ATMOIC ENERGY CENTRAL SCHOOL, INDORE

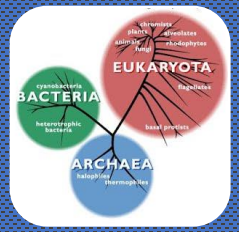
CLASS XI

BIOLOGY

UNIT 1

CHAPTER 2

MODULE 2/4



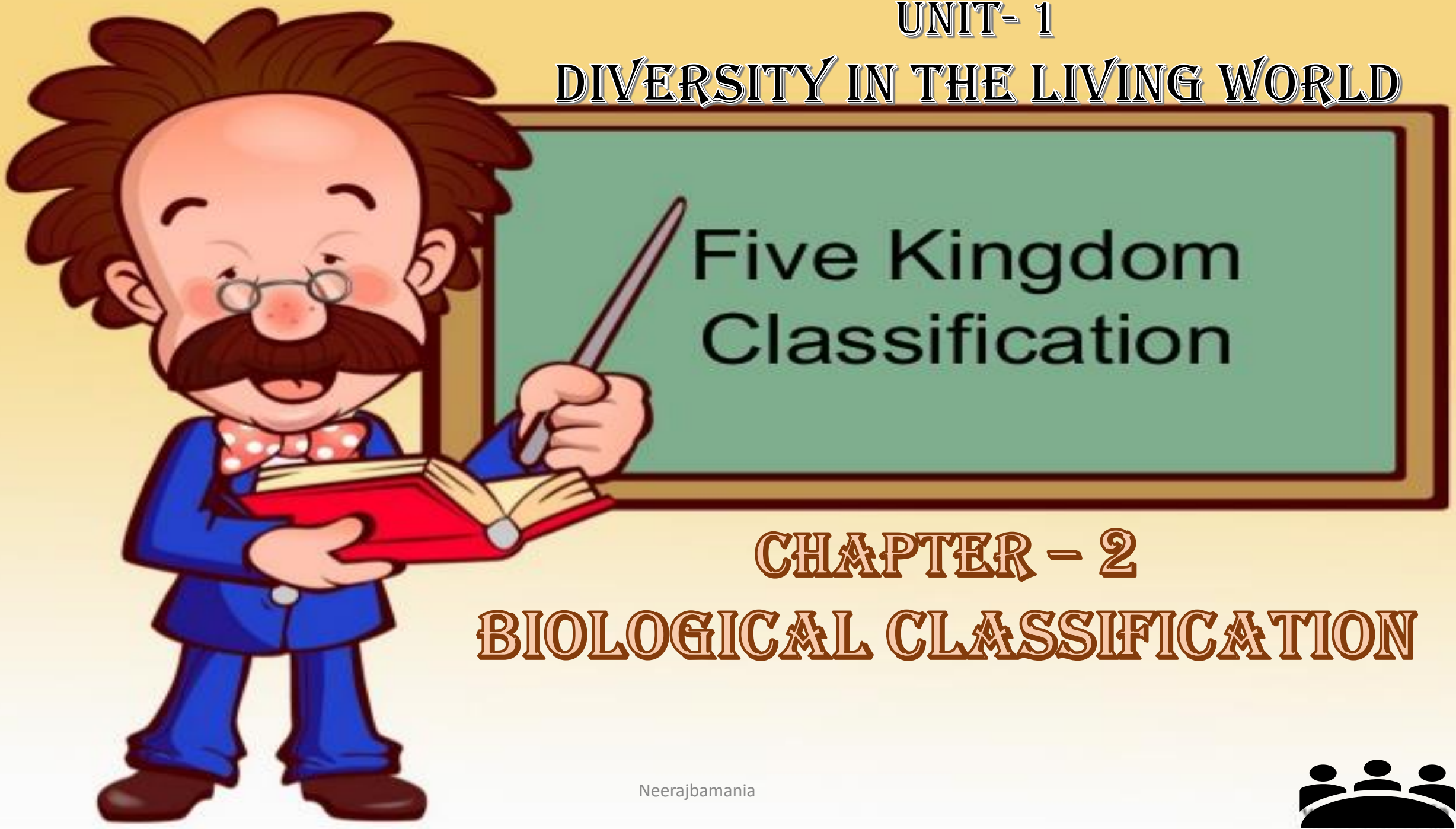
BIOLOGICAL CLASSIFICATION

NEERAJ KUMAR BAMANIA

- PGT(SS) - BIOLOGY
- ATOMIC ENERGY CENTRAL SCHOOL, INDORE

UNIT- 1

DIVERSITY IN THE LIVING WORLD

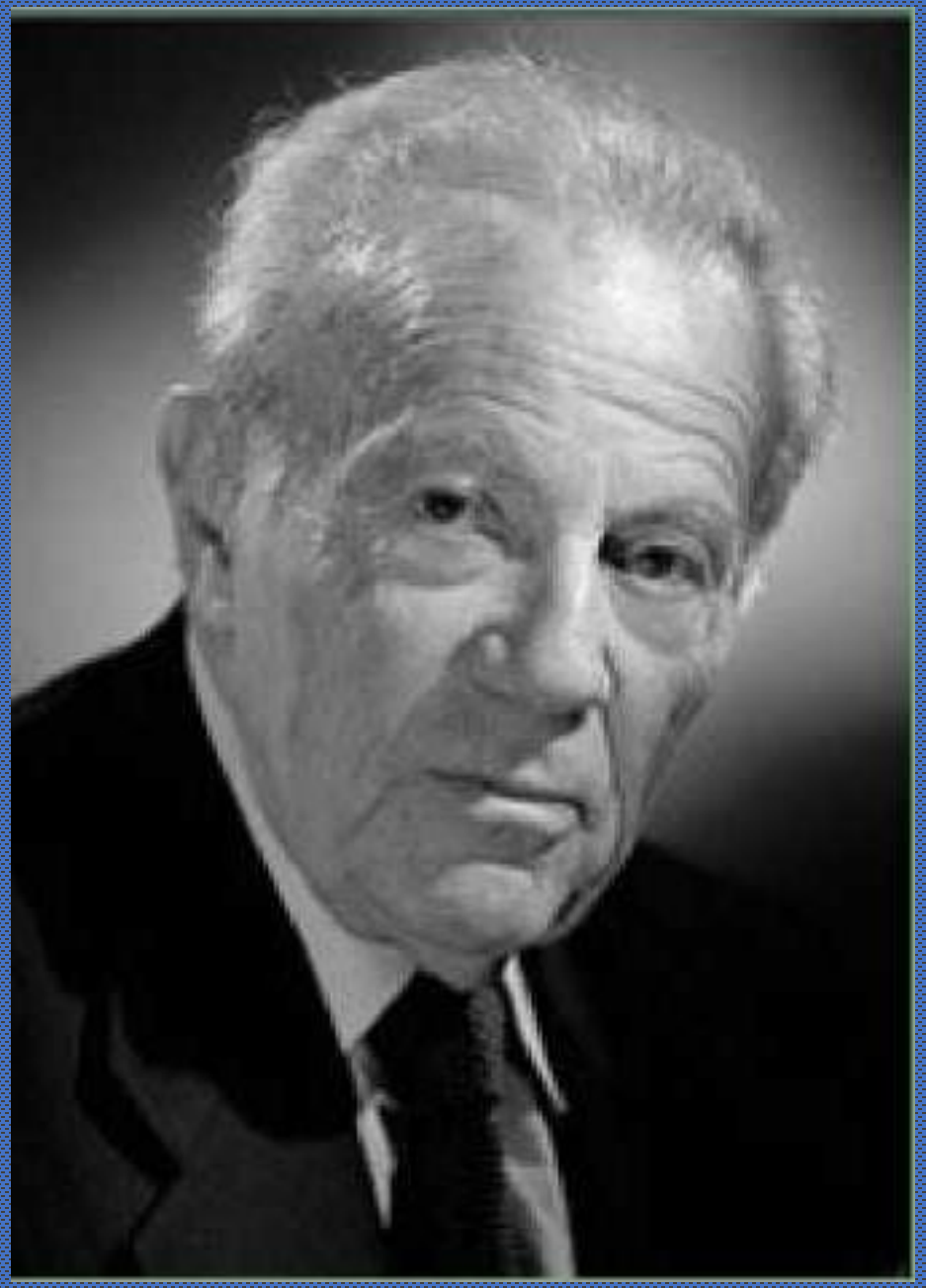


CHAPTER – 2

BIOLOGICAL CLASSIFICATION

- In 1937, E-Chatton suggested the terms of,

"**Procariotique**" to describe bacteria and "**Eucariotique**" to describe animal and plant cells.

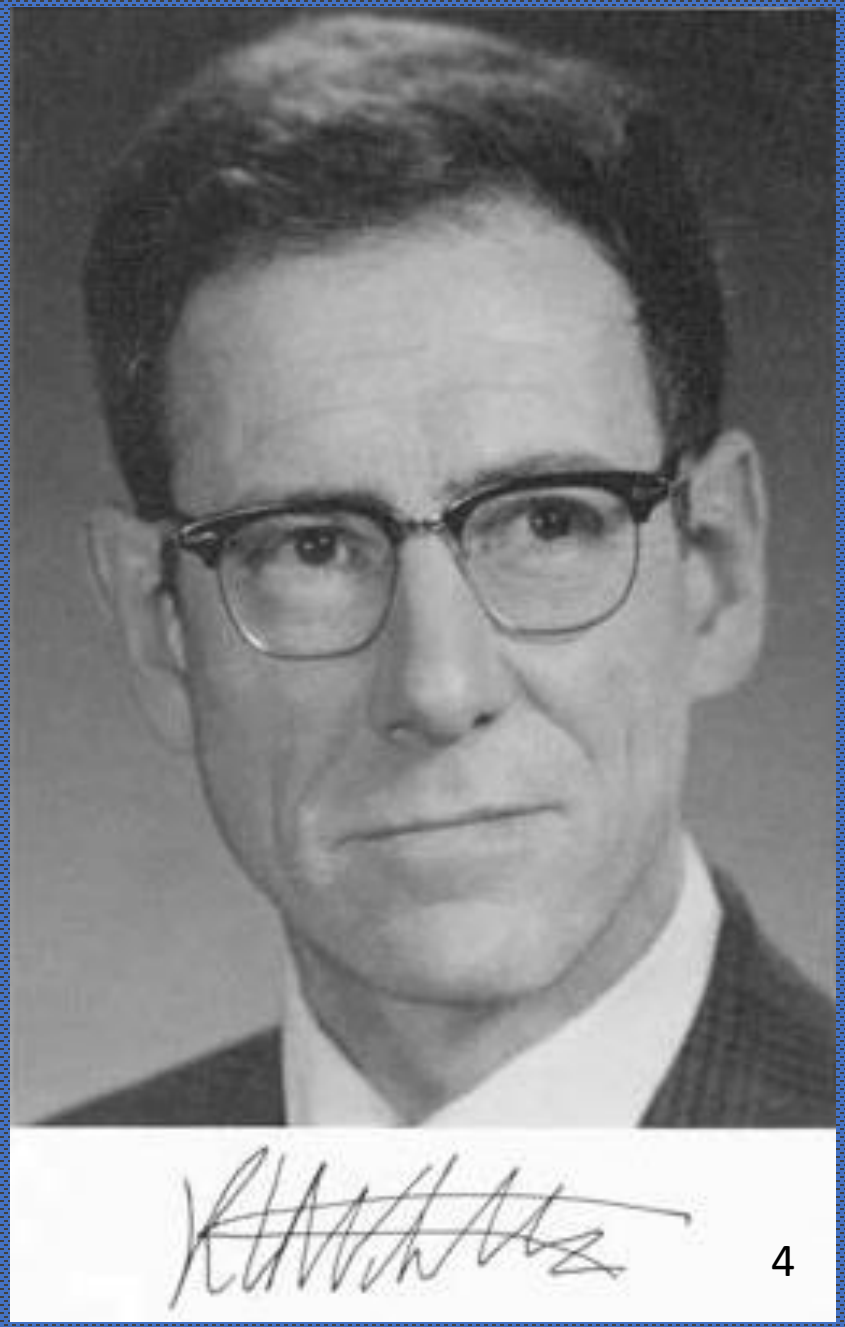


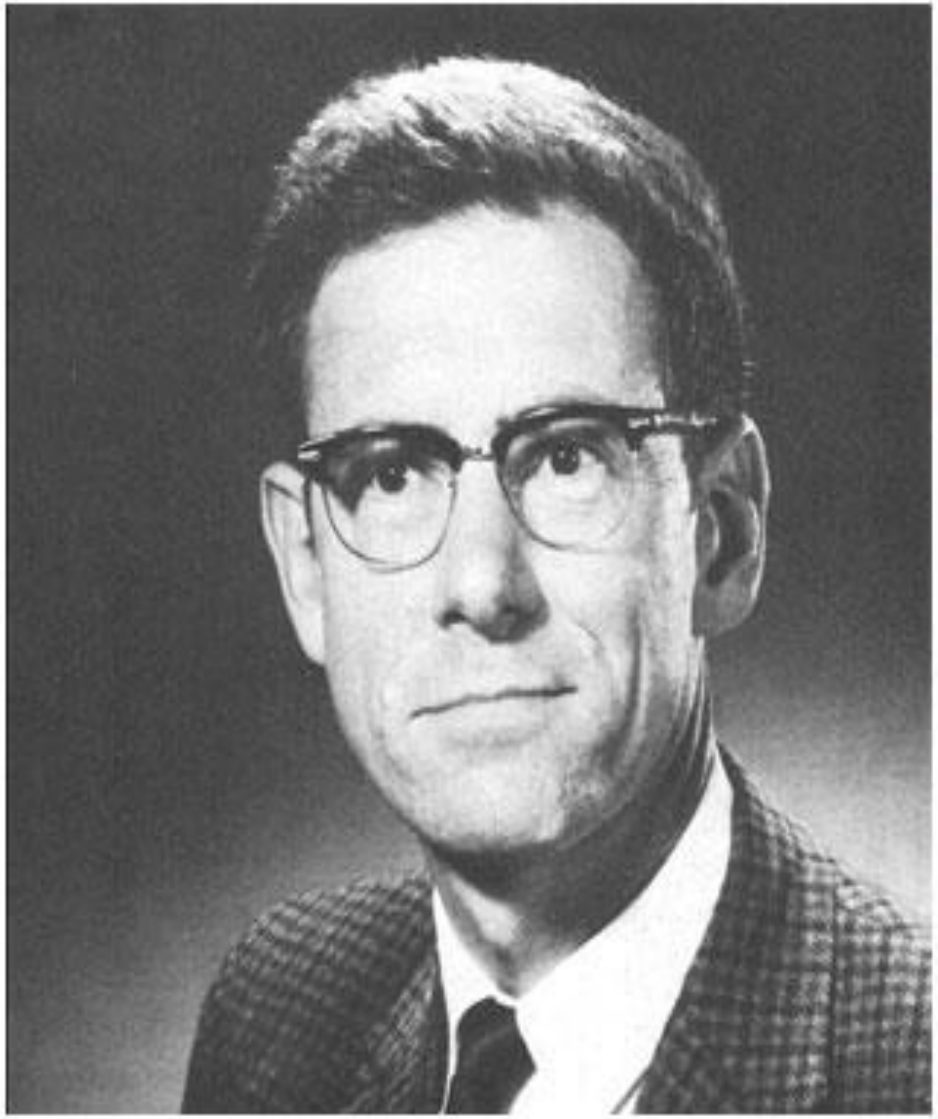
R.H. Whittaker (1969), an American Taxonomist, classified all organisms into five kingdoms:

Monera, Protista, Fungi, Plantae and Animal.

He used following criteria for classification:

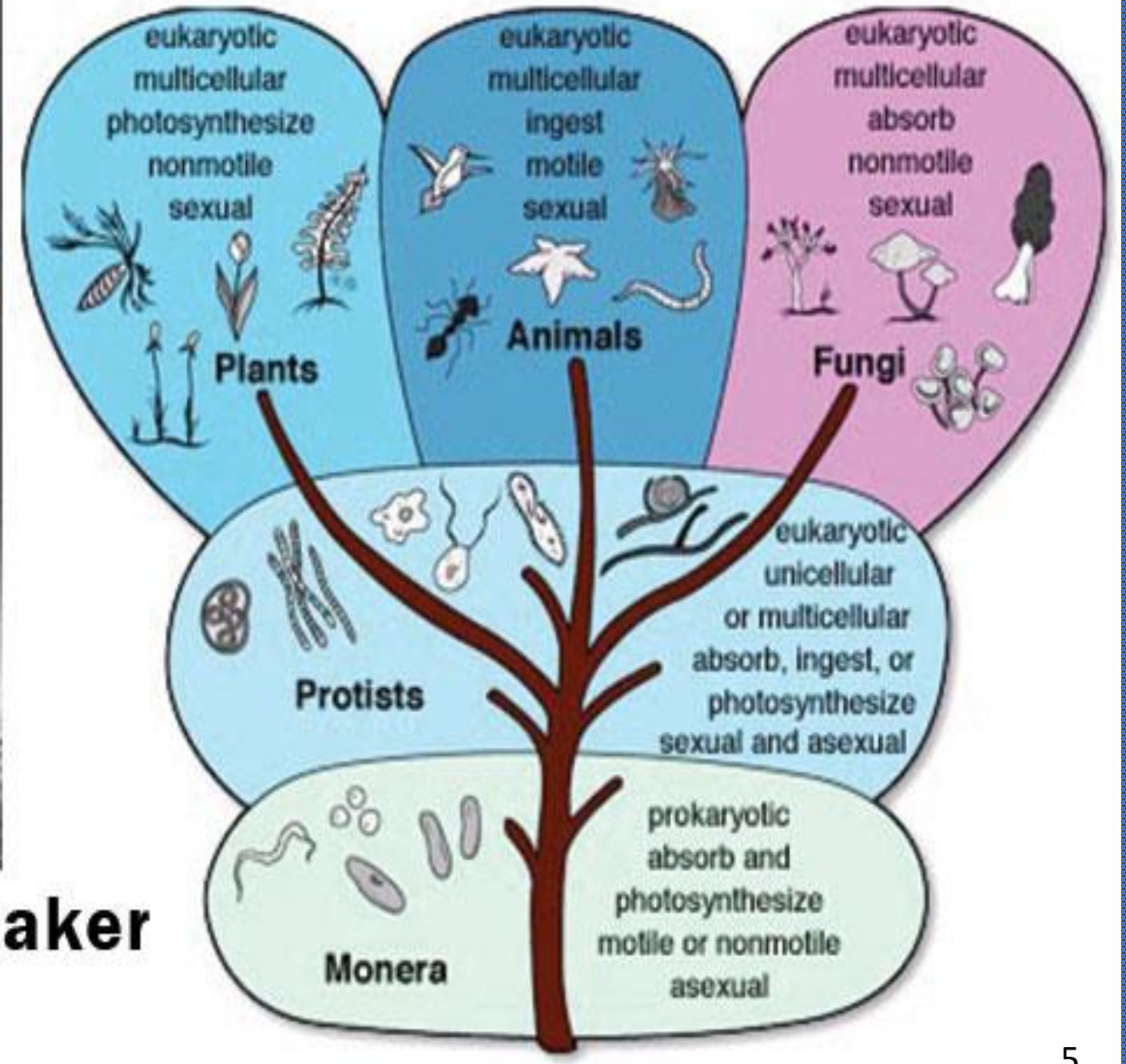
- (i) Complexity of cell structure
- (ii) Complexity of body organization
- (ii) The mode of nutrition
- (iv) Life style (ecological role) and
- (v) Phylogenetic relationship





Robert Harding Whittaker

(1920 – 1980)



Features of Five Kingdom System of Classification

- Whitaker proposed that organisms should be broadly divided into kingdoms, based on certain characters like the structure of the cell, mode of nutrition, the source of nutrition, interrelationship, body organization, and reproduction.

The kingdoms include:

- Bacteria and archaea are in the **Kingdom Prokaryotae (or Monera)**
- Algae and protozoa are in the **Kingdom Protista** (organisms in this kingdom are referred to as protists)
- Fungi are in the **Kingdom Fungi**
- Plants are in the **Kingdom Plantae**
- Animals are in the **Kingdom Animalia**

Five kingdom classification

R.H.Whittaker taxonomist was the first one to propose five kingdom classification.

	Monera	Protista	Fungi	Plantae	Animalia
Type	Unicellular Prokaryotes	Unicellular Eukaryotes	Multicellular Non green Eukaryotic	Multicellular, Eukaryotic	Multicellular Eukaryotic
Mode of nutrition	Autotrophic or Heterotrophic	Autotrophic or Heterotrophic	Saprophytic or Parasitic Sometimes Symbiotic	Autotrophic	Heterotrophic
Body	Lack well defined nucleus and cell organelles	Some organisms use pseudopodia or cilia or flagella for movement	Fungus is made up of long filaments called hyphae. The network of hyphae is mycelium	Exhibits high level of tissue differentiation and have specialized body organs.	Exhibits high level of tissue differentiation and have specialized body organs. They have well developed nervous system.
examples	Bacteria, Blue-green Algae 	Amoeba, Paramecium, Euglena 	Yeast, Rhizopus, Mushrooms moulds 	Trees, Plants, Shrubs 	Fish, Insects, Animals Humans, Birds 

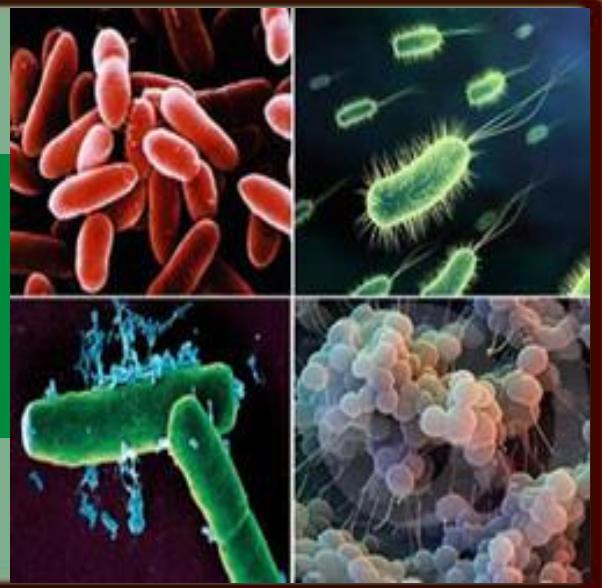
Merits of Five Kingdom Classification System

- (a) Euglena and other transition types which had been included both amongst plants and animals are given proper place under kingdom—Protista.
- (b) Fungi have their own biochemical, physiological and structural organisation. They have never been related to plants. In this system of classification fungi are separately placed.
- (c) A separate kingdom of prokaryotes include Monera has been created. Monerans differ from all other organisms in their cellular, reproductive and physiological organisations.
- (d) The five kingdom classification system is based on cellular organisation, the mode of nutrition and complexity of structure. These were the basic factors used in earliest two kingdom system of classification.
- (e) The system shows the gradual evolution of early organisms into plants and animals.
- (f) The plant and animal kingdoms are more homogenous than, they were in the two kingdom system of classification.

Demerits of Five Kingdom Classification System

- (a) Animal protozoans have been included in kingdom—Protista, which also includes unicellular plants. They show different modes of nutrition.
- (b) Yeasts are though, unicellular eukaryotes, do not belong to kingdom—Protista.
- (c) Chlorella and Chlamydomonas, though unicellular included under the kingdom-Plantae. They should be kept in Protista.
- (d) Euglena like organisms and slime moulds with flexible life style may need the creation of an intermediate kingdom of Protista.
- (e) Viruses and viroids are not kept in proper place in this system.

KINGDOM MONERA



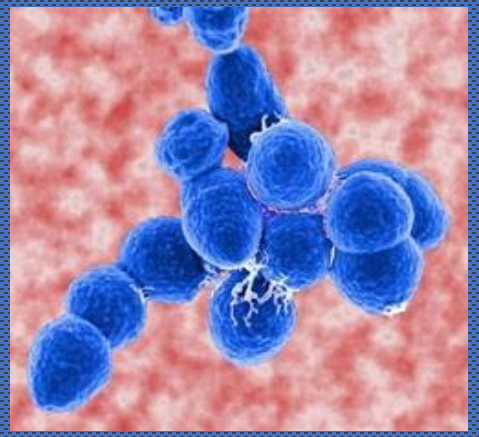
2.1 Monera (Kingdom of Prokaryotes):

- (a) The members of this kingdom are microscopic prokaryotes.
- (b) Monerans are mostly unicellular. But some are mycelial, filamentous (e.g. Nostoc) or colonial.
- (c) The cells are prokaryotic with one envelope system or organisation.
- (d) Cell wall usually present (except Mycoplasma) which composed of peptidoglycan or murein.
- (e) True nucleus and other membrane bounded organelles absent.
- (f) Genetic material is a circular naked DNA (without histone proteins) lies coiled near the centre of cell called nucleoid.
- (g) More than one structural genes (cistrons) arranged together and regulated in units called operons.
- (h) Ribosomes 70s type. (30S + 50S type)
- (i) Cytoskeleton (microtubules, microfilaments and intermediate filaments) absent.
- (j) Flagella if present consists of flagellant proteins.

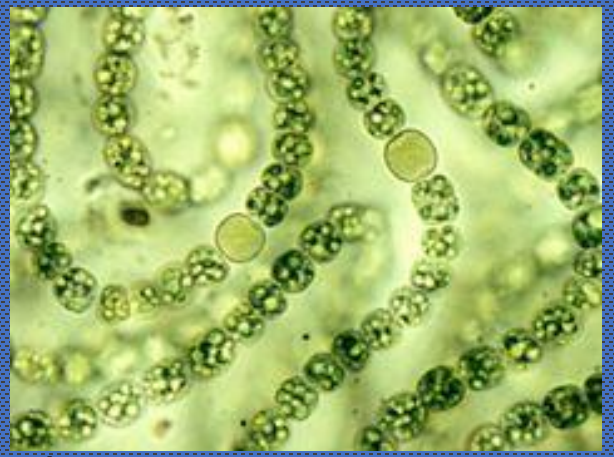
2.1 Monera (Kingdom of Prokaryotes):

- (k) Nutrition may be autotrophic (photoautotrophic or chemoautotrophic). Saprotrophic, parasitic or symbiotic.
- (l) Reproduction mainly occurs by binary fission. Sexual reproduction (Gamete formation) absent. In some cases genetic recombination occurs.
- (m) They are the important decomposers and mineralizes and help in recycling of nutrients in biosphere.
- (n) Most are found in deep ocean floor, hot deserts, hot springs and even inside other organisms.
- Monera includes archaebacteria, bacteria, cyanobacteria (BGA), and filamentous actinomycetes.

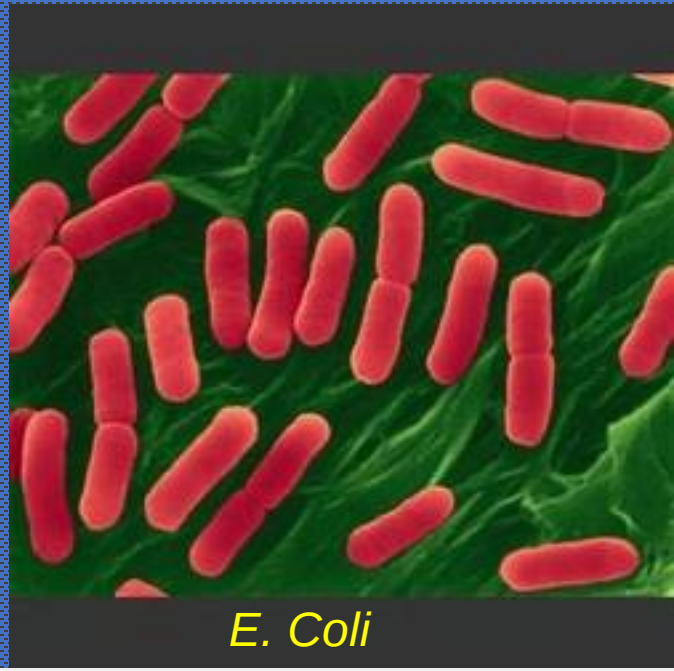
Streptococcus pyogenes



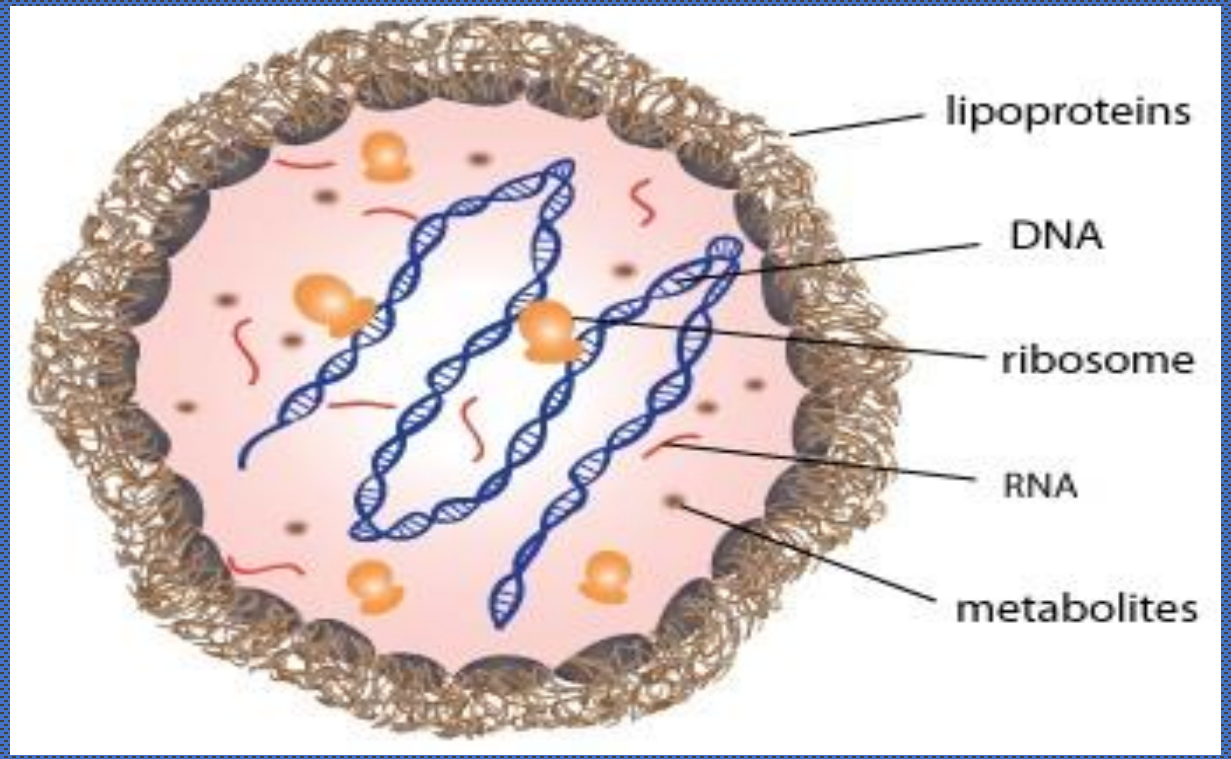
Streptococcus pneumoniae



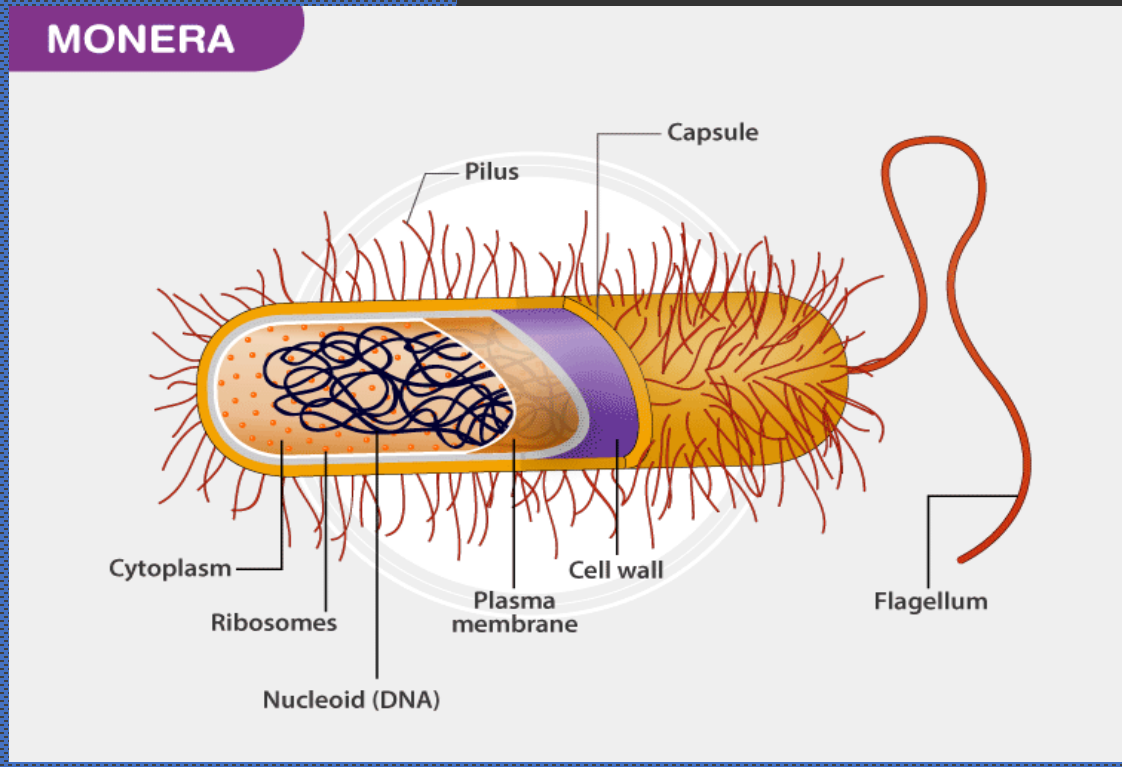
BGA



E. Coli



Mycoplasma (PPLO)

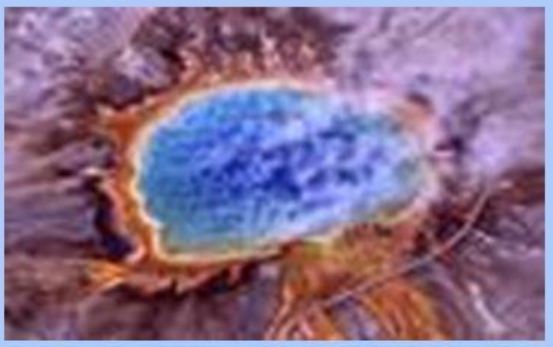


2.1.1 ARCHAEBACTERIA

- **Archaebacteria (Archae- ancient; bact—rod) are special since, they live in some of the most harsh habitats such as**
- **extreme salty areas (halophiles),**
- **hot springs (thermoacidophiles) and**
- **marshy areas (methanogens).**

Examples of Archaebacteria

- *Thermophiles*



- *Acidophiles*

- *Halophiles*

2.1.1 ARCHAEBACTERIA

The characteristics of this domain are

(i) They are most primitive prokaryotes.

(ii) They are found in stressed environment, such as high salt content (Great salt lake, the dead sea), edge of the ocean, hot sulphur springs, volcanic walls, etc.

(iii) Their cell walls lack peptidoglycan. In most cases, the wall composed of non-cellulosic polysaccharides and some proteins. In some members, there is no cell wall. This feature of having different cell walls is responsible for their survival in extreme condition.

(iv) Most of the archaebacteria are chemoautotrophs.

2.1.1 ARCHAEBACTERIA

Types of Archaebacteria

Archaebacteria are of following three types

i. Methanogens

These are stricdy anaerobes. They live anaerobically in gut of several ruminants. These bacteria help in fermentation of cellulose. They produce almost 65% of atmospheric methane. Example Methanobacterium, Methanobacillus, Methanosarcina and Methanococcus.

ii. Halophiles

These are found in extreme saline environments like salt lakes, salt marshes, salt pans, salt solutions, etc. They are mostly anaerobes. They contain a chemical called halorhodopsin to pump in chlorides into the cell to prevent cellular dehydration.
Halobacterium develops purple membrane having photoreceptor pigment bacteriorhodopsin. Examples Halobacterium and Halococcus.

iii. Thermoacidophiles

These archaebacteria can live in both extreme heat and acidic pH (around 2) environment. Under anaerobic conditions, these organisms oxidise sulphur to sulphuric acid.

$2S + 2H_2O + 3O_2 \longrightarrow 2H_2SO_4 + \text{Energy}$

Thermoacidophiles can survive in high temperature and low pH conditions because of

(a) Special branched chain lipids in cell membranes that reduce cell fluidity.

(b) Enzymes can work at low pH.

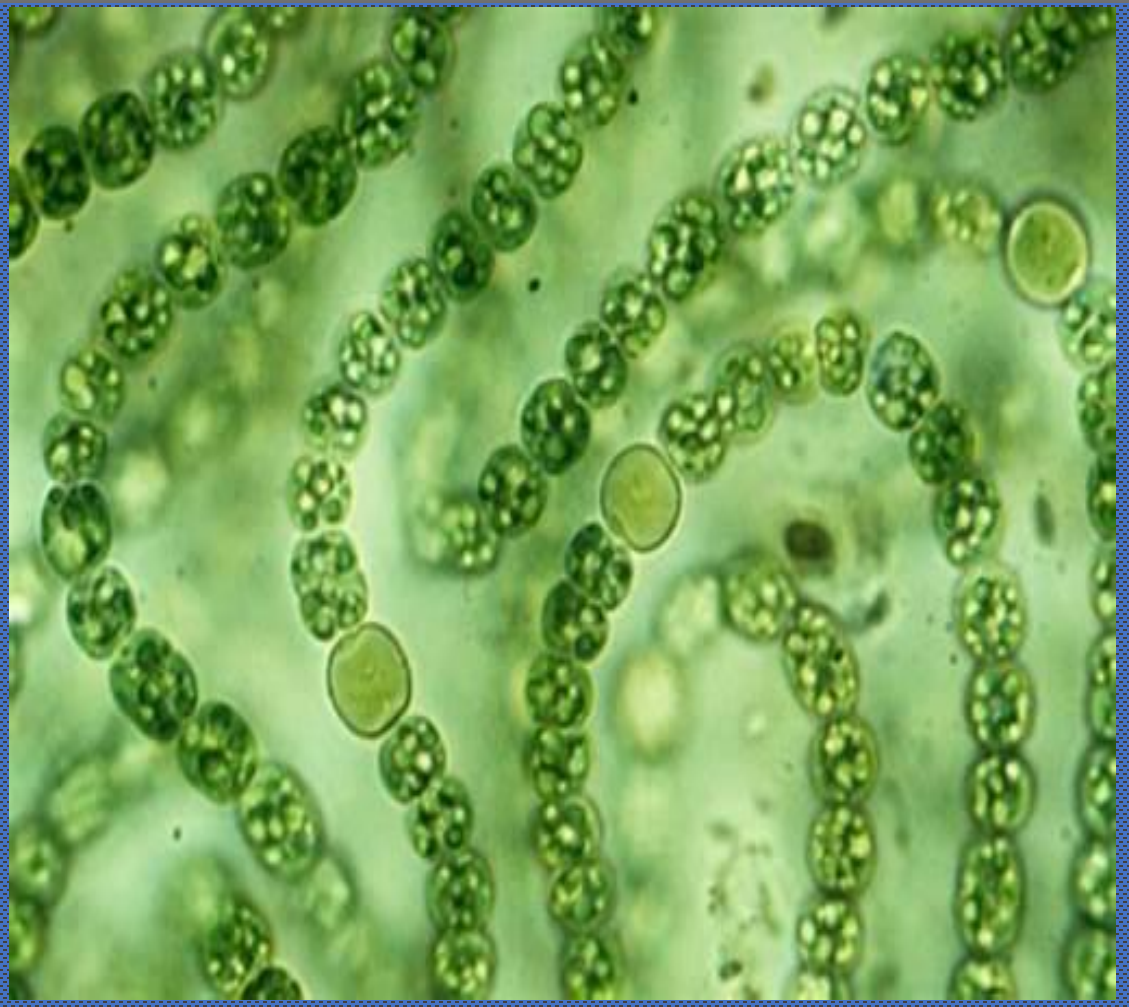
(c) Enzymes are resistant to high temperature coagulation. Examples Sulfobolus, Thermoplasma and Thermoproteus.

2.1.2 EUBACTERIA

They are called 'true bacteria' and are characterised by the presence of a rigid cell walls, and if motile, have flagellum.

- **Cyanobacteria**

  Cyanobacteria, member of this group (blue-green algae) have many characters similar to bacteria. The examples of cyanobacteria are Nostoc, Oscillatoria, Spirulina, Rivularia, Anabaena, etc. They can survive in a wide variety of habitats, such as hot springs, sea water, polluted water, etc.



2.1.2 EUBACTERIA

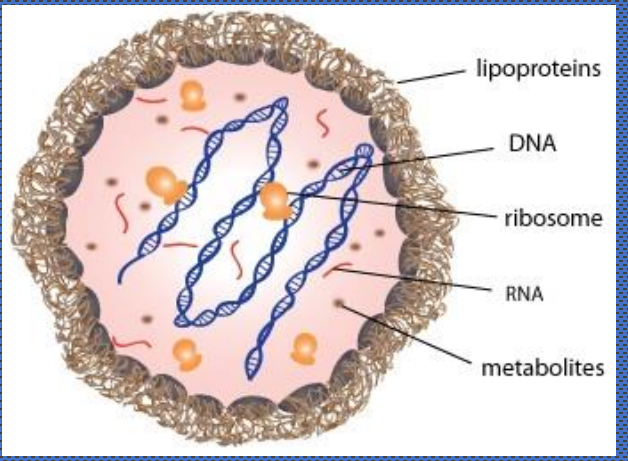
Major Characteristics of Eubacteria

Some of the main nutritional modes of different species in the domain Eubacteria include:

- · **Autotrophic** – **Produce their own food through photosynthetic processes**
- · **Heterotrophic** - **Obtain nutrients from their environment (because they are unable to synthesize their own food)**
- · **Strictly or facultatively aerobic** - Survive in the presence of oxygen (strict aerobes) or can switch to anaerobic respiration in the absence of oxygen (facultative anaerobes)
- · **Strictly or facultatively anaerobic** - Survive in the absence of oxygen (strict anaerobes) or can survive with or without oxygen (facultative anaerobes)

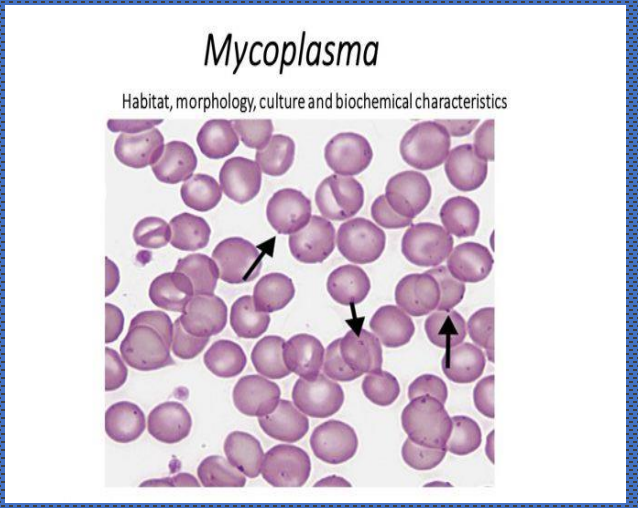
Mycoplasma

Mycoplasma are organisms that completely lack a cell wall.
They were discovered by Roux (1898) in pleural fluid of cattle suffering from pleuropneumonia.
The organisms are often called MLOs (Mycoplasma Like Organisms) or PPLOs (Pleuropneumonia Like Organisms).

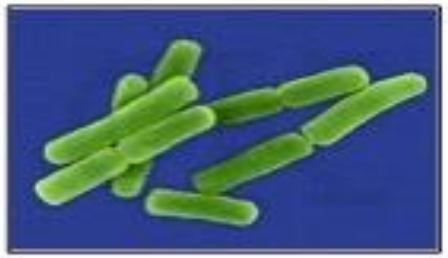
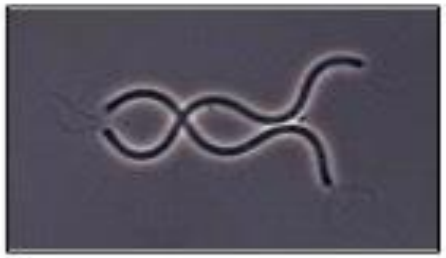
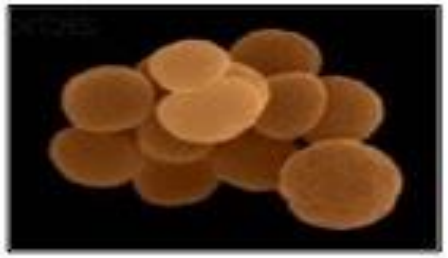
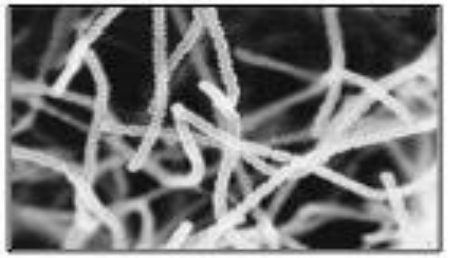


The characteristic features of mycoplasma are

(i) Their size ranges from 0.1-0.5 pm and have organised nucleus, plastids, mitochondria and other organelles are absent.
(ii) DNA is naked (because of absence of histones) and ribosomes (of 70S type).
(iii) Mycoplasma possess heterotrophic nutrition. Examples Mycoplasma gallisepticum, M. laidlawii. They cause pleuropneumonia in domestic animals, mycoplasmal urethritis in humans.



Sub-Classifications of Eubacteria

Circular	Rod-shaped	Curved Forms	Other Shapes
 Diplo- (in pairs)	 Coccobacilli (oval)	 Vibrio (curved rod)	 Helicobacter (helical)
 Strepto- (in chains)	 Streptobacilli	 Spirilla (coil)	 Corynebacter (club)
 Staphylo- (clusters)	 Mycobacteria	 Spirochete (spiral)	 Streptomyces

Contd...