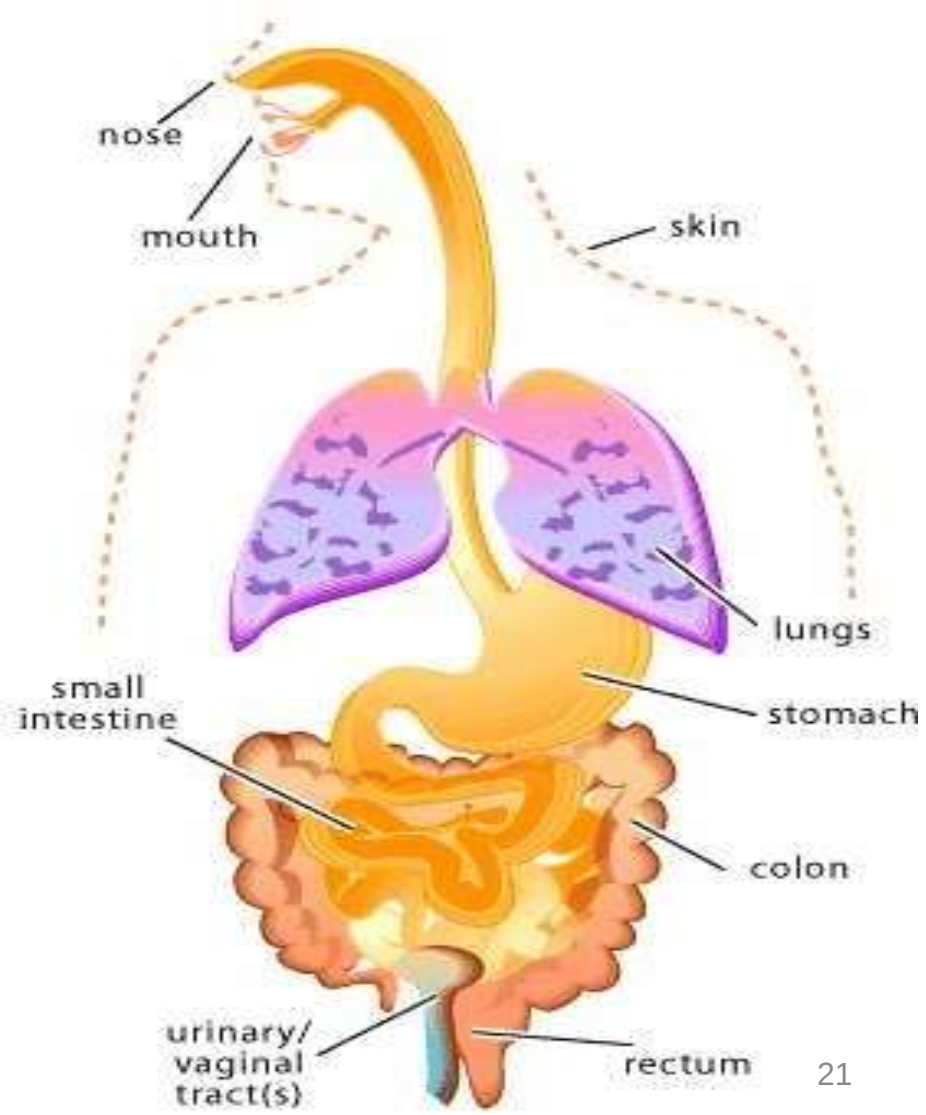
The science of metagenomics is shedding new light on the microbial world.

Scientists estimate that less than 1% of Earth's millions of microbial species can be grown in the laboratory. Using metagenomics, scientists can now study how whole communities of microbes function without having to grow each species separately—making more microbes accessible to science than ever before.

Living in a microbial world...

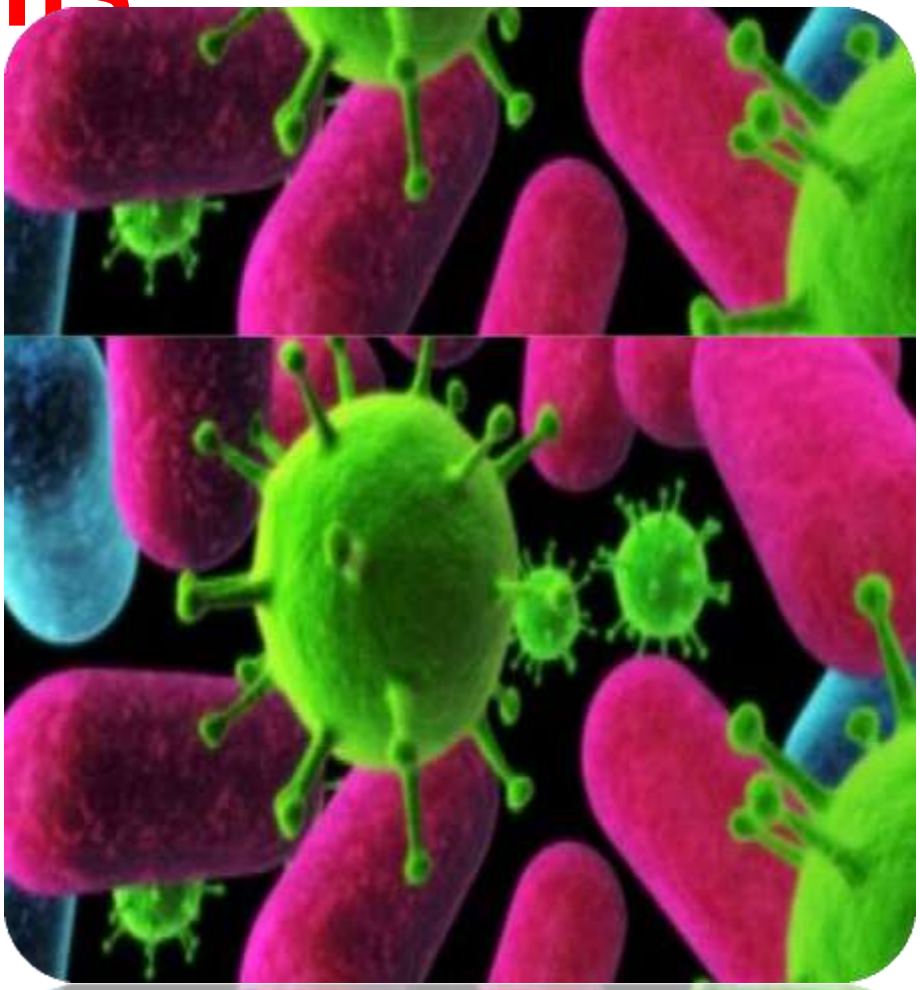
Microbes make the Universe

- There are > 5 x 10^{30} types Microbes in the world
- Humans have intimate relation with Microbes > 90% of the cells in our Body are Microbes



Classification of Microorganisms

- Three domains
  - Bacteria
  - Archaea
  - Eukarya
    - Protists
    - Fungi
    - Plants
    - Animals



Naming and Classifying Microorganisms

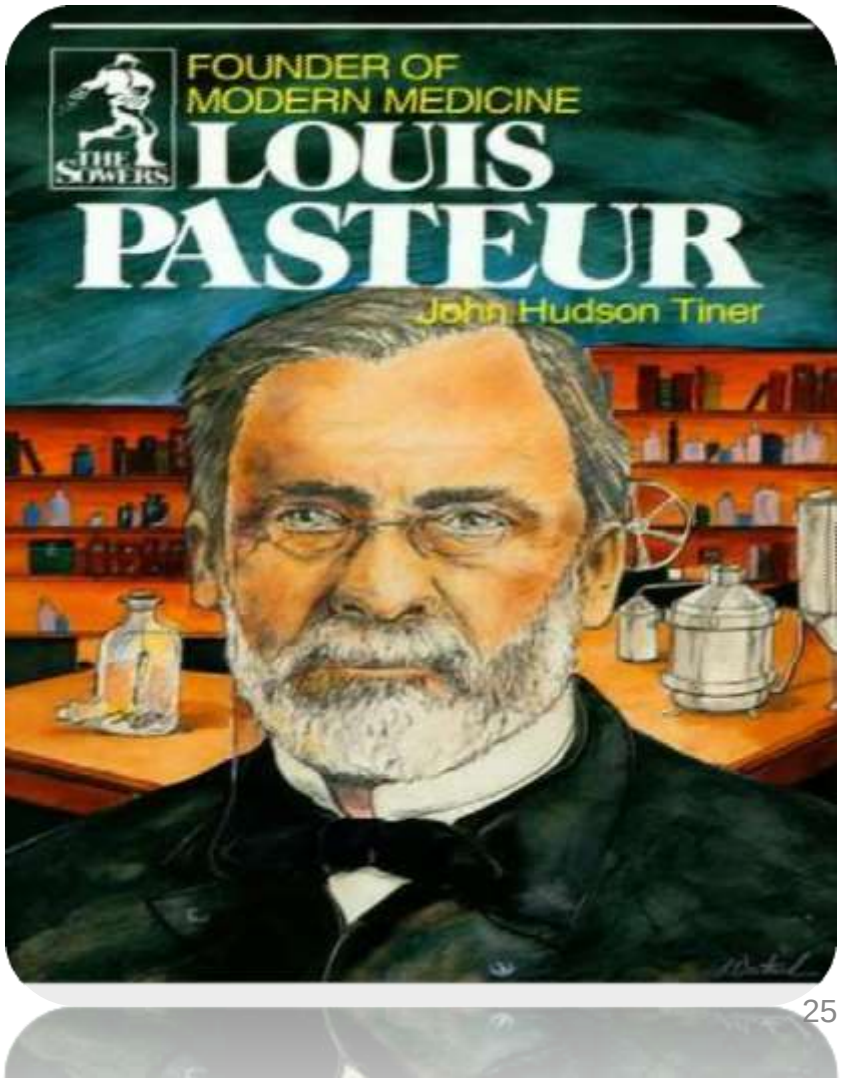
- Carolus Linnaeus (1735) established the system of scientific nomenclature.
- Each organism has two names: the genus and specific epithet.
- Are italicized or underlined. The genus is capitalized and the specific epithet is lower case.

Edward Jenner Vaccinating a

Louis Pasteur

1822-1895

- Contributed best in Microbiology
- Sterilization
- Hot Air oven
- Autoclave
- Anthrax vaccine
- Rabies vaccine
- Built the Pasteur Institute



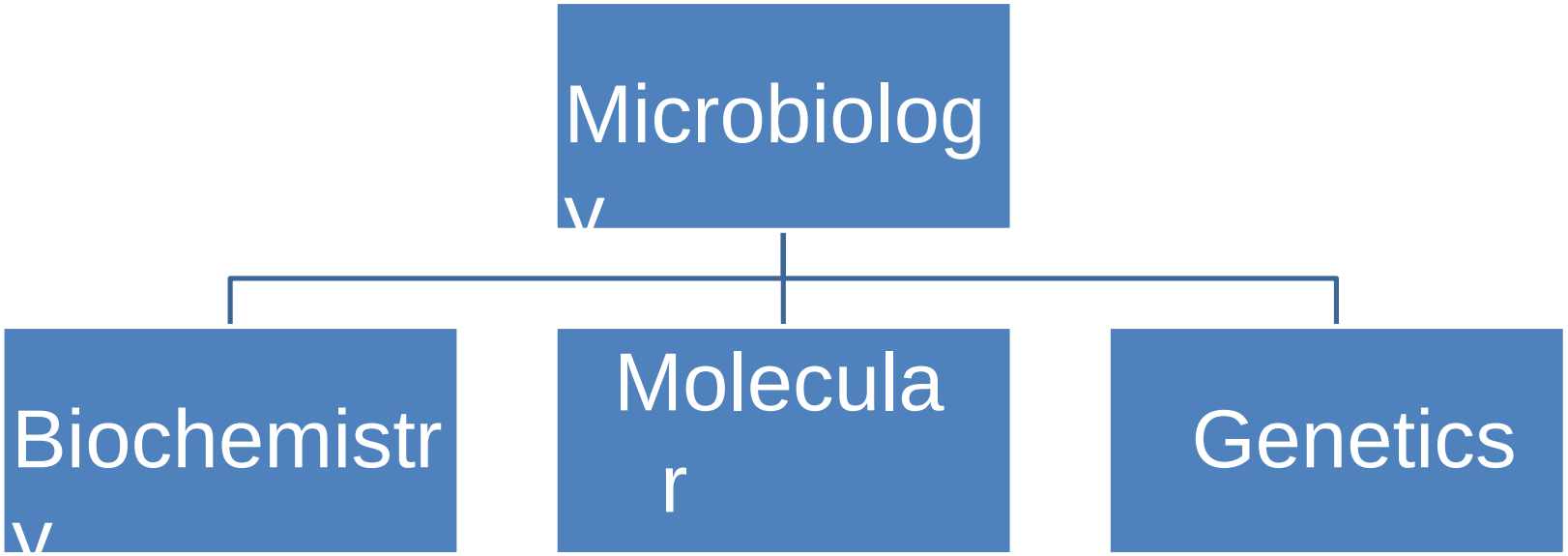
Louis Pasteur

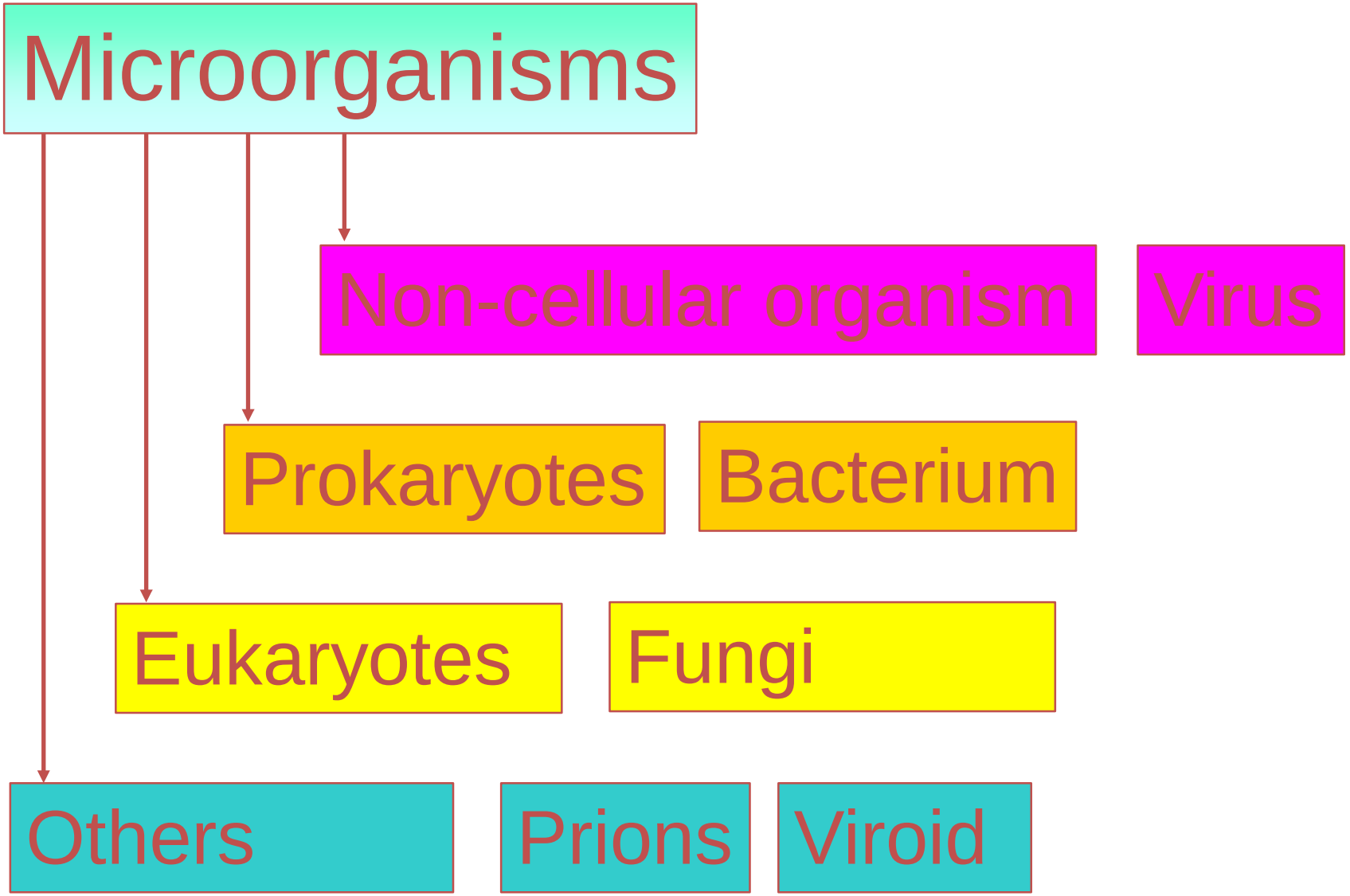
- Pasteur coined the word Vaccine
- Vacca – Cow cow pox virus are given for the prevention of Small Pox
- Louis Pasteur considered the father of Modern Microbiology

Robert Koch 1843 1910

- A German scientist
- Formulated the Bacteriological techniques
- Staining Methods
- Discovered the Mycobacterium and Vibrio cholera

Biological Principles illustrated by Microbiology




Microorganisms
Non-cellular organism
Virus
Prokaryotes
Bacterium
Eukaryotes
Fungi
Others
Prions
Viroid

Organisms included in the study of

1. Bacteria	Bacteriology
2. Protozoans	Protozoology
3. Algae	Phycology
4. Parasites	Parasitology
5. Yeasts and Molds	
Fungi	
6. Viruses	

ow to Study Medical Microbiology?

Fundamentals of Microbiology

Bacteriology

Virology

Mycology

- **Biological Properties**
  - Morphology, identification,
  - Antigenic structure
- **Pathogenesis and Pathology**
  - Clinical findings
- **Diagnostic Laboratory Tests**
- **Immunity**
- **Treatment & Prevention**
  - Epidemiology & Control

Basic Classification of Microorganism

- **Eukaryotes**

Large in size

Mitochondria Present

Membrane bound

Nucleus Eg Algae

Protozoa

Fungi

Slime Moulds

Contains all enzymes for production of metabolic energy

Prokaryotes

Small in Size

DNA not separated from cytoplasm

Mitochondria absent

Eg Bacteria

Contains all enzymes like Eukaryotes

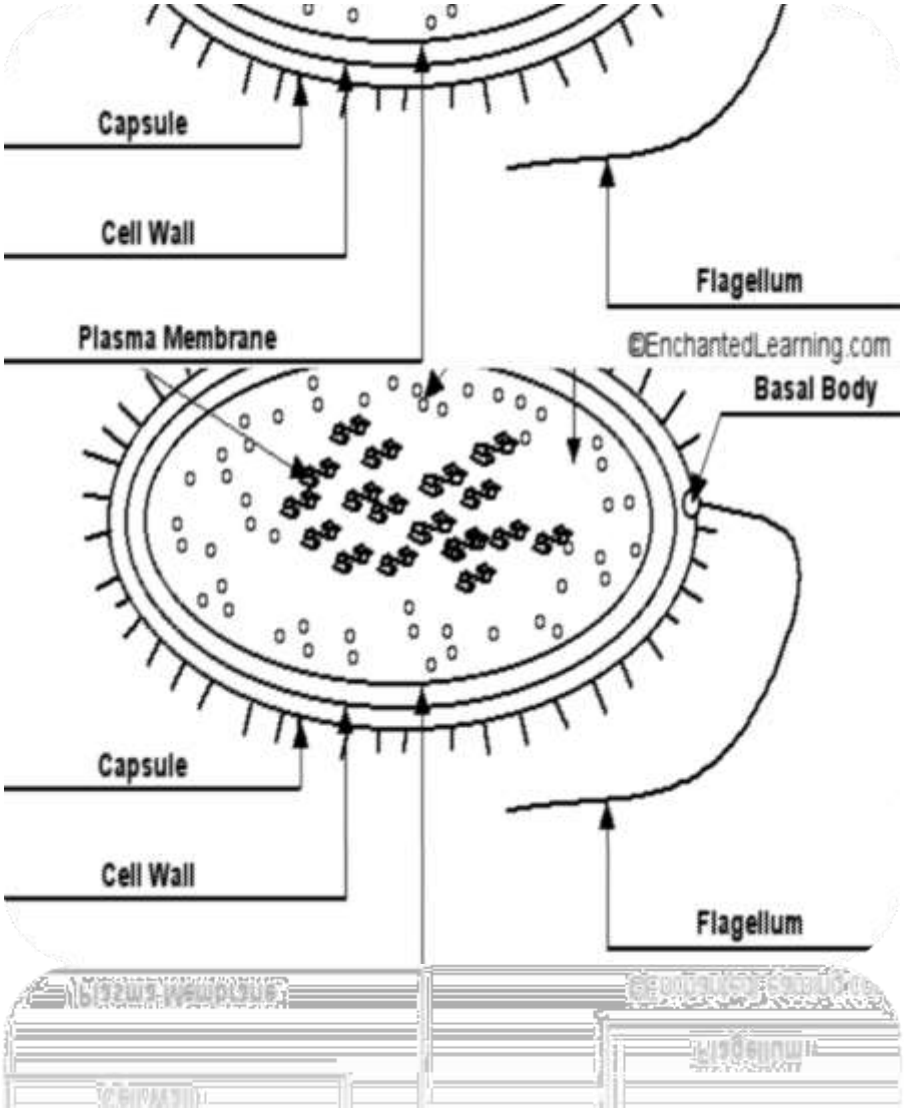
Summary of differences between prokaryote and eukaryote cells

Prokaryotic cells	Eukaryote cells
Small cell (< 5µm)	Larger cells (> 10 µm)
Always unicellular	Often multicellular
No nucleus or any membrane bound organelles	Always have nucleus and membranes bound organelles.
DNA circular, without proteins	DNA is linear and associated with proteins to form chromatin.
Ribosomes are small 70S	Ribosomes are large 80S
No cytoskeleton	Always have cytoskeleton
Motility by rigid rotating flagellum made from flagellin	Motility by flexible waving cilia or flagella made from tubulins.
Cell division is by binary fission	Cell division is by meiosis and mitosis.
Reproduction is always asexual	Reproduction is sexual and asexual.

Prokaryotic Cell Structure

Prokaryotic cells are about 10 times smaller than eukaryotic cells. A typical *Escherichia coli* cell is about 1 μm wide and 2 to 3 μm long. Structurally, *prokaryotes* are very simple cells when compared with eukaryotic cells, and yet they are able to perform the necessary processes of life. Reproduction of prokaryotic cells is by *binary fission*, the simple division of one cell into two cells, after DNA replication and the formation of a separating membrane and cell wall.

Bacteri



- Prokaryotes
- Peptidoglycan cell walls
- Binary fission
- For energy, use organic chemicals, inorganic chemicals, or photosynthesis

Bacterial Cell Wall

The structure of bacterial cell walls is quite different from the relatively simple structure of eukaryotic cell walls, although they serve the same functions, providing rigidity, strength, and protection. The main constituent of most bacterial cell walls is a complex macromolecular polymer known as ***peptidoglycan*** (murein), consisting of many polysaccharide chains linked together by small peptide (protein) chains. Peptidoglycan is only found in bacteria. The thickness of the cell wall and its exact composition vary with the species of bacteria. The cell walls of "Gram-positive bacteria" have a thick layer of peptidoglycan combined with teichoic acid and lipoteichoic acid molecules. The cell walls of "Gram-negative bacteria" have a much thinner layer of peptidoglycan, but this layer is covered with a complex layer of lipid macromolecules, usually referred to as bacteria capsule.

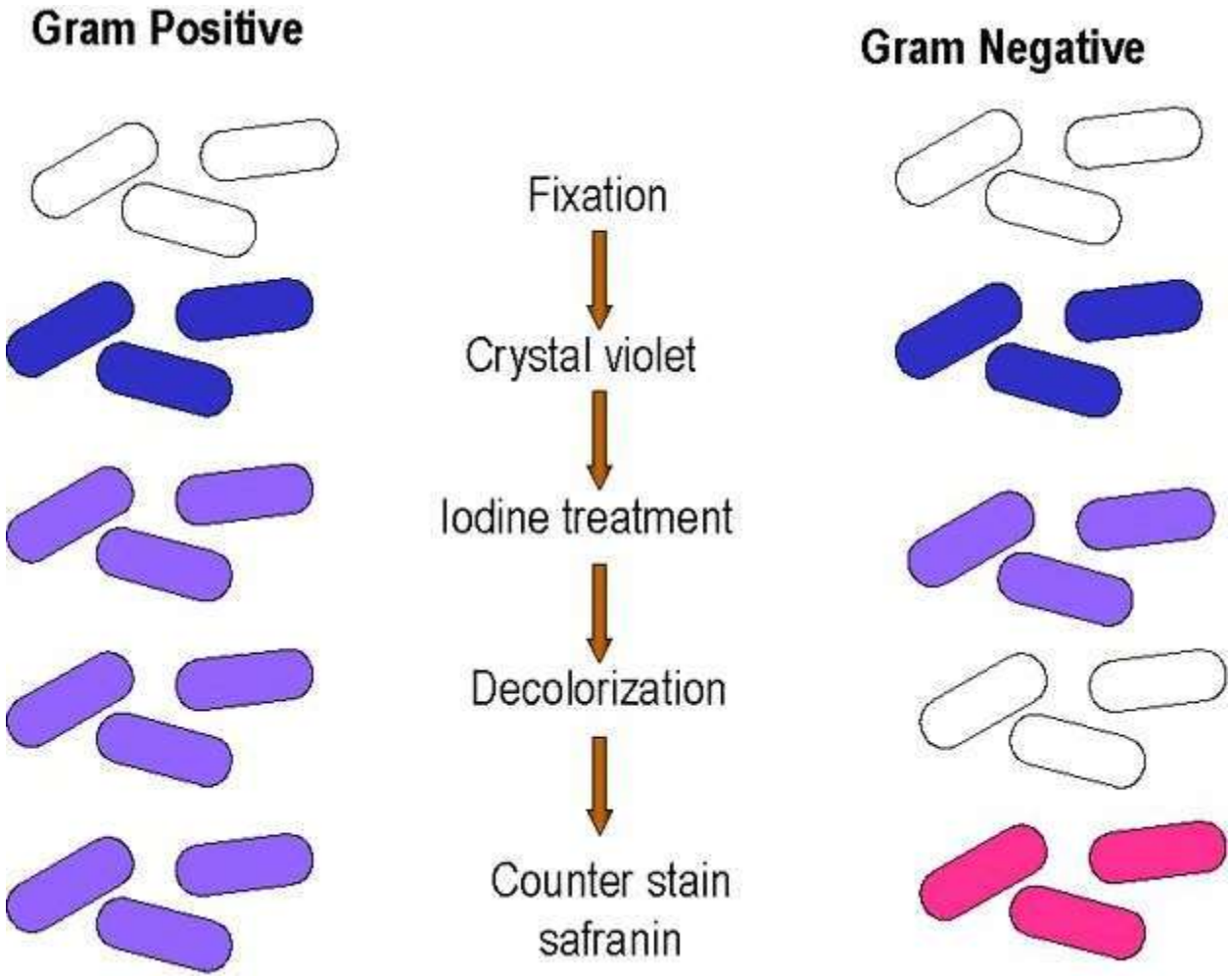


Figure 1-9: Gram Stain

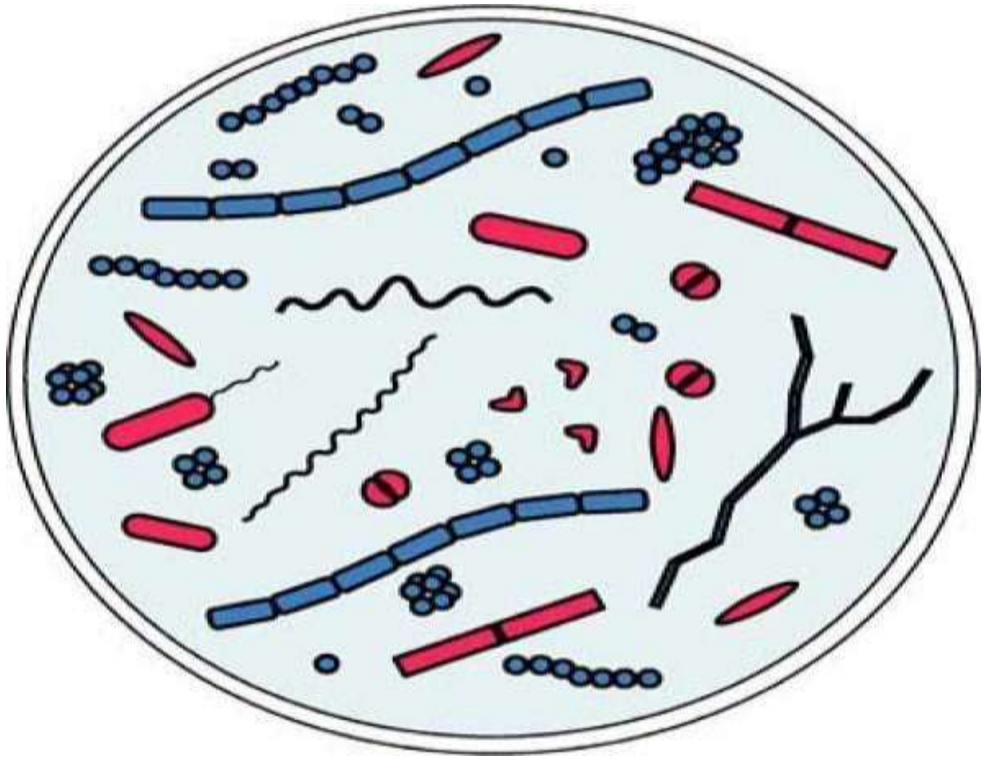
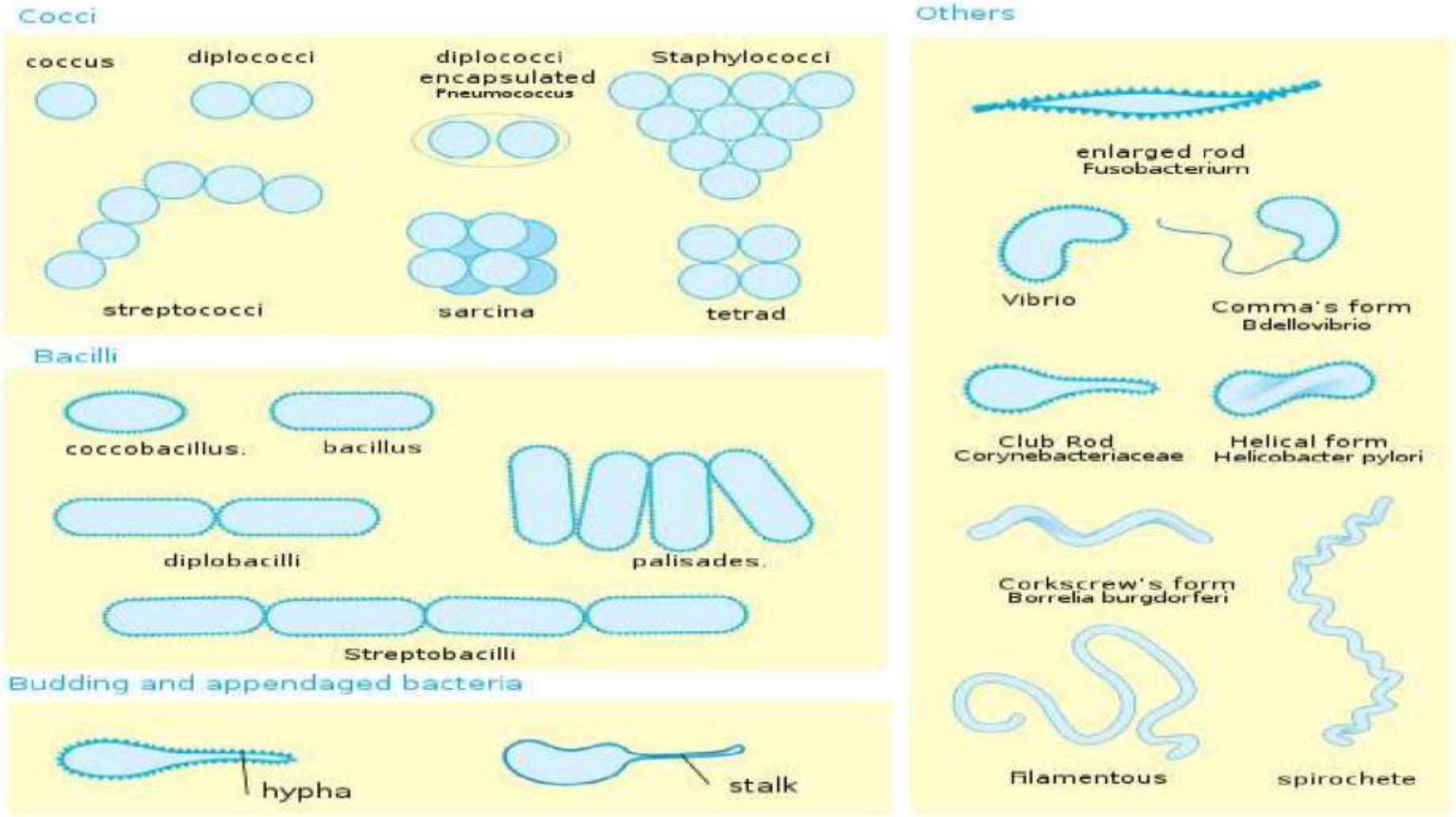
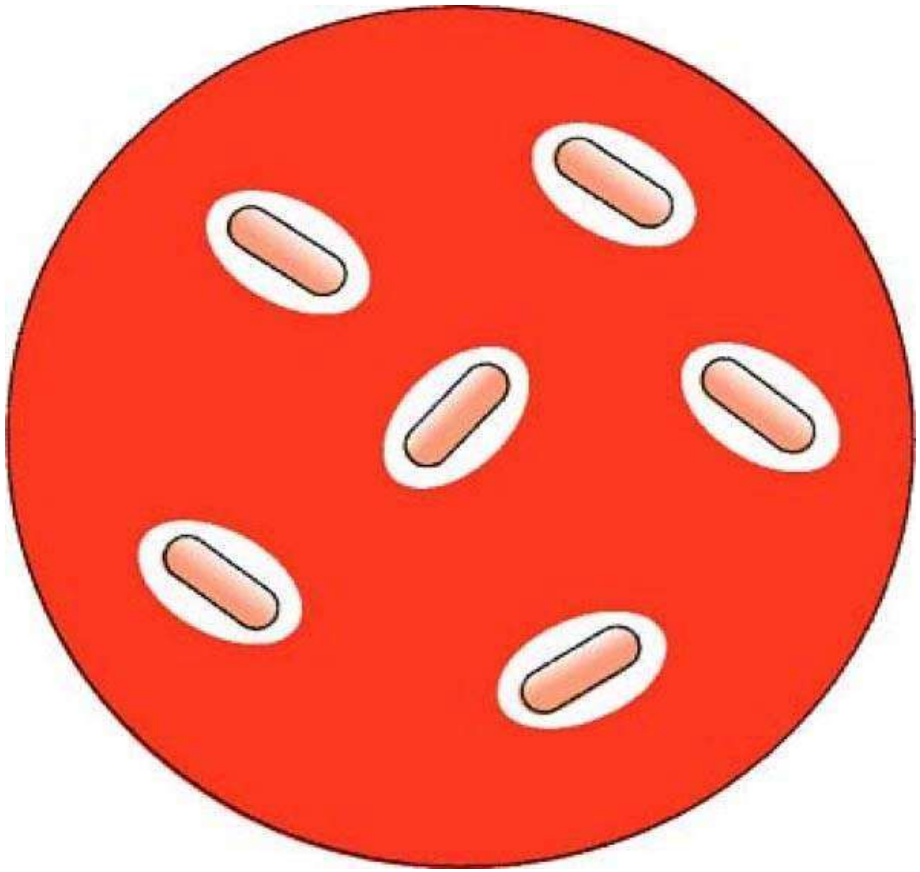


Figure 3-1. Various forms of bacteria, including single cocci, diplococci, tetrads, octads, streptococci, staphylococci, single bacilli, diplobacilli, streptobacilli, branching bacilli, loosely coiled spirochetes, and tightly coiled spirochetes.



Morphologic arrangements of bacteria.



Capsule stain. The capsule stain is an example of a negative staining technique. The bacterial cells and the background stain, but the capsules do not. The capsules are seen as unstained "halos" around the bacterial cells.