Rayat Shikshan Sanstha

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Department of Zoology

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Chapter: 1

Topic: Principles of Classification

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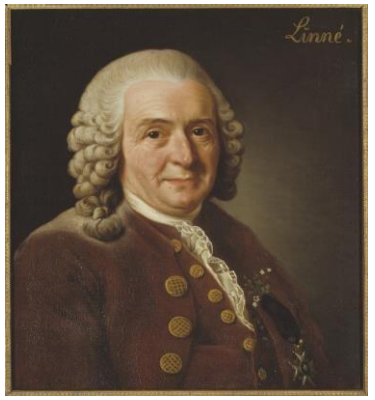
CHAPTER 1

PRINCIPLES OF CLASSIFICATION

Introduction

- Taxonomy is the branch of biology that deals with the identification, nomenclature & classification of organisms
- IDENTIFICATION – placing of new organism in previously described group
- NOMENCLATURE – naming of organism
- CLASSIFICATION – ordering of organism into group; can be phenetic or phylogenetic

PRINCIPLES OF TAXONOMY



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TAXONOMY:

- Branch of biology that deals with identification, classification and nomenclature of organisms.
- Taxonomy provides correct identification of organisms.
- The word taxonomy was coined by A.P.de Candolle.

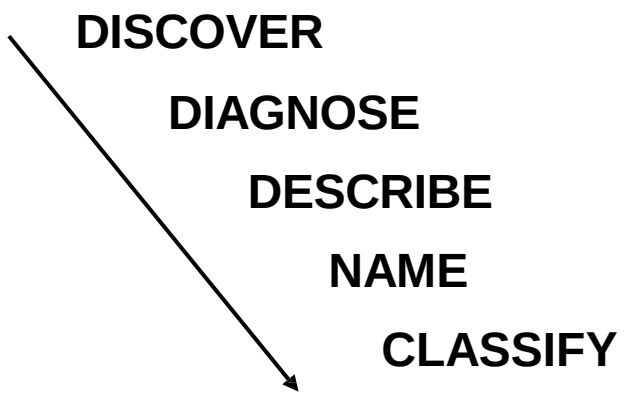
SYSTEMATICS:

- Term was first used by Linnaeus in his book 'Systema naturae'
- Taxonomy and evolutionary relationship of all the organisms.

PRINCIPLES OF TAXONOMY

METHODS OF TAXONOMY :

- Discovery of new species;
- Recognition and diagnosing of taxa on the basis of characters (morphological, molecular, behavioral, etc.)
- Formal description and naming of the species
- Placement of species within a hierarchical classification.

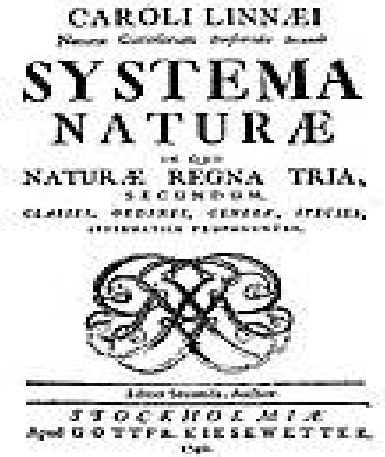


PRINCIPLES OF TAXONOMY

- Carolus Linnaeus, Swedish naturalist, 'Father of Taxonomy' developed a system to name and organize species.
- He explained the new system of classification of nature in his book 'Systema naturae'.
- Linnaeus contributions to classification :

  a) Linnean system of classification 'hierarchical model'.

  b) Binomial nomenclature.


CAROLI LINNÆI
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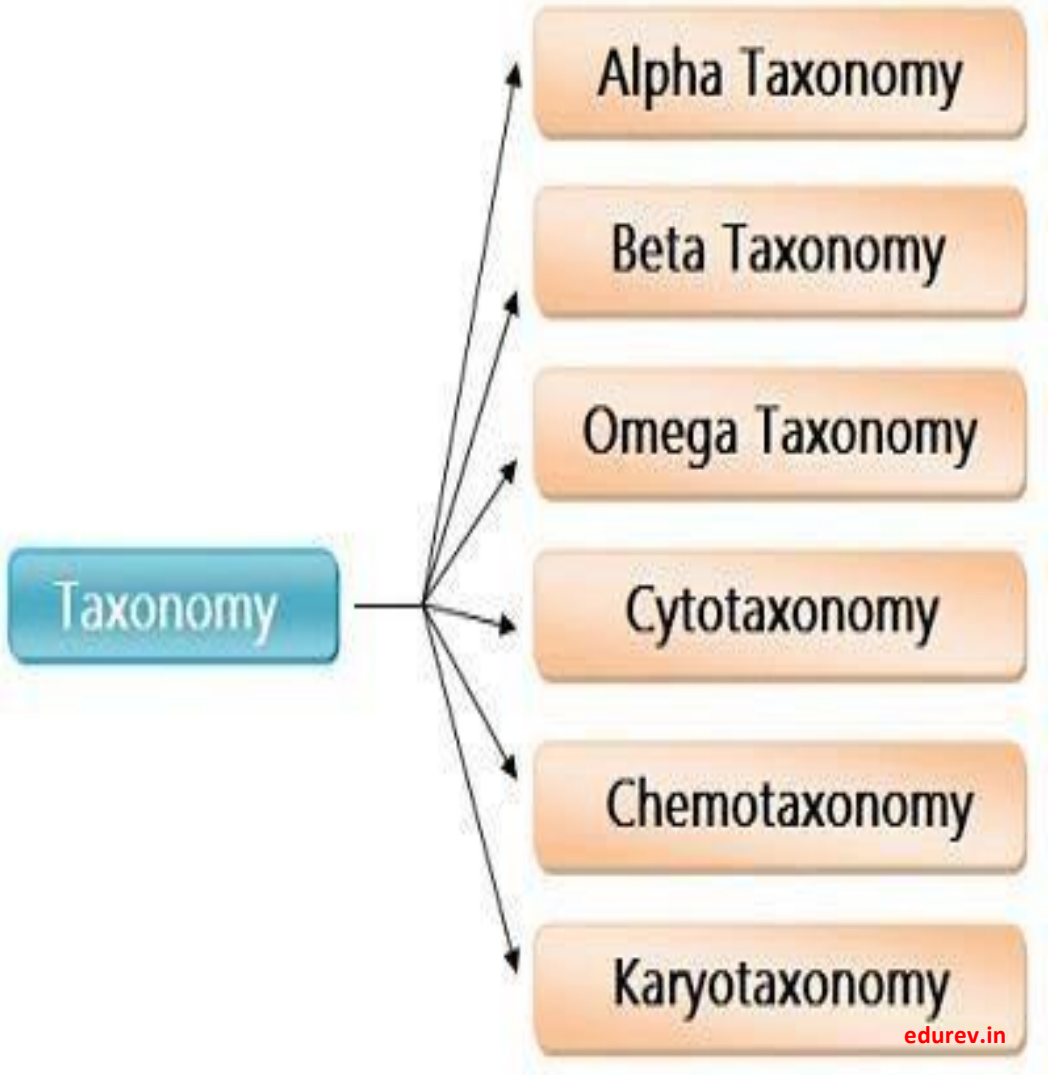
PRINCIPLES OF TAXONOMY: TYPES & LEVELS OF TAXONOMY



Alpha taxonomy: morphological characters
Beta taxonomy: genetical, anatomical, cytological, physiological characters
Omega taxonomy: Phylogenetic relationships
Cyto taxonomy: cytological characters
Chemo taxonomy: Use of chemical compounds present in plants
Karyo taxonomy: characters of Nucleus and chromosomes; patterns of chromosome bands

PRINCIPLES OF TAXONOMY

Types of Classification:

i) Artificial system: one or few superficial characters chosen randomly

e.g. Aristotle classified the organisms on the basis of habitat

ii) Natural system: information pertaining to constant and natural characters of plants are taken into consideration.

e.g. Bentham and Hooker classification of plants.

iii) Phylogenetic system : phylogenetic & genetical relationships of organisms.

e.g. Engler and Prantl's classification of flowering plants.

Systematics, Linnaean hierarchy,[Phylum ,class ,order, family, genus, species]

Systematics:

- Systematics may be defined as the **science of diversity of organisms.**
- A systematics is determined by **comparison**, the **unique properties** of every species and groups of species at **every level of classification.**
- Systematics includes **taxonomy** , **identification**, **classification**, and **nomenclature** and all other **aspects** dealing with different kinds of organisms and **data** about them.
- **Carolus Linnaeus**[1707– 1778] did the remarkable work in the field of taxonomy and therefore , he is often referred to as the '**father of taxonomy** '.
- He introduced the binomial system of nomenclature .
- The work of Linnaeus became the foundation of systematics.

Linnaean Hierarchy:

- **It is the System of classification consists of a hierarchy of groupings called texa which ranges from kingdom to species.**
- There are large no. of plants and animals species in the living world. It is impossible to know them individually by their names or to refer them in the literature. Therefore, it is necessary to arrange them into categories and taxa of different grade.
- **Carlous Linnaeus** was the first taxonomist who establish a definite hierarchy of taxonomic category in animal kingdom. There are species, genus, family, order, phylum and kingdom in hierarchy
- Parallel species are group in the **genus** based on common characteristics. Parallel genera are grouped into a **phylum .**
- Finally parallel **phyla** are placed in a kingdom. The highest grouping kingdom classification called as Hierarchical classification. Hierarchy means a **group of thing ranked one above another.**

Taxonomic category:

Class:

- The class is the subdivision of a phylum. **It** is the basic category called the class group in which infraclasses are included. The classes are best known taxa in animal kingdom.

Ex. The class mammalia include the lion, the cat, dog, rat etc.

Order:

- It is the basic taxonomic category which includes parallel families, suborder, infraorder , superfamilies and infraclasses.
- In some phyla orders are well known groups, but in some they are less well known than classes.

e.g the order carnivora includes families Felidae and Canidae.

Family :

- This is a taxonomic category containing one or more related genera and which is separated from other related families by important and characteristics difference.

e.g the family Felidae includes the tiger, the lion and all types of cats belonging to different genera. But family is distinctly different from Canidae which includes dogs and foxes

Genus:

- The first higher category above the species level is the genus which is the group of related species. The genus has the position of importance in the classification.
- By the rules of binomial nomenclature, a species cannot be named unless it is assigned to genus.
- In general, genus has many features in common. Such groups of common feature are called co−related characters.
- The significance point is species in which such characters occurs together are more closely related .
- Such species belongs to same genus . some times a genus may consist of only one existence species.
- e.g modern man in the genus Homo.

Species:

- It is the most important category in the taxonomic Hierarchy and it is consider as **basic unit in classification and in this process of evolution .**
- species refers to group of organism that closely resemble each other either because they freely inbreed in nature or because they have descended from common ancestor a not too distinct fast they are also called biological species
- e.g in Homo sapien , the sapien the species of homo . the species inhibiting different geographical area are called allopathic species. Where as these species which occupies the same geographical areas are called sympatric species .

Nomenclature:

- In classification, naming is very important, which is called nomenclature.
- It is the system of naming plants or animals. Or a group of plants or animals.
- Taxonomist used the scientific name for an organism which is internationally accepted or universally used for a particular species or a particular animal.

Binomial nomenclature:

- In this type of naming of an organism, the name of the species is composed of two words in Latin. Hence the nomenclature is called **binomial nomenclature.**
- The first word is called **generic name** and it indicates the **genus** to which the species belongs.
- The second word is called **specific name** which indicates the **species** itself.
- e.g Homo sapiens Linnaeus[or L.for short] is the complete scientific or the technical name of the **modern human species**. Here the **homo** is the **genus** to which the species belongs and the **sapiens** is the specific name which identifies the species.
- In case of humans , Linnaeus was the first author who have publish species name Homo sapiens.

- It is also important to note that the generic names always begin with a **capital letter** where as the specific name always begins with **small letter**. It should be printed in **Italics** and **underline** when **type or handwritten.**
- When the binomial system of nomenclature was first used by Linnaeus, the appropriate Latin or Greek common names were used.
  e.g homo = man.In latin man become homo.
- To avoid confusion, two generic names in any kingdom cannot be the same. Specific names can however, be repeated as they often qualify the generic name.

e.g the specific name of both mango [Mangifera indica] and Tamarind [Tamarindus indicus] are the same and means of india often specific name of animals and plants are given in honour of some persons.

- If the person honour is man the specific letter ends in letter ‘i’
  e.g the earthworm Lumbricus friendi is name after Rev. H. Friend.
- If the person honour is the women the specific name ends ‘ae’. Some times the specific name indicates the locality. e.g Indica for India

Trinomial Nomenclature :

- The subspecies is the name of species to which it belongs.
- The names are **genus, species and subspecies**. Itself , thus use of subspecies is the third name naming.
- e.g the house crow Carvus splendens is found in India , Pakistan , Burma and Celon The Indian and Pakistani house crow has same specific name Carvus splendens splendens
- When the nomenclature of an organism consist of **three names** then it is called **trinomial nomenclature** .

Following are the common rules and recommendation which are consider as essential for nomenclature .

The naming system adapted is binomial nomenclature to indicate the specific names .

1. **The generic** name is single and always being with **capital letter.**
2. The **specific** name begin with **small letter.**
3. The name of the taxonomist who first described the species name in scientific generals is added at the ends It should be **abbreviation** and printed in **Roman types**
4. The scientific name of **plants and animals** must be different.
5. The scientific name should be printed in **etalics** and they must be in lattin .
6. Care should be taken that within plants and animal kingdom .Two genera and species cannot have **the same name** .
7. If the species after its publication transfer to any other genus or the generic name change then the first author's name should be written in bracket.

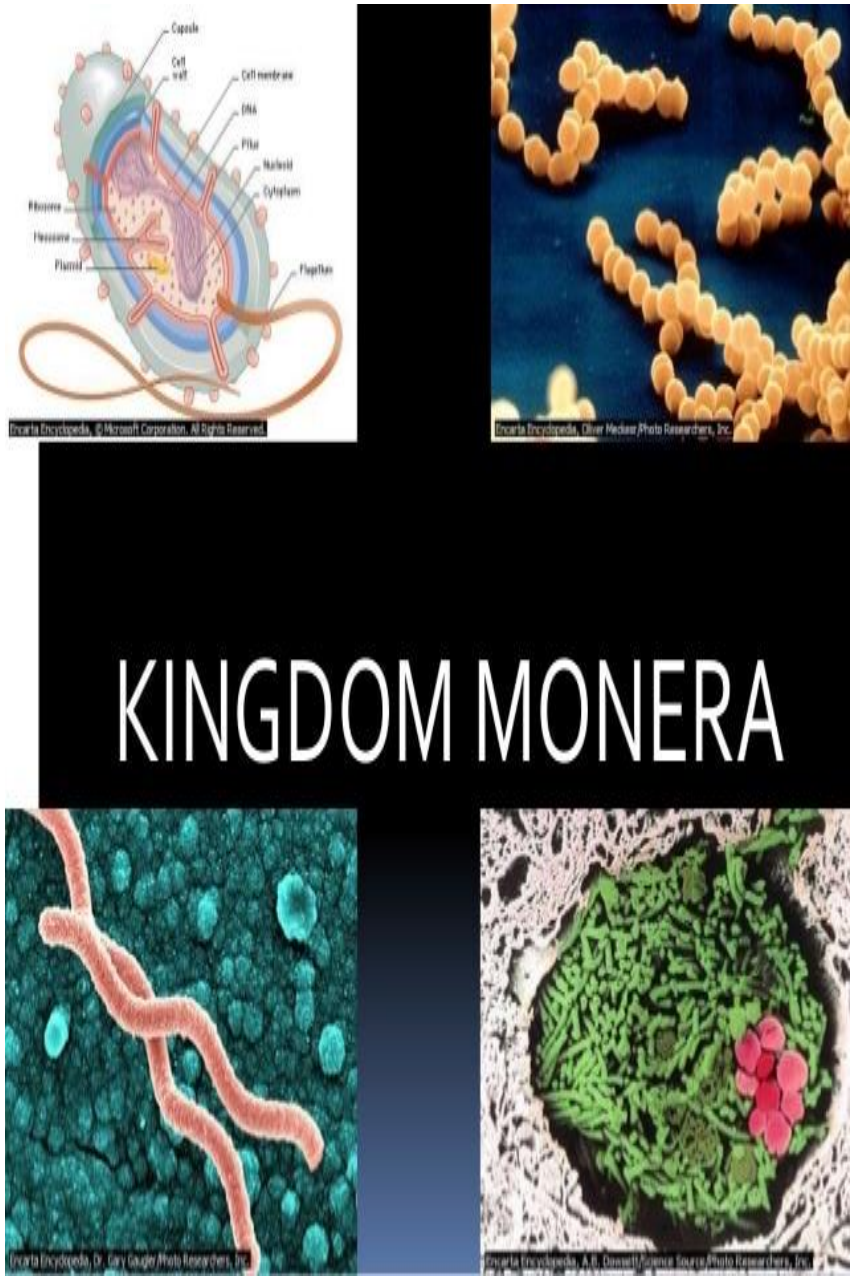
Recommendation :

1. A name should be in lattin or it should be latinised with suitable ending .
2. In the new names these should not be less than three and more than 12 letters
3. It should be easy to pronounced
4. The name should described some important characters of an organism.
5. A name should be derived from single language and it should be important.

Five kingdom classification System -

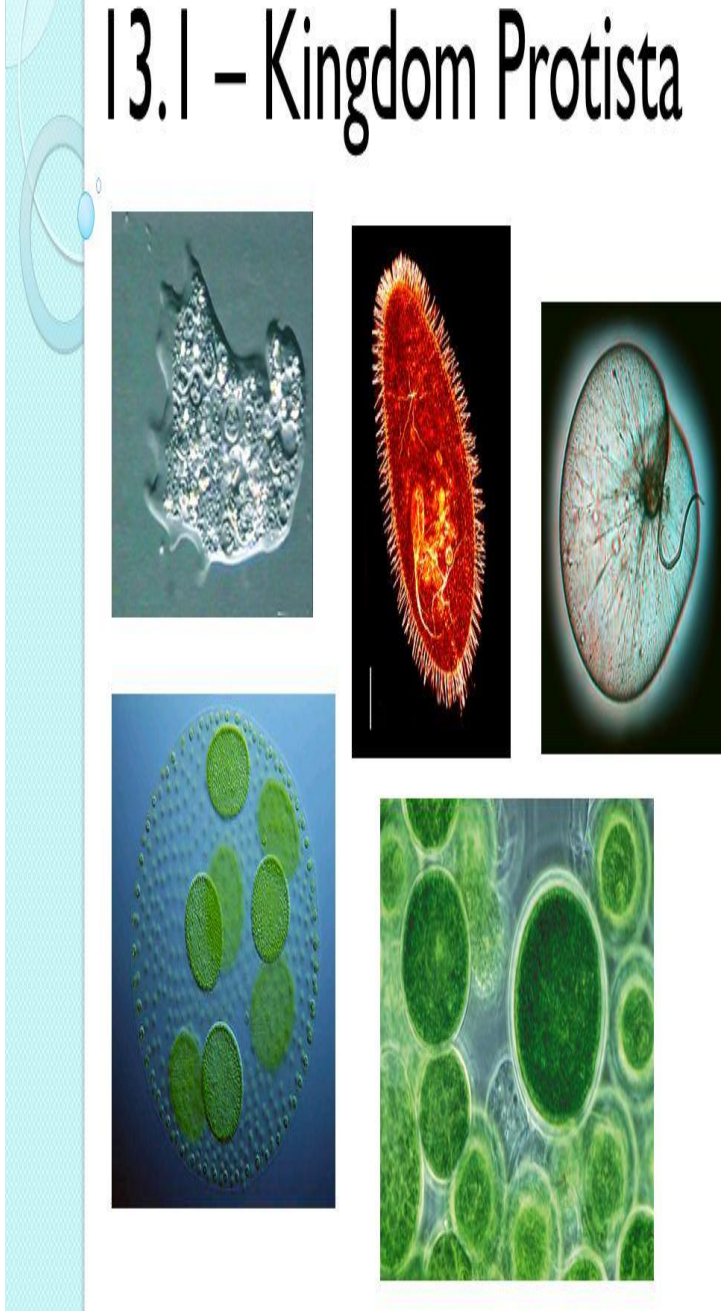
1- MONERA

- It is the kingdom of prokaryotes[monus-single]
- It includes all prokaryotic organism . i.e bacteria ,a filaments bacteria, actinomycetes and photosynthetic cyanobacteria.
- Monera cells are microscopic.
- Ranges from one to a few micron in length.
- They do not contain a nucleus and other membrane bounded organelle. [mitochondria ,cytoplasm ,nucleus, endoplasmic reticulum].
- Most monera cells have a rigid cell wall.
- Many monera decompose and absorbs organic matter in soil.
- There wall prevents injection of particulates organic matter.
- Some are heterotrophs other are
- The autotrophic monera prepare their own food by reducing Co2 & using either light energy or energy derived from chemical reaction .
- Monera are the important decomposers and mineralizers in the biosphere.



2-PROTISTA

- It is the kingdom of **unicellular eukaryotes.** [protiso–primary].
- They includes different kinds of mostly unicellular and primary aquatic eukaryotes.
- They contain typical eukaryotic cell with cell componants such as nucleus , mitochondria, endoplasmic reticulum, golgi bodies and plastids[photosynthetic].
- They offen bear flagella or cilia .
- They includes coloured unicellular algae and diatoms called phytoplanktons.
- Some protist are predetor feeding on other protista. they are called protozoa.
- Protozoa shows holozoic or animal like nutrition
- Some protozoans are parasitic in other animals.
- Some protozoans lives in the digestive tract of other animal.
- Some protazoans help in decomposition of organic matter like cellulose of plant cell walls, as found in termites and wood eating cockroaches.



3-PLANTAE

- It is The kingdom of multicellular plants.
- It includes all the coloured , multicellular **photosynthetic** plants found on land ,sea shores ,in lakes and streams.
- These includes red ,brown and green algae, mosses, ferns and seed bearing plants with or without flowers.
- Plants cell walls are **rigid** and made up of **cellulose** and hence, do not show **contraction and relaxation** like animal cell.
- Plants are **immobile** and do not show locomotion like protista and animals.
- They are **producers** because they synthesize their organic food by photosynthesis with the help of corbon dioxide, chlorophyll and solar energy.
- Some **insectivorous** plants have devices to trap and digest extracellularly small animals like insects and absorb their **nitrogenous matter.**
- Some plants have developed symbiotic relationship with certain nitrogen **fixing bacteria** or with fungi to augment their nitrogen or mineral nutrition.

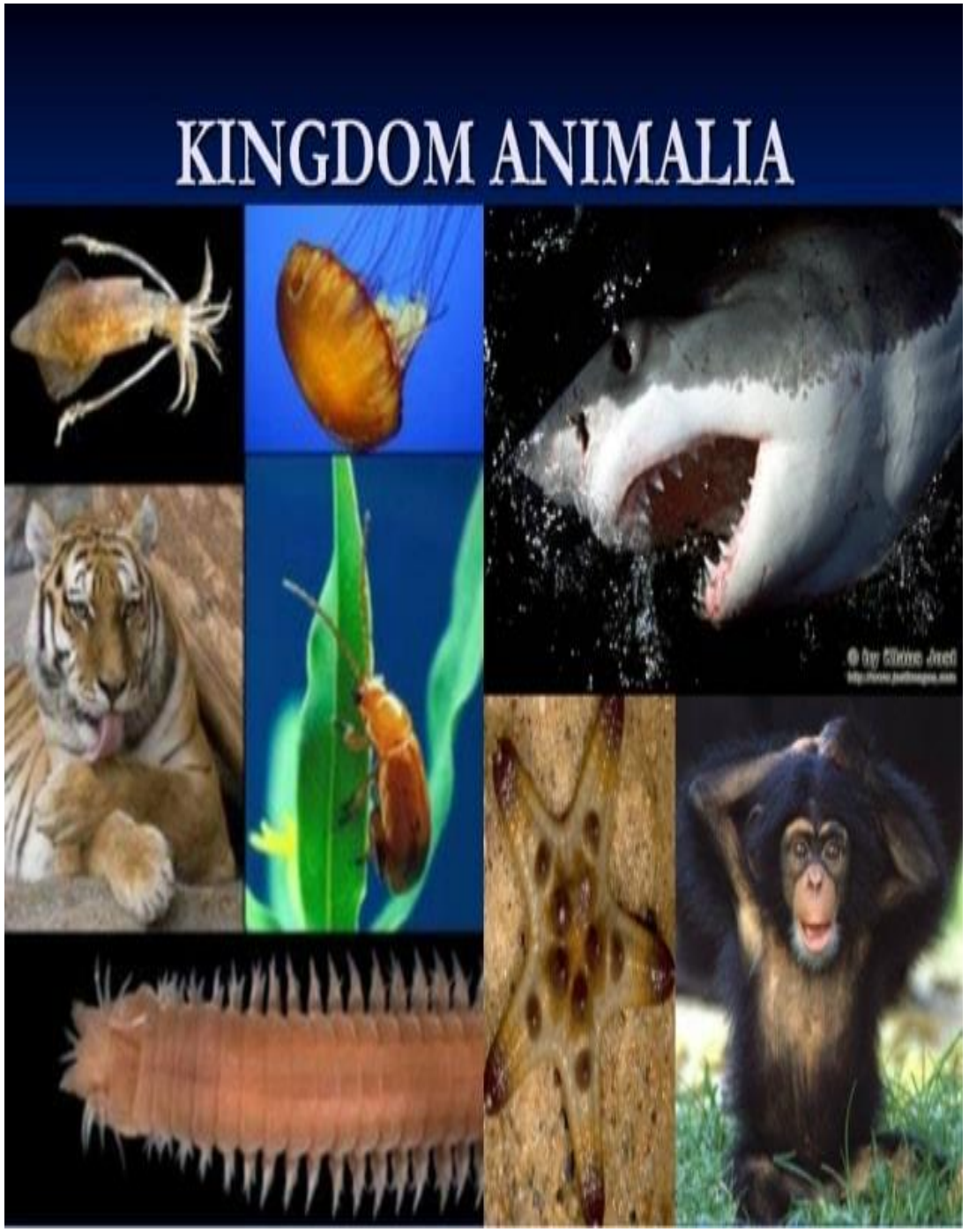
4-FUNGI

- It is the kingdom of **decomposers.**
- It includes diverse kinds of eukaryotic, predominantly, multicellular **heterotropic organisms.**
- Their nutrition is by absorption of organic matter made soluble by **decomposition or decay.**
- They are called **saprobes** when they live on decaying plants or animal matter.
- Some fungi are called **parasites** when they assimilate tissues of living plants and animals.
- **Parasitic fungi** cause diseases like mildews, rusts, smuts, soft or dry rots, wilt and leaf spots in the host plants.
- **Yeasts** are a group of exceptional fungi involved in **fermentation**. They have single cell body.

5-ANIMALIA:

Diagnostic and special features:

- It is the kingdom of **multicellular** animals
- Members of animalia are **multicellular holozoic eukaryotes**. They are also called as **metazoa.**
- Mode of nutrition is by **ingestion** of food.
- The cells have ability to **contract** [muscle cells] or to **transmit impulses** [nerve cells] except Sponges because they lack nerve cells.
- Some animal groups are **parasitic** which live on or within the tissues of other animals or plants.
- Some show symbiotic association with photosynthetic protista.
- The animal kingdom shows **great diversity.** These includes sponges, cnidarians flat ,round or segmented worms, snails and other mollusks; arthropods starfish, and vertebrates such as fishes, amphibians, reptiles, birds and mammals.



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