

Medical Biology

Introduction to medical biology

First Lecture



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Definition of Biology:

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- ➔ *What is Biology?*
- ➔ **Biology** is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution, and taxonomy. The word biology is derived from Greek origin: **Bios** means life and **logos** means science or the study of living things.
- ➔ **Biology** : is the science(study) of life.
- ➔ **Or,** : is the study of structures, functions and relationship of living- things or organisms.

Importance of Biology:

- ▶ Improved understanding on functions of organisms.
- ▶ Improved understanding on causes of disease.
- ▶ Finding treatment for diseases.
- ▶ Improved understanding on ecology.
- ▶ Better management on environment problems.
- ▶ Improved quality and production of food.

The Seven Characteristics of Living Things:

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living things : All animals , plants, bacterium, protist, fungus are living things. If something is living it will carry out all of the seven activities
Non-living things :Sand, wood and glass are all non-living things .

- ➔ **1. Feeding** : All living organisms need to take substances from their environment to obtain energy, to grow and to stay healthy.
- ➔ **2. Movement** : All living organisms show movement of one kind or another. All living organisms have internal movement, which means that they have the ability of moving substances from one part of their body to another. Some living organisms show external movement as well - they can move from place to place by walking, flying or swimming.

The Seven Characteristics of Living Things:

➤ **3. Breathing or Respiration:**

All living things exchange gases with their environment. Animals take in oxygen and breathe out carbon dioxide.

➤ **4. Excretion:**

is the removal of waste from the body. If this waste was allowed to remain in the body it could be poisonous. Humans produce liquid waste called urine. We also excrete waste when we breathe out. All living things need to remove waste from their bodies.

➤ **5. Growth :** When living things feed they gain energy. Some of this energy is used in growth. Living things become larger and more complicated as they grow.

The Seven Characteristics of Living Things:

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- **6. Sensitivity** : Living things react to changes around them. We react to touch, light, heat ,cold and sound, as do other living things.
- **7. Reproduction** : All living things produce young. Humans make babies, cats produce kittens and pigeons lay eggs. Plants also reproduce. Many make seeds which can germinate and grow into new plants. **All these characters can be summarized in :**
 - **A-** Degree of orderliness.
 - **B-** Ability to respond to stimuli.
 - **C-** Capacity to grow, develop and reproduce by using hereditary molecules.
 - **D-** Possession of regulatory processes, which control and coordinate life functions.

Branches of Biology:

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- Biology can be divided into three major fields: **zoology** , **botany** and **microbiology**.
- **Zoology** deals with animals ,while botany deals with plants (**Botany**) is the branch of biology which deals with the study of different aspects of plants.
- **Microbiology** is the branch of biology dealing with the study of different aspects of microorganism.
- **Taxonomy**: It is the science of identification, nomenclature and classification of organisms.
- **Morphology**: It is the study of external form, size, shape, color, structure and relative position of various living organ of living beings.

Branches of Biology:

- **Anatomy:** It is the study of internal structure which can be observed with unaided eye after dissection.
- **Histology:** It is the study of tissue organization and structure as observed through light microscope.
- **Cytology:** It is the study of form and structure of cells including the behavior of nucleus and other organelles.
- **Cell Biology:** It is the study of morphological, organizational, biochemical, physiological, genetic, developmental, pathological and evolutionary aspects of cell and its components.

Branches of Biology:

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- **Molecular Biology:** It is the study of the nature, physicochemical organization, synthesis working and interaction of biomolecules that bring about and control various activities of the protoplasm.
- **Physiology:** It is the study of different types of body functions and processes.
- **Toxicology:** the study of how natural or man-made poisons cause undesirable effects in living organisms.
- **Mycology:** the study of fungi

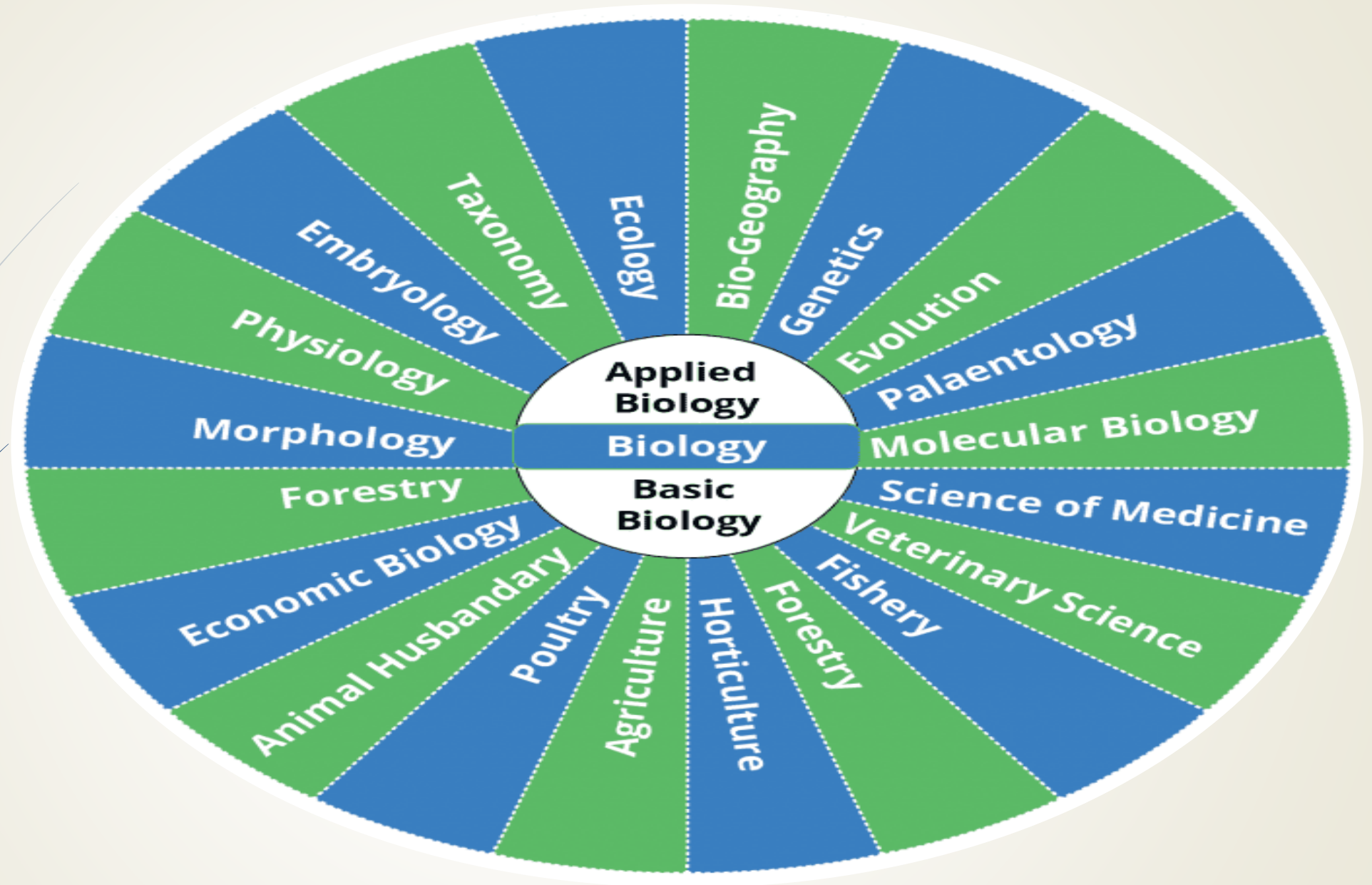
Branches of Biology:

- **Embryology:** It is the study of fertilization, growth, division and differentiation of the zygote into embryo or early development of living beings before the attainment of structure and size of the offspring.
- **Ecology:** It is the study of living organisms in relation to other organisms and their environment.
- **Genetics:** It is the study of inheritance of characters or heredity and variations. Heredity is the study of expression and transmission of traits from parents to offspring.
- **Virology:** It is the study of viruses in all their aspects.

Branches of Biology:

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- **Evolution:** It studies the origin of life as well as new types of organism from the previous ones by modifications involving genetic changes and adaptations.
- **Parasitology** - the study of parasites and parasitism
- **Pathology:** the study of the nature of disease and its causes, processes ,development, and consequences
- **Pharmacology:** the study of preparation and use of drugs and synthetic medicines
Physiology: the biological study of the functions of living organisms and their parts



Biology and its related branches

Diversity in living organisms

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- There are millions of organisms around us. They show such a great diversity that it is impossible to know about them or to study about all of them. If we arrange them in groups on the basis of some common features, it will make their study much easier. The grouping of things on the basis of certain common characteristics is called classification. Similarly different kinds of organisms could be classified on the basis of their similarities and dissimilarities. The branch of biology concerned with classification is called taxonomy.
- **Classification: putting things into orderly groups based on similar characteristics**
- **Taxonomy: the science of describing, naming, and classifying organisms.**

The hierarchy of biological classification

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The Five Kingdom System:-

- We know that living organisms are enormous in number and differ greatly in their characters. The main differences in characters include size and shape, structure, metabolism and life cycle. So, for better understanding living organisms have been classified into different groups by different scientists. In this series, one of the earliest scheme of natural system of classification was the two kingdom system proposed by **Carolus Linnaeus** in 1758. He is therefore known as the '**Father of Classification**'.
- **The Two Kingdom System**
- Carolus Linnaeus divided all living organisms into two kingdoms:
- 1. **Plantae – The kingdom of plants**
- 2. **Animalia – The kingdom of animals.**

The Five Kingdom System:-

- R. H. Whittaker arranged all organisms into five kingdoms in 1969. The classification was based on several criteria.
- 1. Complexity of Cell structure (prokaryote or Eukaryote).
- 2. Complexity of body structure or body organization (unicellular or multi-cellular).
- 3. Mode of nutrition of the organism (autotrophs and heterotrophs).
- 4. Phylogenetic or evolutionary relationship or major ecological role(Producer, Decomposer, consumer).
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- The Five kingdoms are
- **1. Monera 2. Protista 3. Fungi 4. Plantae 5. Animalia**

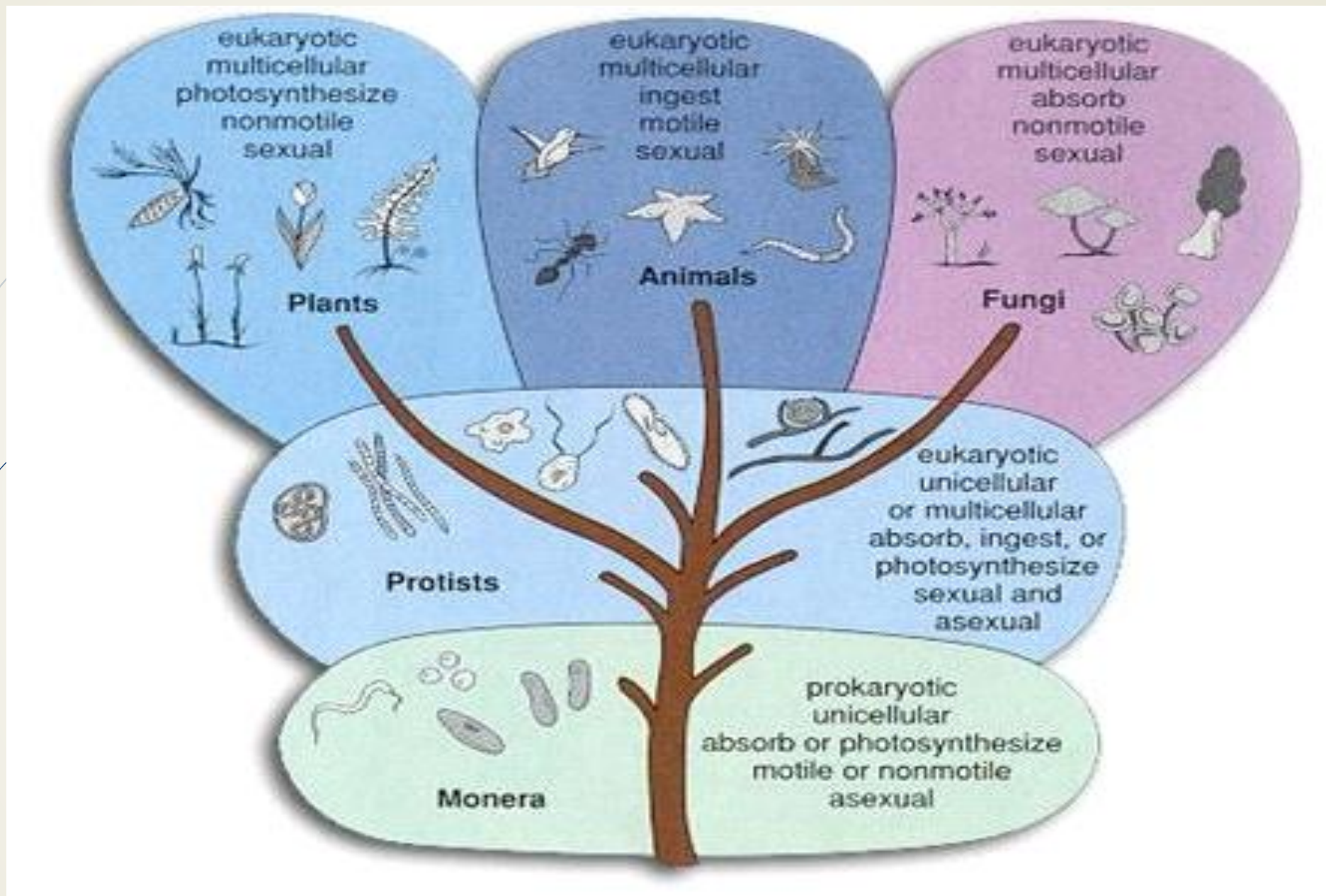


Fig. 1 : The five kingdom system of classification

1. Monera

- This kingdom includes all prokaryotic organisms whose cells do not contain a well-defined nucleus. The nuclear material (DNA) is present in the cell without being enclosed in the nuclear membrane. Common examples are bacteria and blue-green algae. Their features are enlisted.
- • Their cells are microscopic.
- • They do not have cell organelles.
- • They have a rigid cell wall.



Fig. 2 : Bacteria

2. *Protista*

- This kingdom includes both unicellular plants (e.g. *Chlamydomonas*) and animals (e.g. *Euglena*, *Amoeba* and *Paramecium*). They show the following characteristics:
- • They are eukaryotic, i.e., they have a well-defined nucleus with a nuclear membrane.
- • They have all the cell organelles. • They are unicellular microorganisms.



Fig. 3: *Paramecium*

3. *Fungi*

- The common examples of this kingdom are molds and mushrooms.
- ▶ Fungi have the following features:
 - ▶ • They are mostly multicellular and eukaryotic organisms.
 - ▶ • They are heterotrophs, hence cannot make their own food.
 - ▶ • Most of them are made of thread-like hyphae rather than cells and contain many nuclei in the cytoplasm.



Fig.4: Mushrooms

4. *Plantae*

- This group includes red, brown and green algae, bryophytes, pteridophytes, gymnosperms and angiosperms. Their main features are:
 - They are multicellular and eukaryotic plants.
 - They have chlorophyll.
 - They are autotrophs, hence can make their own food.



Fig. 5: Apple tree

- This kingdom includes all multicellular animals including human beings. All vertebrates and invertebrates belong to this group. The distinguishing characteristics of members of this kingdom are:
 - • Their cells are without cell wall and chlorophyll.
 - • They are heterotrophs, hence cannot make their own food



Fig. 6: Bear

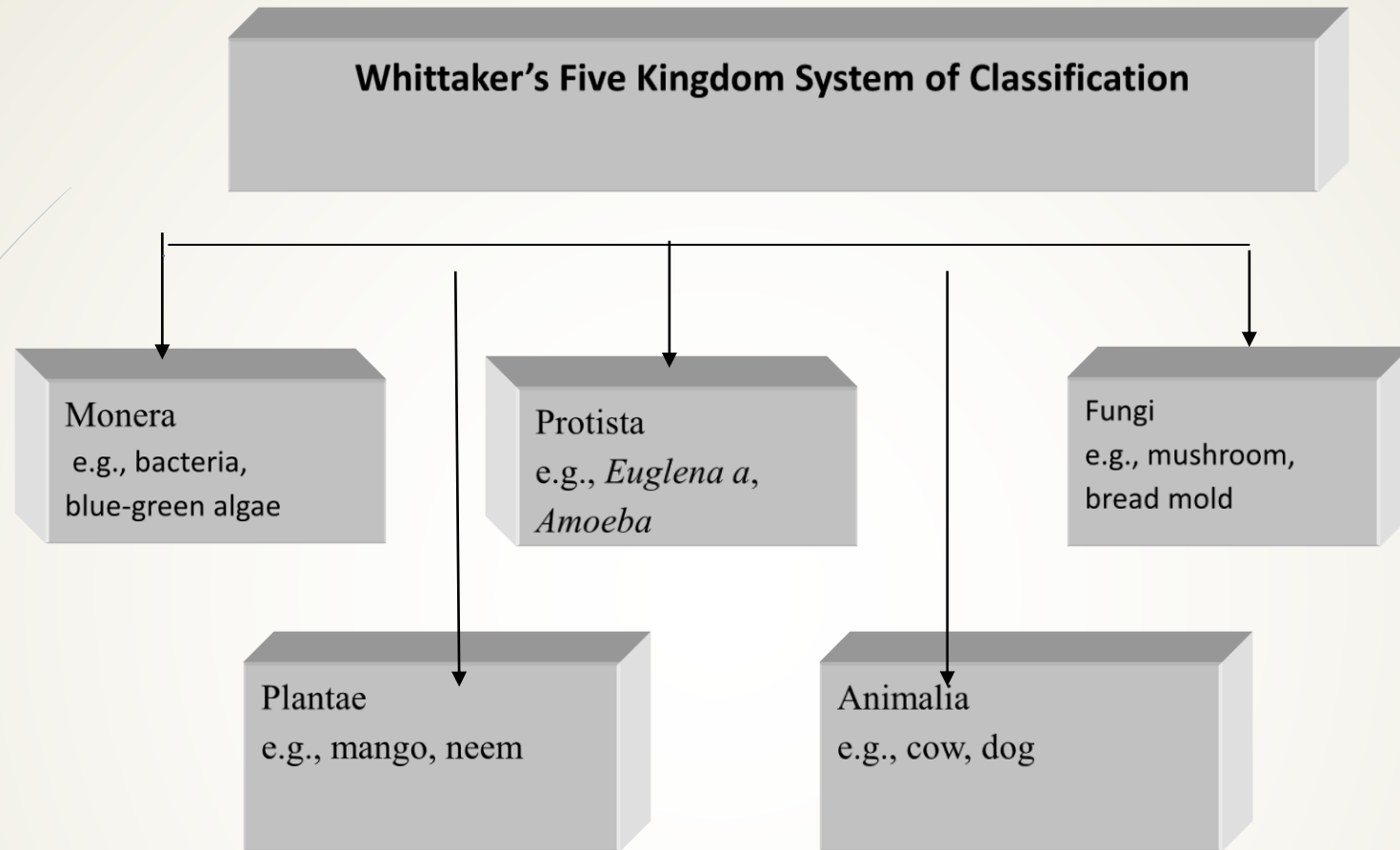


Fig.7 : Whittaker's Five Kingdom System of Classification

Table :(1) Major differences among five kingdoms in the Five Kingdom System of Classification:

Property	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Cell Organization (type)	Mostly unicellular	Mostly unicellular	Multicellular and unicellular	Mostly Multicellular	Mostly Multicellular
Cell wall	Present in most	Present in some: absent in others	Present	Present	absent
Nutritional class	Phototrophic, heterotrophic or chemoautotrophic	Heterotrophic and phototrophic	Heterotrophic	phototrophic	Heterotrophic
Mode of nutrition	Absorptive	Absorptive or ingestion	Absorptive	Mostly Absorptive	Mostly Ingestion
Motility or locomotion	Motile or non motile	Motile or non motile	Non motile	Mostly Non motile	Mostly Motile