

Course: General Microbiology

Introduction to General Microbiology

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SPONTANEOUS GENERATION

- Until the second half of 19th century many scientist believed that life could arise spontaneously from non – living matter

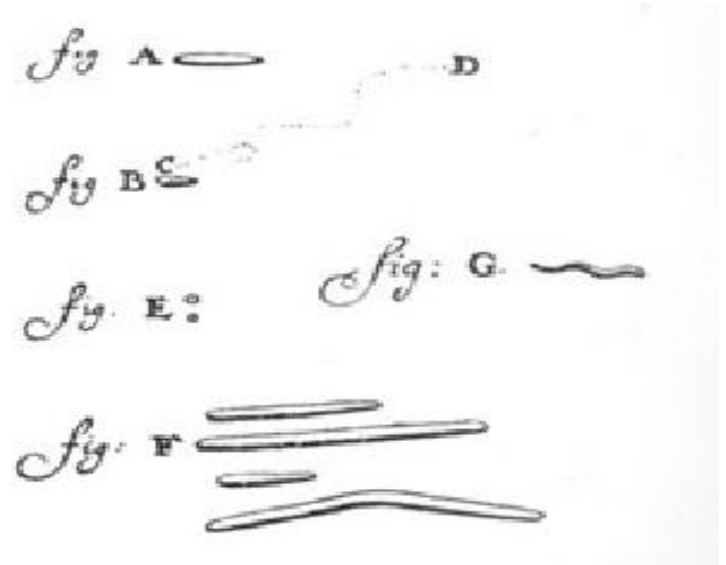
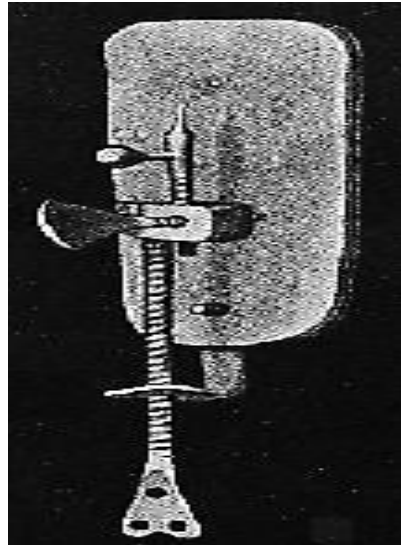
- Redi (1668) experiment on meat

- Meat jar
 - open (flies laid their eggs)
 - closed (no eggs, no flies)

BIOGENESIS

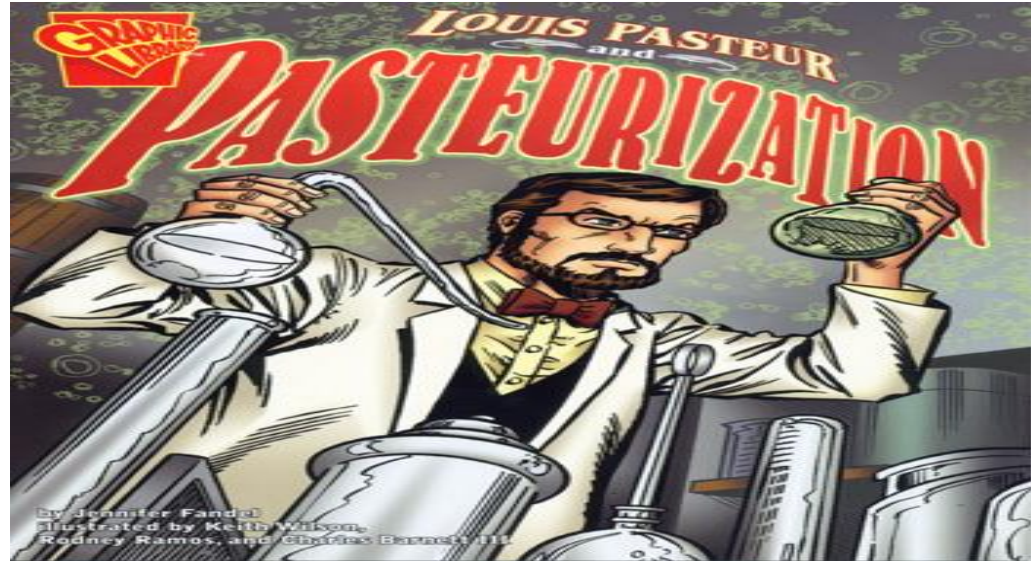
- Pasteur's experiment disproving the theory of spontaneous generation.
 - a) Beef broth in long – necked flask
 - b) Heated the neck of the flask into 'S' shaped and boiled the broth
 - c) Microorganisms didn't appear in the cooled broth even after long periods

Antony van Leeuwenhoek (1632-1723)

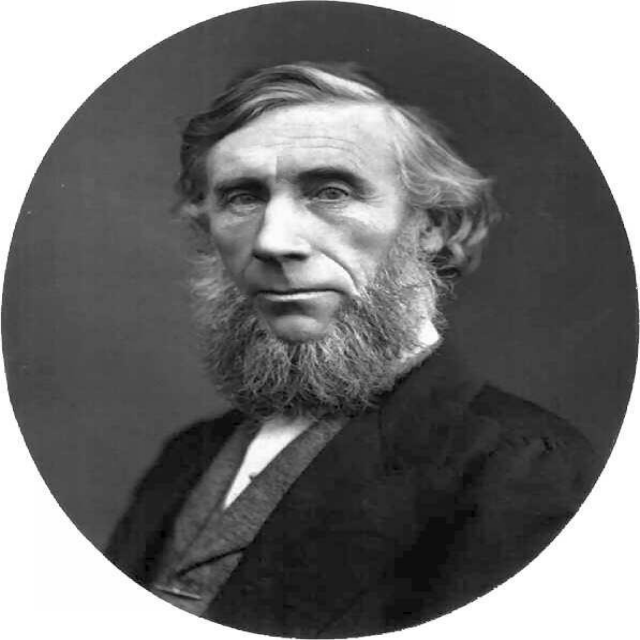


- **Antony van Leeuwenhoek** was an unlikely scientist. A tradesman of Delft, Holland, he came from a family of tradesmen, had no fortune, received no higher education or university degrees, and knew no languages other than his native Dutch. He **who discovered bacteria, free-living and parasitic microscopic protists, sperm cells, blood cells, microscopic nematodes and rotifers, and much more.**

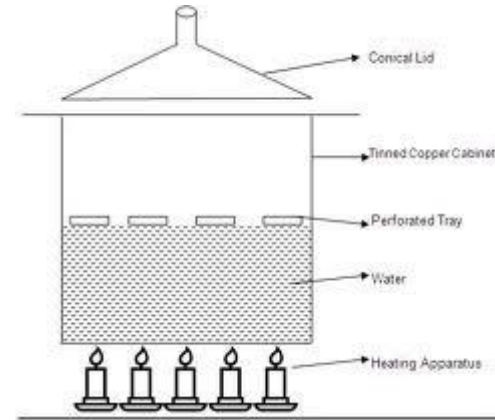
Louis Pasteur (1822-1895)



- **Louis Pasteur** solved the mysteries of rabies, anthrax, chicken cholera, and silkworm diseases, and contributed to the development of the first vaccines. He debunked the widely accepted myth of spontaneous generation, thereby setting the stage for modern biology and biochemistry. He described the scientific basis for **fermentation, wine-making, and the brewing of beer**. Pasteur's work gave birth to many branches of science and he was single-handedly responsible for some of the most important theoretical concepts and practical applications of modern science.



John Tyndall (1820 – 1893)



- **John Tyndall** (2 August 1820 – 4 December 1893) was a prominent 19th century physicist. His initial scientific fame arose in the 1850s from his study of diamagnetism. Later he studied thermal radiation, and produced a number of discoveries about processes in the atmosphere.
- **Tyndallization** is an old process for sterilizing food. It is still occasionally used.
- A **simple, effective, modern sterilizing method** is to heat the substance being sterilized to 121°C for 15 minutes in a pressure cooker. If a pressure cooker is unavailable and sterilization proceeds instead using unpressurized heating up to 100°C, the heat will kill the bacterial cells but the viability of bacterial spores can survive. In this case the Tyndallization process can be used to destroy the spores.
- Tyndallization essentially consists of heating the substance for 15 minutes for three days in a row (usually by boiling it). The Tyndallization process is generally effective, but its reliability is not considered 100% certified. It is not often used today, but it has applications in sterilizing some things that cannot withstand pressurized heating, such as plant seeds. It is not necessary to bring the temperature all the way up to 100°C to kill bacterial cells.



Joseph Lister (1827-1912)



- **Joseph Lister**, 1st Baron Lister, OM, FRS, PC (5 April 1827 – 10 February 1912 aged 84) was a British surgeon and a pioneer of **antiseptic surgery**, who promoted the idea of sterile surgery while working at the Glasgow Royal Infirmary. Lister successfully introduced **carbolic acid (now called phenol)** to sterilize surgical instruments and to clean wounds, which led to reduced post-operative infections and made surgery safer for patients



Robert Koch (1843-1910)



- **Robert Koch**, a German Physician, is well known to the world of microbiology for his significant contribution especially in the area of microbial techniques. He introduced **aniline dyes for staining** bacteria; used **agar-agar and gelatin to prepare solid culture media**; stressed the need for **pure culture** to study microbes in details; confirmed germ theory of disease, and laid down **Koch's postulates** to test the pathogenicity of causative agents. He also discovered the casual organisms of **anthrax** disease of cattle (*Bacillus anthracis*) and tuberculosis (*Mycobacterium tuberculosis*).



Golden Age of Microbiology

1857 **Pasteur** - **Fermentation**

1861 **Pasteur** - **Disproved spontaneous
generation**

1864 **Pasteur** - **Pasteurization**

1867 **Lister** - **Aseptic surgery**

1876 ***Koch** - **Germ theory of disease**

(*) Indicates a Nobel laureate

1879 **Neisser**

- *Neisseria gonorrhoeae*

1881 ***Koch**
Finely

- **Pure culture**
- **Yellow fever**

1882 ***Koch**
Hess

- *Mycobacterium tuberculosis*
- **Agar(solid) media**

1883 ***Koch**

- *Vibrio cholerae*

1884 ***Metchnikoff**
Gram
Escherich

- **Phagocytosis**
- **Gram-staining procedure**
- *Escherichia coli*

(*) Indicates a Nobel laureate

1887 **Petri**

- **Petri dish**

1889 **Kitasato**

- ***Clostridium tetani***

1890 ***Von Bering**

- **Diphtheria antitoxin**

 ***Ehrlich**

- **Theory of immunity**

1892 **Winogradsky**

- **Sulfur cycle**

(*) Indicates a Nobel laureate

1898 **Shiga** - *Shigella dysenteriae*.

1908 ***Ehrlich** - Syphilis.

1910 **Chagas** - *Trypanasoma cruzi*.

1911 ***Rous** - Tumor-causing virus
(1966 Nobel prize).

(*) Indicates a Nobel laureate

Microorganisms

Virus

DNA viruses



RNA viruses



Enveloped viruses



Bacteria



E. coli

Fungi

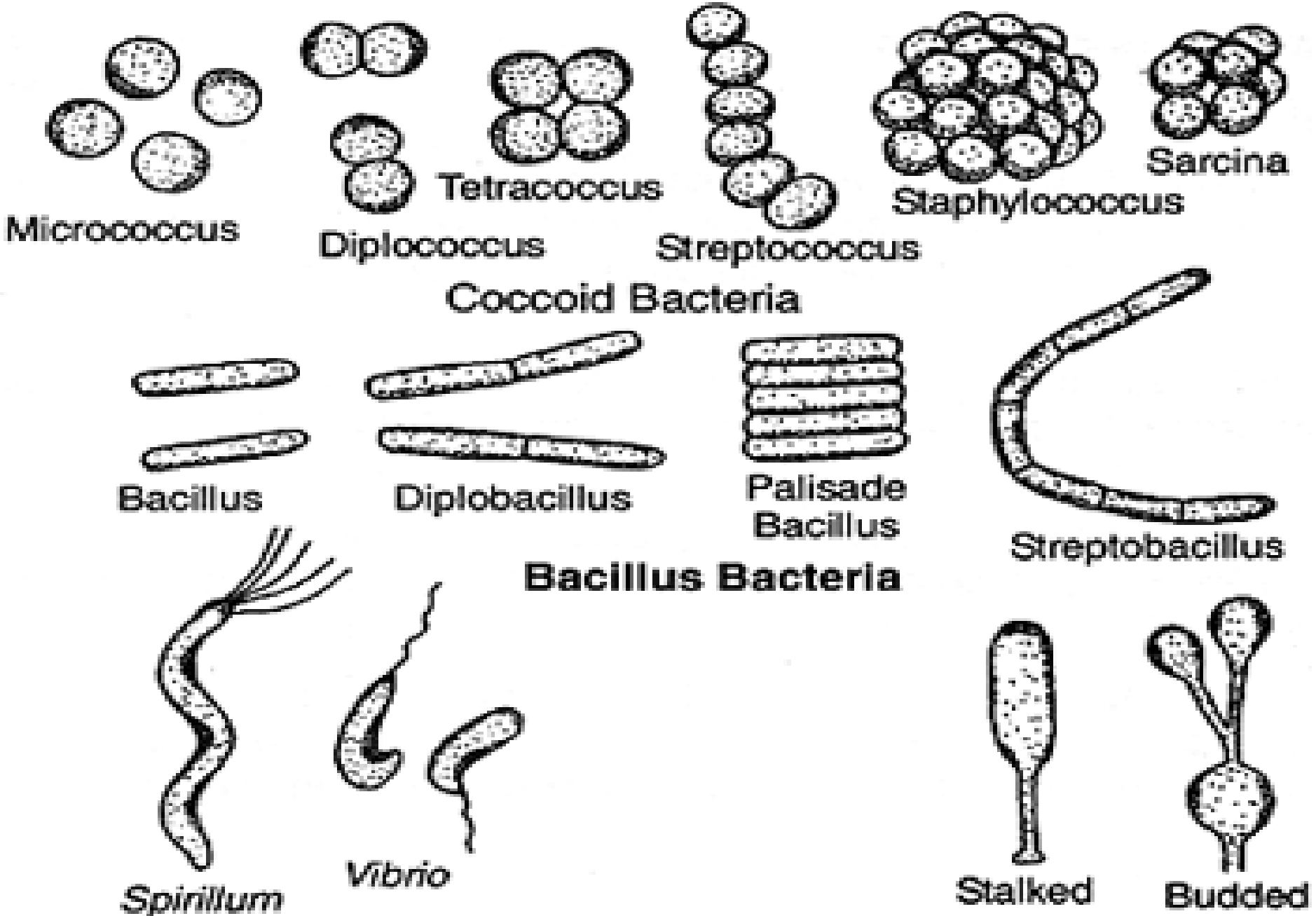


Penicillin Mold

Protists



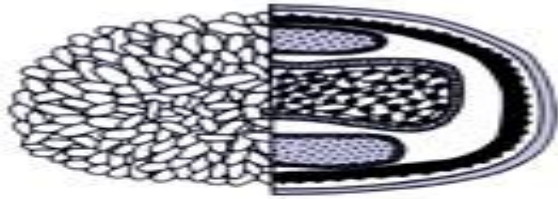
Amoeba



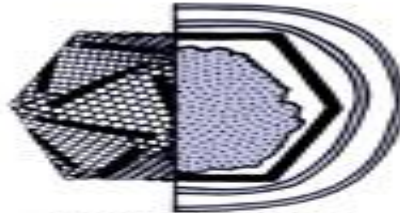
Various shapes of bacteria

VARIOUS TYPES OF VIRUSES

DNA VIRUSES



Poxviridae



Asfarviridae



Herpesviridae



Adenoviridae



Papovaviridae



Parvoviridae



Circoviridae

REVERSE-TRANSCRIBING VIRUSES

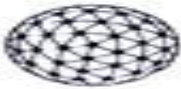


Hepadnaviridae



Retroviridae

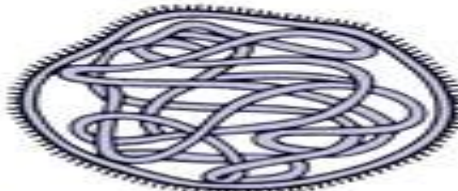
RNA VIRUSES



Reoviridae



Birnaviridae



Paramyxoviridae



Rhabdoviridae



Bornaviridae



Filoviridae



Orthomyxoviridae



Bunyaviridae



Arenaviridae



(Coronavirus)
Coronaviridae



(Torovirus)
Coronaviridae



Arteriviridae



Picornaviridae



Caliciviridae



Astroviridae

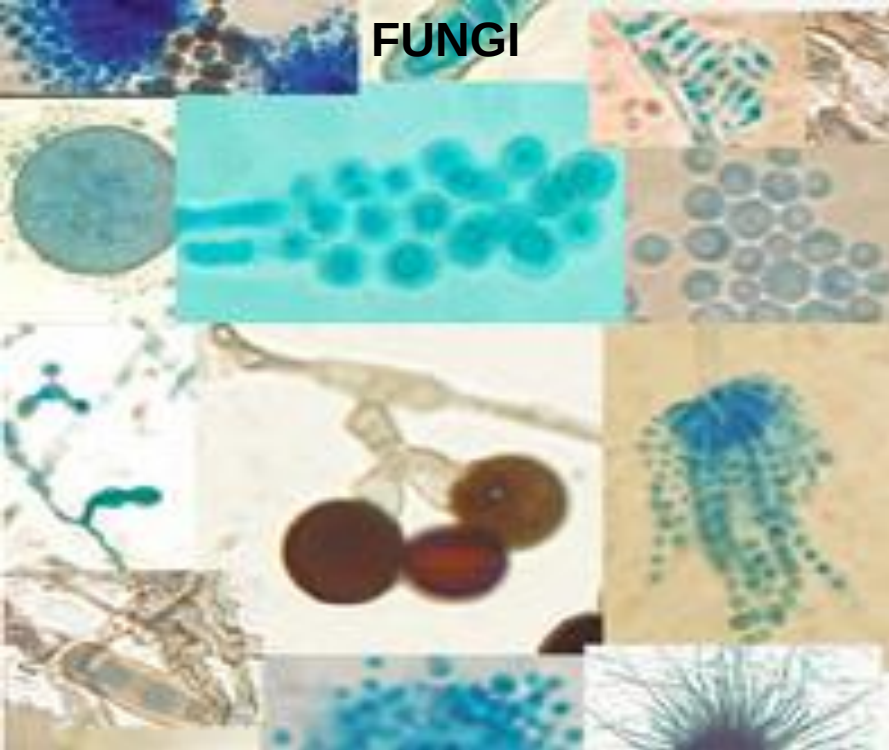


Togaviridae

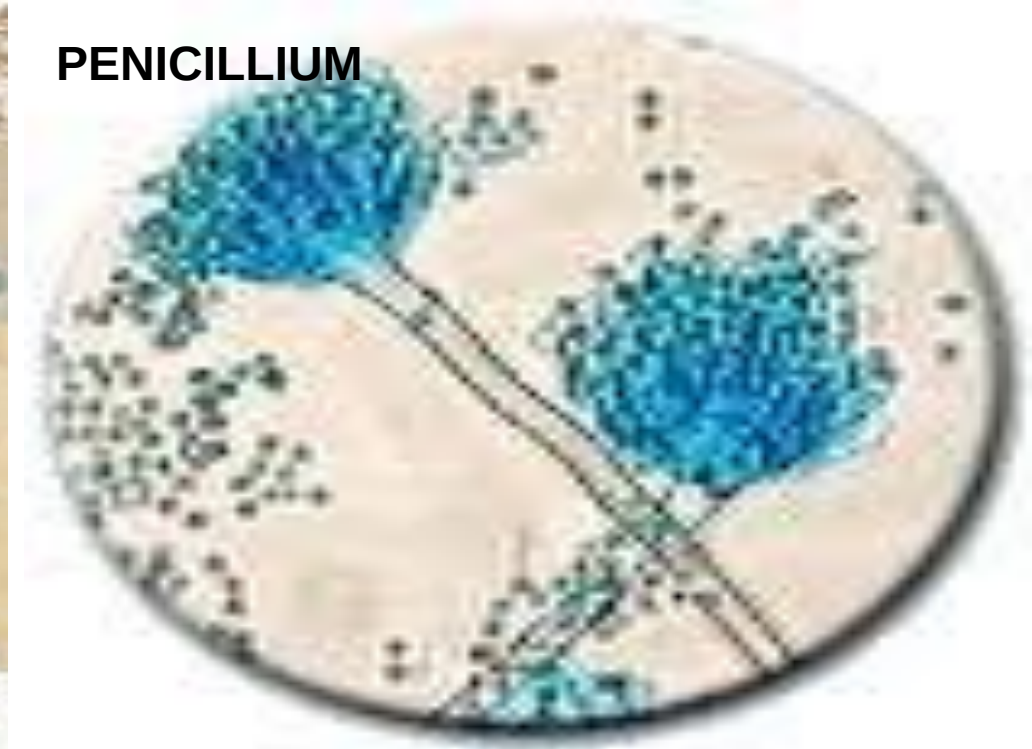


Flaviviridae

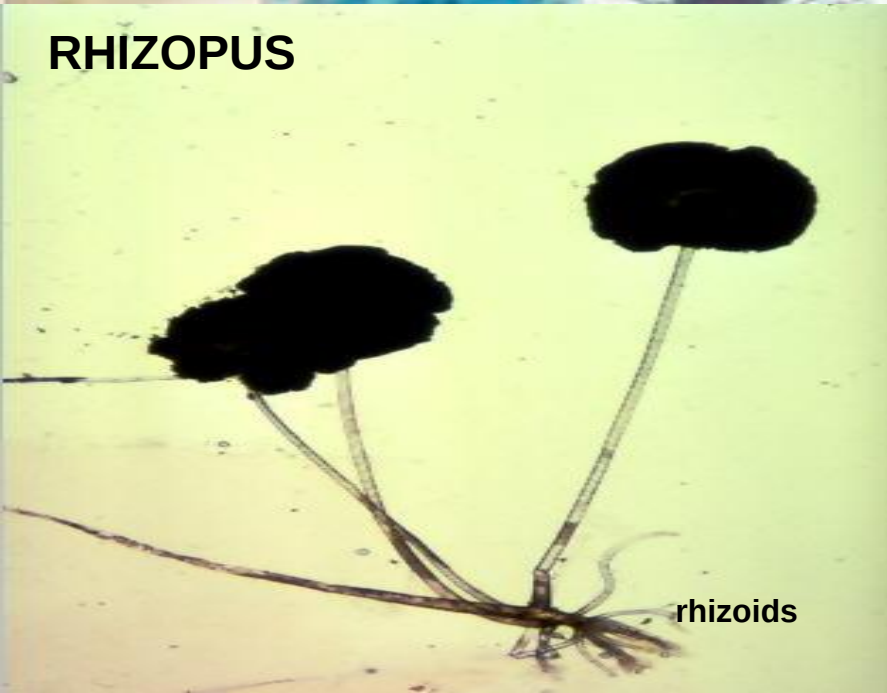
FUNGI



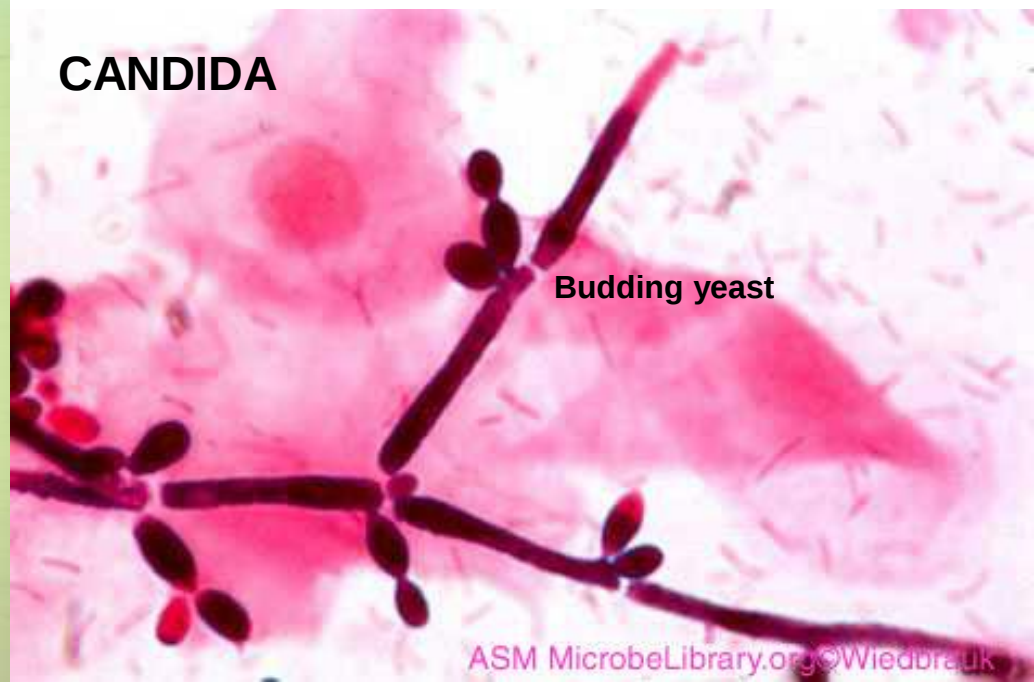
PENICILLIUM

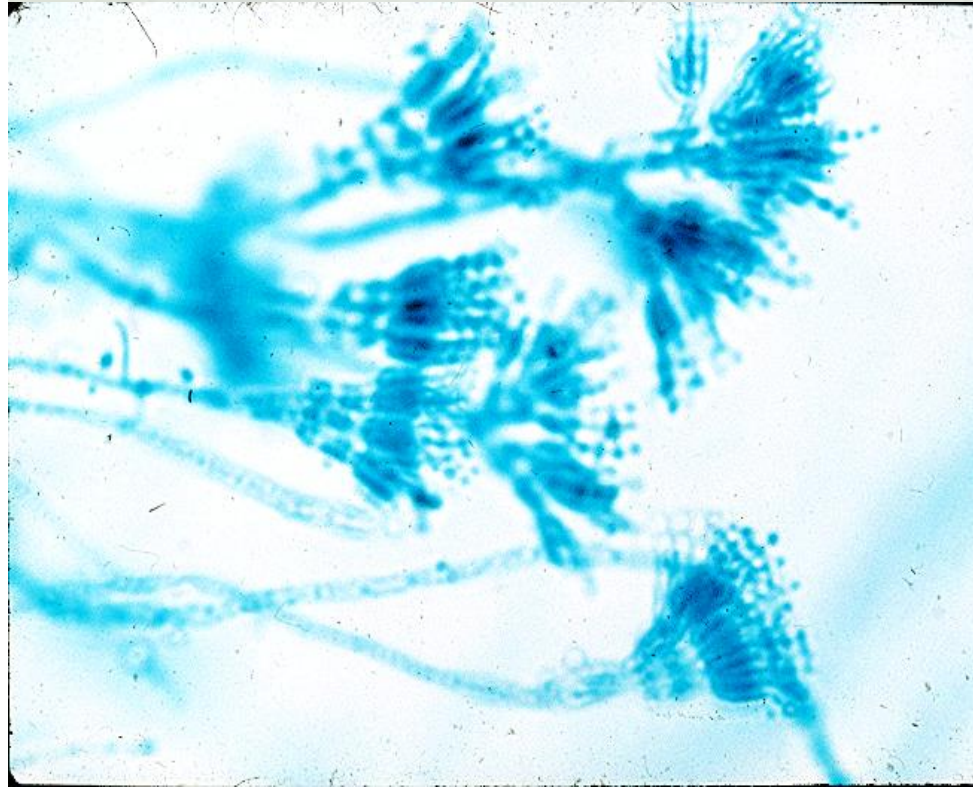
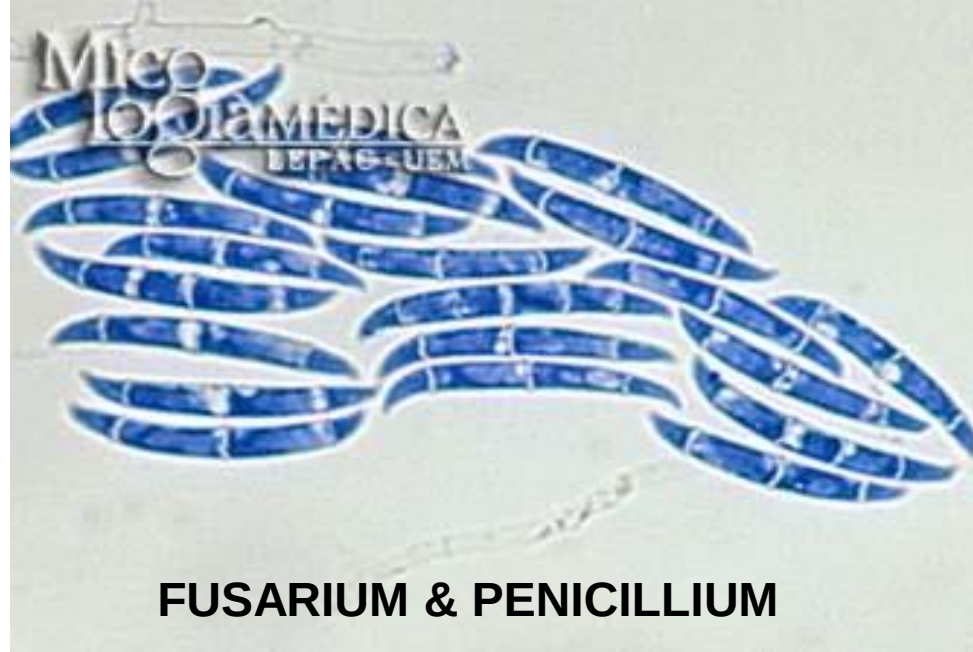


RHIZOPUS

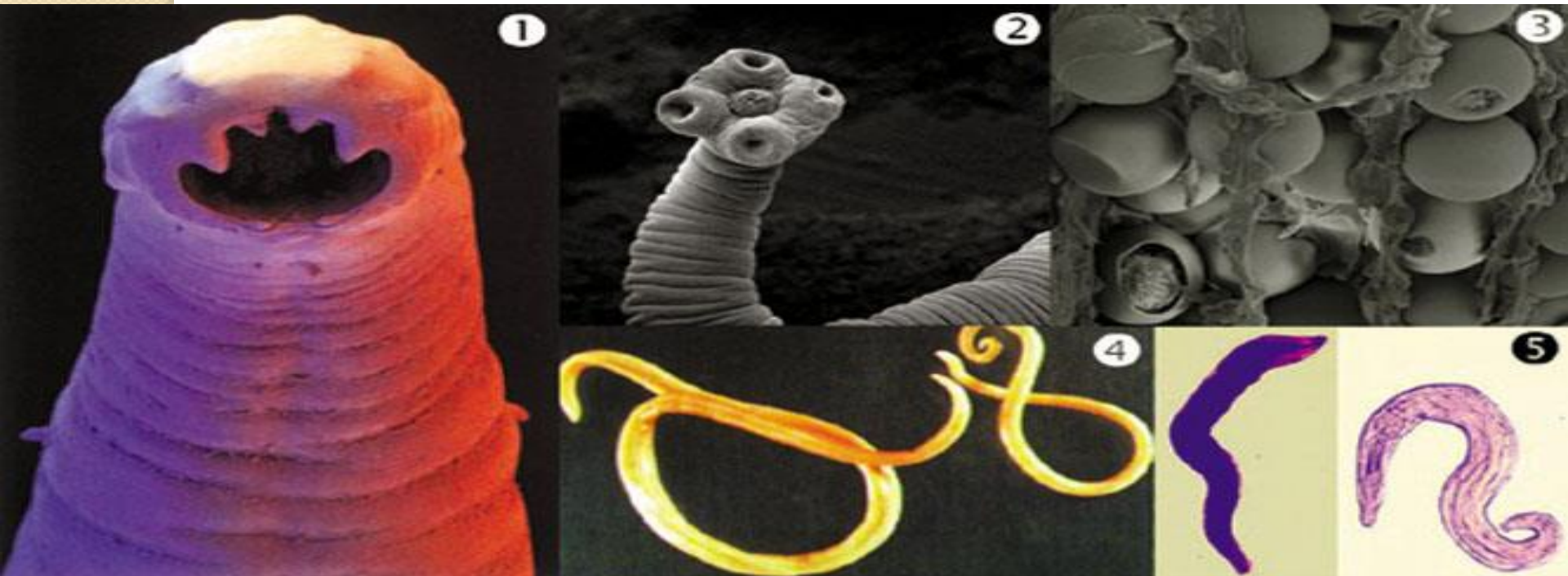


CANDIDA





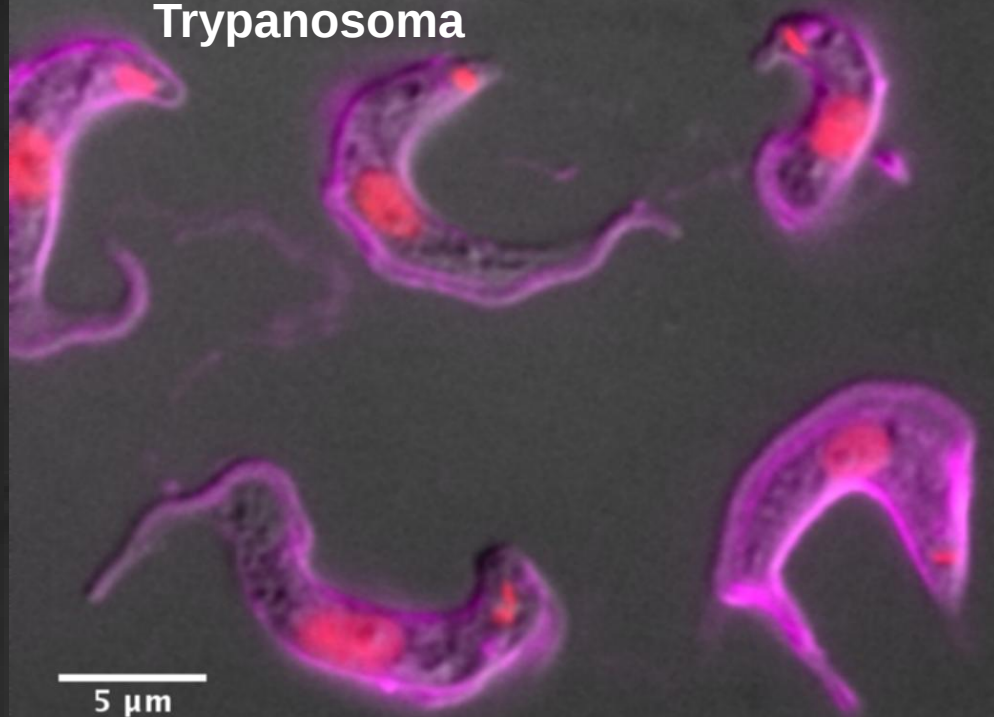
VARIOUS TYPES OF PROTOZOANS



Giardia

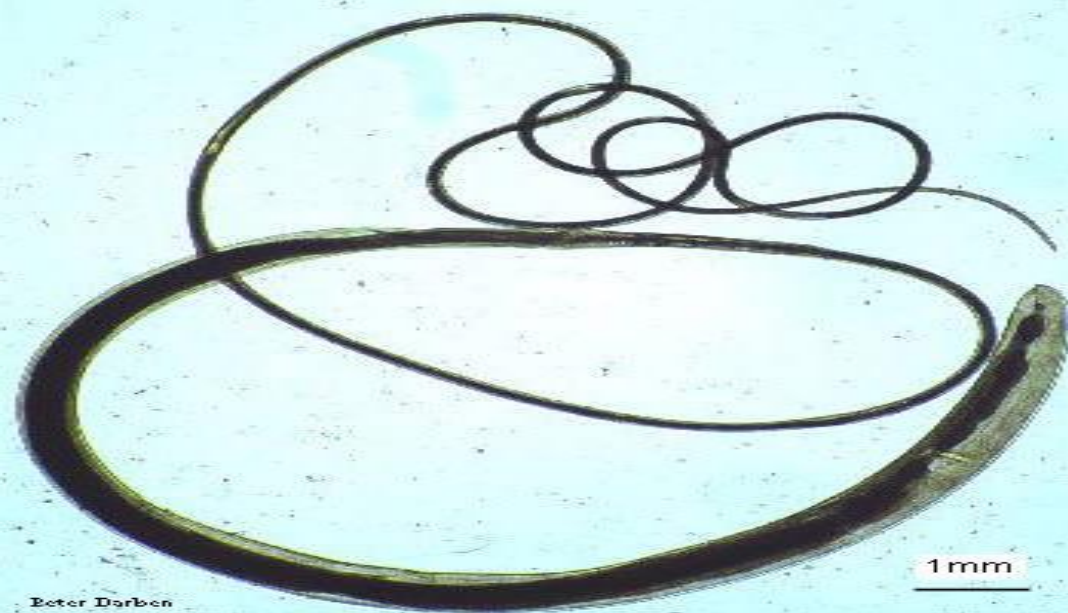


Trypanosoma



Trichuris trichiura

Female



Male



Bacteria - Classification

- Eubacteria – Bacteria with peptidoglycon cell walls
- Archaea – Bacteria lacking peptidoglycon cell walls

DIVISIONS

- I. Gracilicutes – Thin cell wall ,G^{-ve}
- II. Firmicutes – Thick cell wall, G^{+ve}
- III. Tenericutes – Lack of rigid cell wall and soft nature
- IV. Mendosicutes – Lack conventional peptidoglycon cell walls

THE FIVE KINGDOM SYSTEM

5) Animals (Ingestion)



4) Plants (Photosynthesis)



3) Fungi (Eucaryotic – mostly multicellular)



2) Protista (Eucaryotic – mostly unicellular)

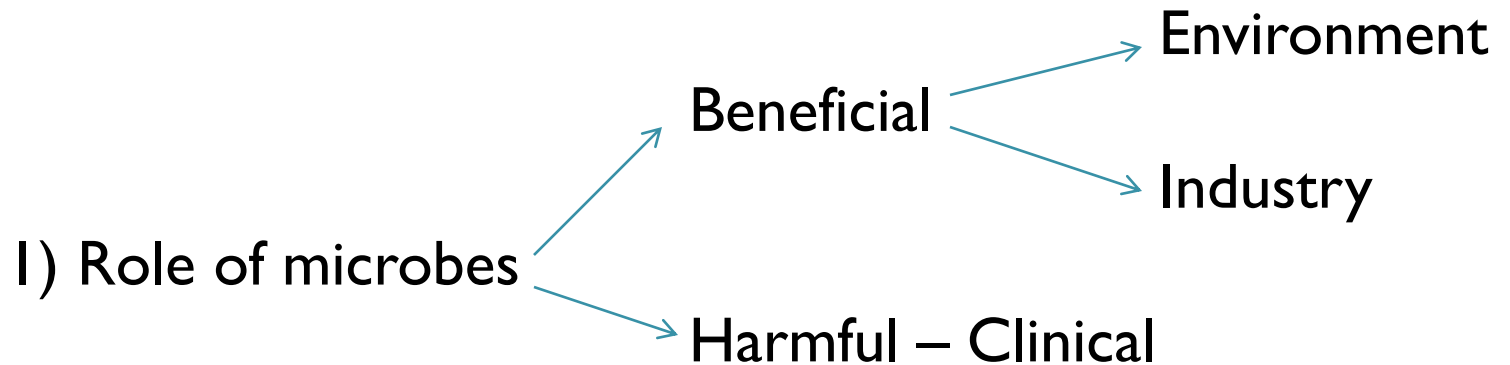


1) Procaryotae (Procaryotic - unicellular)

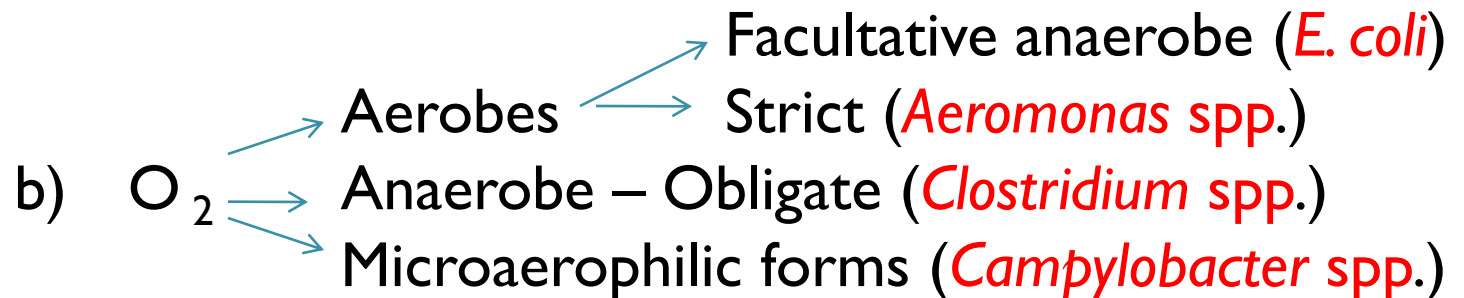
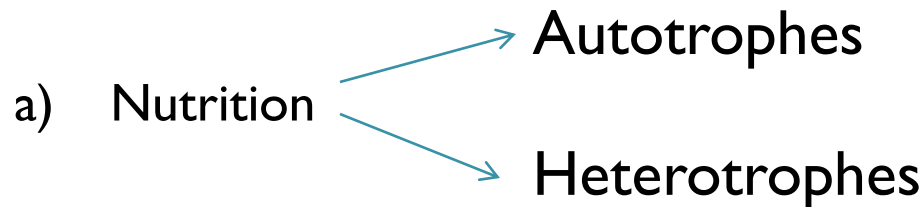
THE THREE DOMAINS

- 1) **Archaea** – Methanosarcina (Methanogens, Halophiles and thermo acidophiles)
- 2) **Eubacteria** – *E. coli* & *Bacillus* (G^{+ve} , G^{-ve} and Mycoplasma)
- 3) **Eucaryotes** – Amoeba (Fungi, plants, animals and protists, amoeba, micro algae)

General Terms – Microbiology



2) Types of organisms



3) Aerogens (*E. coli*)

4) Anaerogens (*Vibrio spp.*)

5) Oxygenic 6) Anoxygenic

7) Temperature

- Psychrophiles – Cold lovers(0-4°C)
- Mesophiles – Moderate temp. lovers (20-40°C)
- Thermophiles – High temp. lovers (40-50°C)

8) pH

- Acidophiles (2-4)
- Neutrophiles (6-8)
- Alkalophiles (8-10)

9) Salinity – **Halophiles** – Salt loving forms

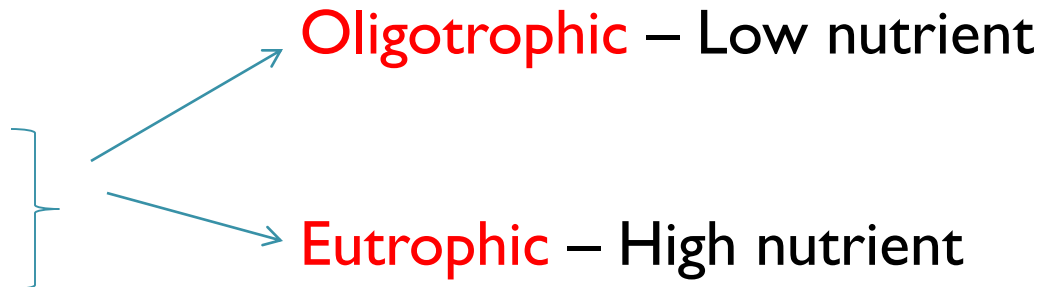
10) Pressure (Hydrostatic) – **Barophiles** –
Pressure loving forms

11) Autochthonus – **Indigenous** (Native)

12) Allochthonus – **Foreign** (Transported
from various places)

I 3) Nutrients

- a) Organic
- b) Inorganic



I 4) a) Degradation (or) Decomposition

- b) Biodegradation
- c) Biodeterioration

I 5) a) Suspended matter

- b) Particulate matter
- c) Detritus

- 16) a) Soil
b) Mud
c) Sand and
d) Sediment

17) Antibiotics

18) Hydrothermal Vent

THANK YOU