R. Selvam (1)

Diversity of MICROBES :-

Microbial diversity may be defined as the variability among living organisms. (Biological diversity (or) Bio diversity).

This includes the diversity within the species, between species and of ecosystem.

The current list of the world's biodiversity is quite incomplete and that of viruses, M/o & invertebrates is especially deficient.

The fungal diversity indicate the total number of species in a particular taxonomic group.

To estimate of 1.5 million fungal species is based principally on a ratio of vascular plants of fungi about 1:6

Estimation of biological species*

Group	Known Species	Estimated total Species	percentage of Known species
1. Viruses	5,000	1,30,000	4
2. Bacteria	4,760	40,000	12
3. Fungi	69,000	1,500,000	5 %
4. Algae	40,000	60,000	67 %
5. Bryophytes	17,000	25,000	68 %
6. Gymnosperms	750	-	-
7. Angiosperms	2,50,000	2,70,000	92%
8. Protozoa	30,800	1,00,000	31

Based on Dicastri and Younes (1990), Bull & Hand Man (1991)

The microbial diversity, therefore, appears in large measures to reflect obligate or facultative associations with higher organisms and to be determined by the spatio-temporal diversity of their hosts or associates.

Systematics devise kingdoms as the major frame work for grouping organisms with similar charecteristics.

In 1700's Carolus linnaeus a swedish Scientist, introduced binomial system called "species plantaram"

He divided all living beings into two kingdoms namely plantea and animalia.

↳ He included all microorganisms under plantae

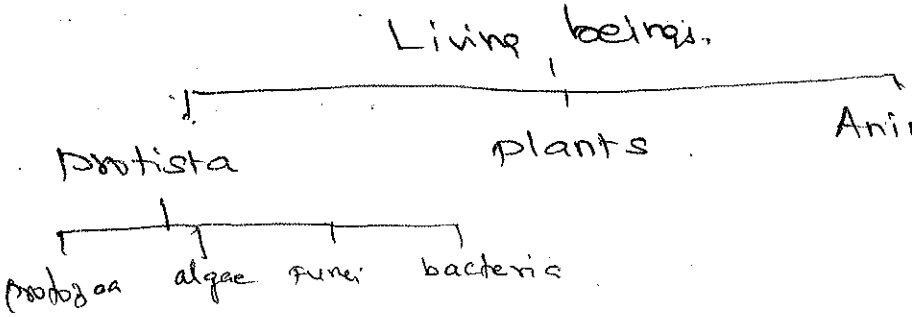
Living Beings

plantae	Animalia
(plants & M/o)	(all animals),

Later year it was realized that the "king dom plantae" was not exact for m/o due to cellularity and cell nature among the different groups.

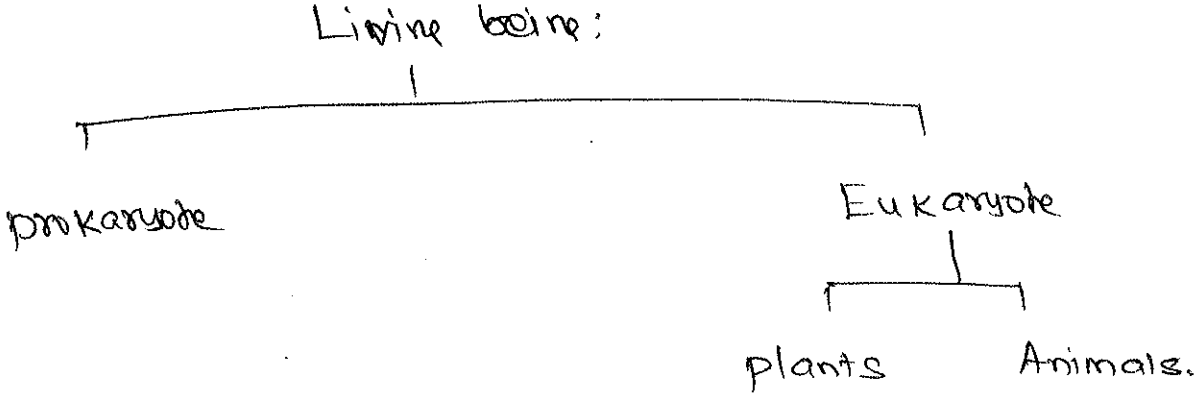
In 1865 a German Scientist Ernst haeckel proposed a third kingdom called "protista" to include m/o.

He placed m/o such as protozoa, algae, fungi and bacteria under protista.



In 1962 Stamir and Van Niel distinguished the concept of bacteria on the basis of cell anatomy.

Thus prokaryote formed a part of microbiology

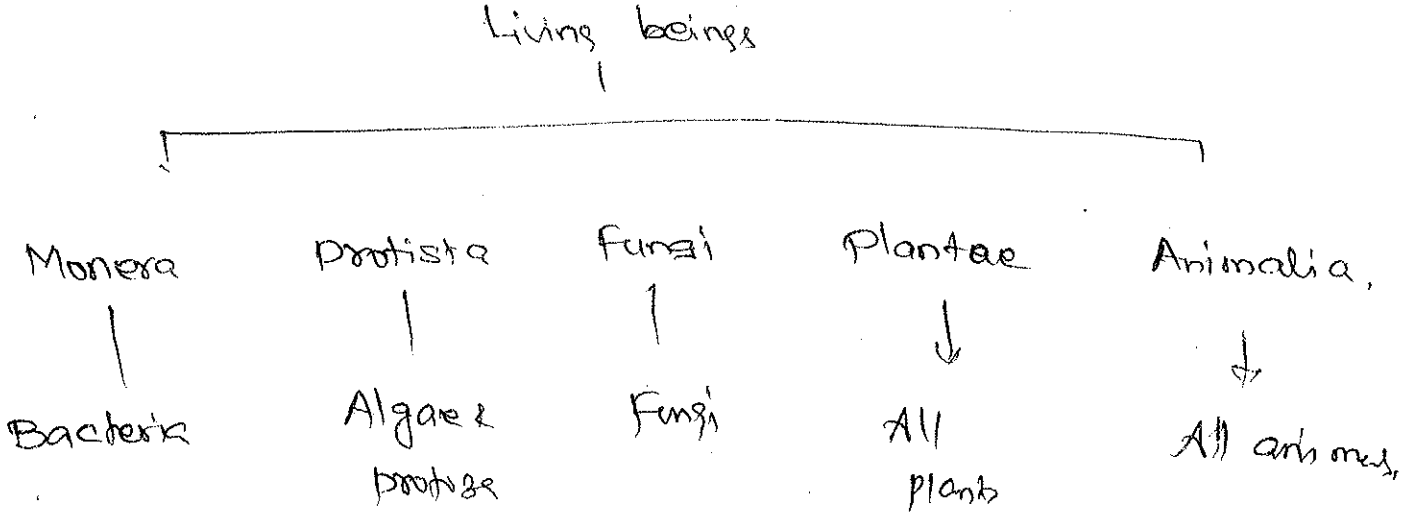


In 1969 R.H. Whittaker proposed a five kingdom Concept, namely plantae, animalia, fungi, protista and monera.

≠ Here bacteria was included Monera,

≠ Single cell algae and protozoa were included in kingdom protista.

⇒ Fungi placed in the kingdom Fungi whereas plants and animals are placed in plantae & animalia.



In 1980's C.R. Whose et al, on the basis of 5S RNA Studies proposed that the five kingdom Concept. which doesnot accurately show the evolutionary relationships among the living beings.

They propored a three kingdom system of classifica namely Eubacteria, Archeabacteria and Eukaryotes Living beings.

Eubacteria	Archae bacteria	Eukaryote
1. G+	Halobacters	Microsporidia
2. purple bacters.	Methanogen	Flagellates
3. Cyano bacters.	Thermophile	Slime moulds
4. Green Sulphur bacters.		Fungi, plants
5. Green non-Sulphur bacters.		Animals.
6. Spinchetes, Flavo bacters.		
7. Chalamydia, Planetomyces		

Both Whittaker & woese systems of classification based on cellular M/o ignore viruses because they are non-cellular M/o.

MICROBIAL TAXONOMY:

≠ Taxonomy is defined as the Science of "biological classific

≠ Classification means the ordering of groups from lower unit to higher units.

≠ The basic unit of taxonomic rank is Species

≠ A bacterial species is a collection of strains that shares essential characteristics which differ from all other ~~organism~~ strains.

≠ A single bacterial colony represents a clone.

≠ The highest unit of taxonomy is Kingdom.

≠ The kingdom can be divided successively into division, class, order, family, genus & species.

eg: pneumonia.

Kingdom – prokaryote.
Division – Tenericutes
Class – Mollicutes
Order – Mycoplasmatales
Family – Mycoplasmataceae
Genus – mycoplasma
Species – mycoplasma pneumoniae.

Classification of Mo.

1. Criteria of classification :-

These criteria sometimes do not help in characterisation of these genera or species which are not characterised by traditional biochemical or physiological tests.

Serological tests (agglutination, fluorescent antibody techniques etc), have limited role in classification but have enormous value in identification.

Genetic tools are the modern one for identification of bacteria, based on the detection of a specific portion of an organisms's genetic material.

2. General Methods of classifying Bacteria :-

(1) The Intuitive Method :-

Since a large array of microbiologist study the characteristics of organisms (morphological, physiological, biochemical, genetical, Molecular). ~~Sometimes~~.

Sometimes it is difficult to assign an organism based on all the characters because a character may be important to a particular microbiologist may not be that important to another, hence different taxonomists may arrive at very different groupings. Some times this approach is useful.

(11) Numerical Taxonomy:-

This is based on several characteristics for each strain and each character is given equal weightage.

The % Similarity of each strain may determined by the following ~~further~~ equation

$$\% S = \frac{NS}{NS + ND}$$

where

NS - no. of character for each strain which similar

ND : Number of characteristics that are ~~not~~ dissimilar

On the basis of % S, S = Similarity, If it is high to each other, placed in to groups lager and so on.

(3) Genetic Relatedness.

This classification is based on genetic relatedness (DNA & RNA) between organisms.

% of G+C determines the organism whether it is the same (or) different species.

If two organisms have quite different mol % G+C, than the species are different and seem to be not related to each other.

a) DNA - DNA hybridisation (or) DNA - homology:-

After annealing ie seperation of two strand and converting them in to single strand, the latter one is mixed with those obtained from other organisms.

If two organisms are similar the pairing will occur in strands of both the organisms and will form hetero duplexes otherwise not.

(b) 16S rRNA Sequencing:-

Due to the highly Conserve nature of rRNA gene the 16S rRNA nucleotides sequence gives better information than DNA molecule.

It is important to mention that if there is no DNA - DNA relatedness (homology) between two organisms still nucleotide sequence of their rRNA cistrons may be studied so as to observe the similarity.

Hence the degree of similarity may be used as a measure of relatedness between organisms, but at a level beyond that of species.