Taxonomy of Fungi

Taxonomy is the science of classification, i.e. the assigning of objects to defined categories. Classification has three main functions: it provides a framework of recognizable features by which an organism under examination can be identified; it is an attempt to group together organisms that are related to each other; and it assists in the retrieval of information about the identified organism in the form of a list or catalogue.

Traditional and modern taxonomic methods

Early philosophers classified matter into three Kingdoms: Animal, Vegetable, and Mineral. Fungi were placed in the Vegetable Kingdom because of certain similarities to plants such as their lack of mobility, absorptive nutrition, and reproduction by spores. Early systems of classification were based on morphological (macroscopic) similarity. but the invention of the light microscope revealed that structures such as fruit bodies which looked alike could be anatomically distinct and reproduce in fundamentally different ways, leading them to be classified apart.

Until the 1980s, the taxonomy of fungi was based mainly on light microscopic examination of typical morphological features, giving rise to classification schemes which are now known to be unnatural. Useful ultrastructural details, provided by transmission electron microscopy TEM, concern the appearance of mitochondria, properties of the septal pore, details of the cell wall during spore formation or germination, or the arrangement of secretory vesicles in the apex of growing hyphae**.**
Biochemical methods have also made valuable contributions, especially in characterizing higher taxonomic levels. Examples include the chemical composition of the cell wall, alternative pathways of lysine biosynthesis, the occurrence of pigments and the types and amounts of sugars or polyols. Microscopic features are still important today for recognizing fungi and making an initial identification which

can then, if necessary, be backed up by molecular methods. Indeed, the comparison of DNA sequences obtained from fungi is meaningful only if these fungi have previously been characterized and named by conventional methods. It is therefore just as necessary today as it ever was to teach mycology students the art of examining and identifying fungi.

Fungi are a specific and large kingdom and it is difficult to classify them. So we must collect a lot of information starting with cultural characters reaching to the spore. Generally, the characters used in fungal classification are:

1. Cell wall
   Cell wall present: true fungi
   Cell wall absent: slime molds
2. Chemical components of cell wall
3. Somatic phase
4. Reproduction
5. Structure formed by fungi
6. Spores : size, color, shape, number of cell and type of spores.

Process of Classification

Have three distinct steps:

1. Identification
2. The relationships among other fungi and living organisms
3. Nomenclature

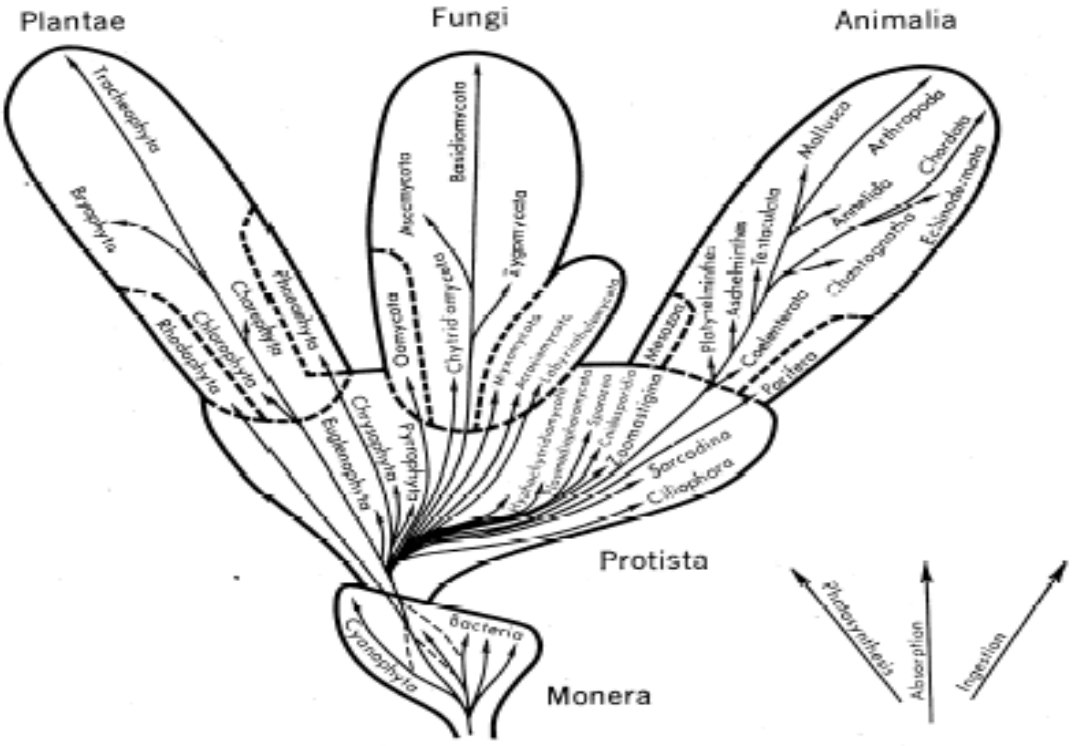
The mycologists of fungal taxonomy:

1. **Carl Linnaeus (1707-1778) the "Father of Taxonomy"**

   " *Minerals exist; plants exist and live; animals exist, live and sense*."

   Plants without obvious sexual organs were classified in Class Cryptogamia (lichens, **fungi**, mosses, ferns), Fungi are primitive plants under this classification of organisms

2. **R. H. Whittaker's 1969 Classification:** divided the living organisms in to five kingdoms according to cellular characterizations and he placed all eukaryotes, heterotrophs and have cell wall organisms in kingdom fungi



3. Alexopoulos *et al*. : in his book "Introductory Mycology" 1962 ,2nd ed.

He put the fungi in one division "myota" and divided it into two subdivision as follow :

1. Organisms of uncertain affinity Slime molds :

   Order: Acrasiales
   Order: Labyrinthulales
) some of slime molds

2. Division: Mycota

A. Sub division: Myxomycotina (slime molds)

B. Eumycotina (true fungi)

Classes: Chytridiomycetes, Hyphochytridiomycetes, Oomycetes, Plasmodiophoramycetes. Zygomycetes, Trichomycetes, Ascomycetes, Basidiomycetes and Deutromycetes.

4. Alexopoulos *et al*. : in his book "Introductory Mycology" 1979 , 3rd ed.

He put the fungi in kingdom "Mycetae" and divided them in to three divisions as follow:

Kingdom: Mycetae
Division1: Gymnomycota
Division2: Mastigomycota
Division3: Amastigomycota

The classification system in fungi at this edition started with kingdom and end with species as follows:

Kingdom: Mycetae (Fungi)
Division: Mycota
Subdivision: Mycotina
Class: Mycetes
Subclass: Mycetidae
Series: Mycetes
Order: ales
Family: aceae
Genus and Species: There is no special ends

5. **Alexopoulos *et al*. : in his book "Introductory Mycology" 1996 , 4th ed.**
   He put the fungi in three kingdoms and divided them in to phylum as follows:
   Kingdom1: protista
   Kingdom2: straminipila
   Kingdom3: true fungi

6. **Kendrick in his book " fifth kingdom"(2002) put the fungi in three groups**
   as follows:
   1: Pseudo Fungi: Included Slime Molds
   2:Simple Fungi
   3:True Fungi
7. **Minnesote University classification in USA(2005): divided fungi in**
   To two large super kingdoms as follows:

   1. **Super kingdom Eumycota :** included
      kingdom Eumycota
      (Phylum : Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota and form group Deurtomycota).

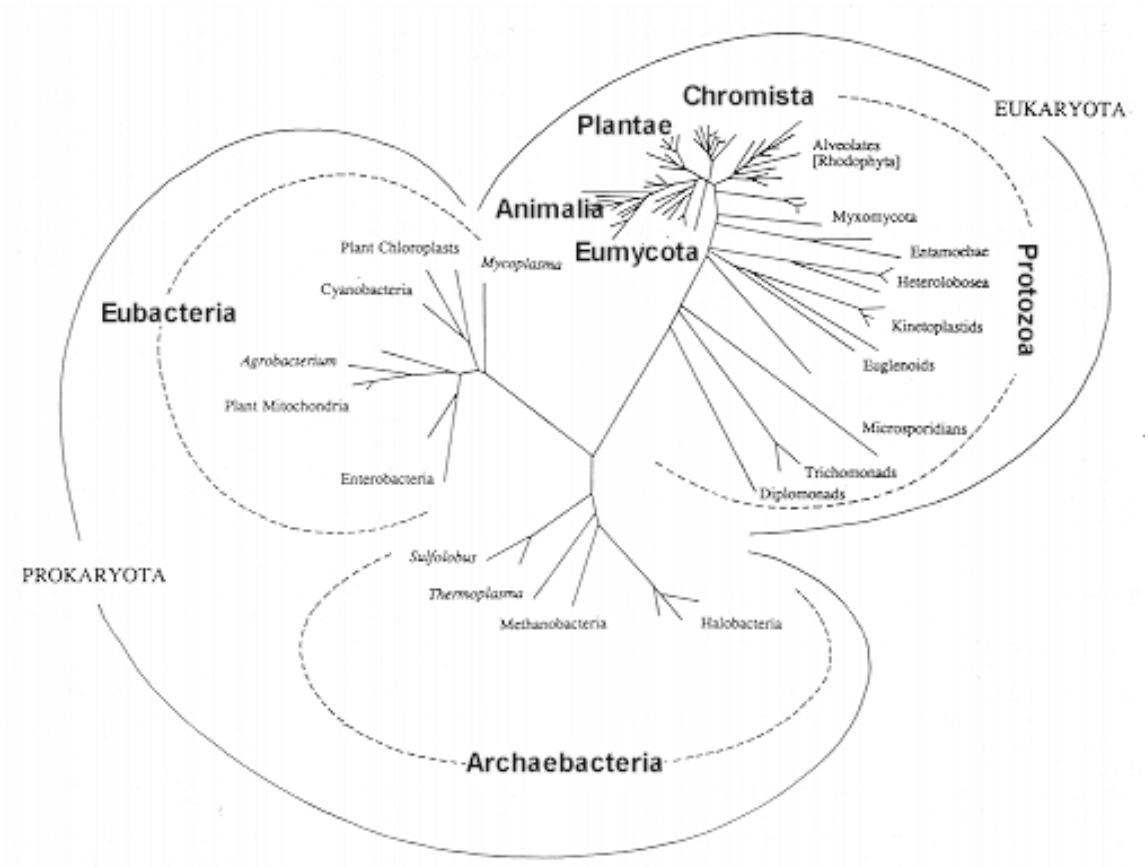
   2. **Super kingdom Psudomycota:** included
      a. kingdom Mycetozon **(** phylum: Myxomycota)
      b. kingdom protozoa **(**phylum: Plasmodiophoromycota)
      c. kingdom Straminipila or Chromista
      (phylum: Oomycota and phylum: Hyphochytriomycota)

8. The modern classification:

At least 7 kingdoms are now recognized:

Eubacteria, Archaebacteria, Animalia, Plantae, Eumycota, Stramenopila (Chromista), Protoctista (Protozoa, Protista)

True fungi are recognized as kingdom: Fungi . While slime molds and lower fungi were distributed on two kingdoms: Chromista (Straminipila) and Protozoa.



The classification scheme adopted in book of Webster and Weber (Introduction to Fungi, 2007 3rd ed.) , showing mainly those groups treated in some detail.

Kingdom1: Protozoa
Phylum1 :Myxomycota
Acrasiomycetes
Dictyosteliomycetes
Protosteliomycetes
Phylum2 :Plasmodiophoromycota
Plasmodiophorales
Haptoglossales

Kingdom2: Straminipila
(minor fungal phyla)
Phylum1 :Hyphochytriomycota
Phylum2:Labyrinthulomycota
Labyrinthulomycetes
Thraustochytriomycetes
Phylum3:Oomycota
Saprolegniales
Pythiales
Peronosporales

Kingdom3: Fungi (Eumycota)
Phylum1 : Chytridiomycota
Phylum2 : Zygomycota
Phylum3 : Basidiomycota
Phylum 4: Ascomycota
Phylum 5: Anamorphic fungi