UNIT

1

Diversity in Living World

THE LIVING WORLD

- Being alive is defined as unique, complex organization of molecules expressing itself through chemical reactions which lead to growth, development, responsiveness, adaptation and reproduction.
- Each living organism has certain distinctive functions and features that separate it from non-living things, such as:
  - **Growth** which is permanent, irreversible increase in mass (determinate, *e.g.*, humans or indeterminate *e.g.*, plants) in multicellular organisms and increase in number of individuals in unicellular ones.
  - **Reproduction** for continuity of life.
  - **Metabolic functions,** either catabolic (breaking down) or anabolic (building up).
  - Definite **cellular organisation**.
  - Ability of **movement** and **locomotion**.
  - **Adaptability** to increase survival rate.
  - **Respiration** for energy generation (aerobic/ anaerobic).
  - Maintenance of **homeostasis** in body.
  - Consciousness, *i.e.*, the **ability** to sense their surroundings and respond accordingly.
  - Ageing after a growth period and then natural death.

BIODIVERSITY

- Living organisms range from microscopic bacteria and algae to giant blue whale. This diversity of life forms is termed as biodiversity by Edward Wilson. The term biodiversity combines two words Gk. *bios* = life, and Eng. *diversity* = difference in forms.
- Due to such a large diversity of life forms, a proper system of classification is a must because it is not possible to study every organism. The study of one or two organisms of a group gives sufficient information about the essential features of the group. Without any system of classification organisms cannot be identified. Classification helps in knowing the relationships amongst different groups of organisms.

SYSTEMATICS

- Systematics (Gk. *systema*– order, sequence) is the science that deals with diversity of organisms and all their comparative and evolutionary relationships based on the study of comparative anatomy, morphology, biochemistry, physiology etc by grouping of organisms at every level of classification. This term is often used interchangeable with taxonomy.

TAXONOMY

- Taxonomy (*taxis* - arrangement, *nomos* - law, de Candolle, 1813) is defined as the science dealing with identification, nomenclature and classification of organisms. It is the study of rules, principles and practices of classification, identification and nomenclature of organisms.
- Taxonomy of plants is also called systematic botany and that of animals is called systematic zoology. **Carolus Linnaeus** is called the father of taxonomy or father of systematic botany. **H. Santapau** is called the father of Indian taxonomy.

Types of taxonomy

- **α taxonomy** (Turill, 1938) considers only morphology.
- **β taxonomy** (Turill) considers genetics, anatomy, physiology etc. besides morphology.
- **ω(omega) taxonomy** is based on phylogenetic relationships.

Fundamental components of taxonomy

- **Classification** - It is the arrangement of organisms into convenient categories or groups on the basis of their similarities and differences in certain easily observable but fundamental characters.
- **Identification** – It is to determine the exact place or position of an organism in the set plan of classification.
- **Nomenclature** (*nomen* - name, *calare* - call) – The process of giving scientific names to plants and animals is called nomenclature.

	Systematics	Taxonomy
1.	It takes into account evolutionary relationships between organisms.	It takes into account of external and internal structures, along with the structure of cell, development process and ecological information of organisms.
2.	It is used in identification, nomenclature and classification.	It is used in characterisation, identification and nomenclature.

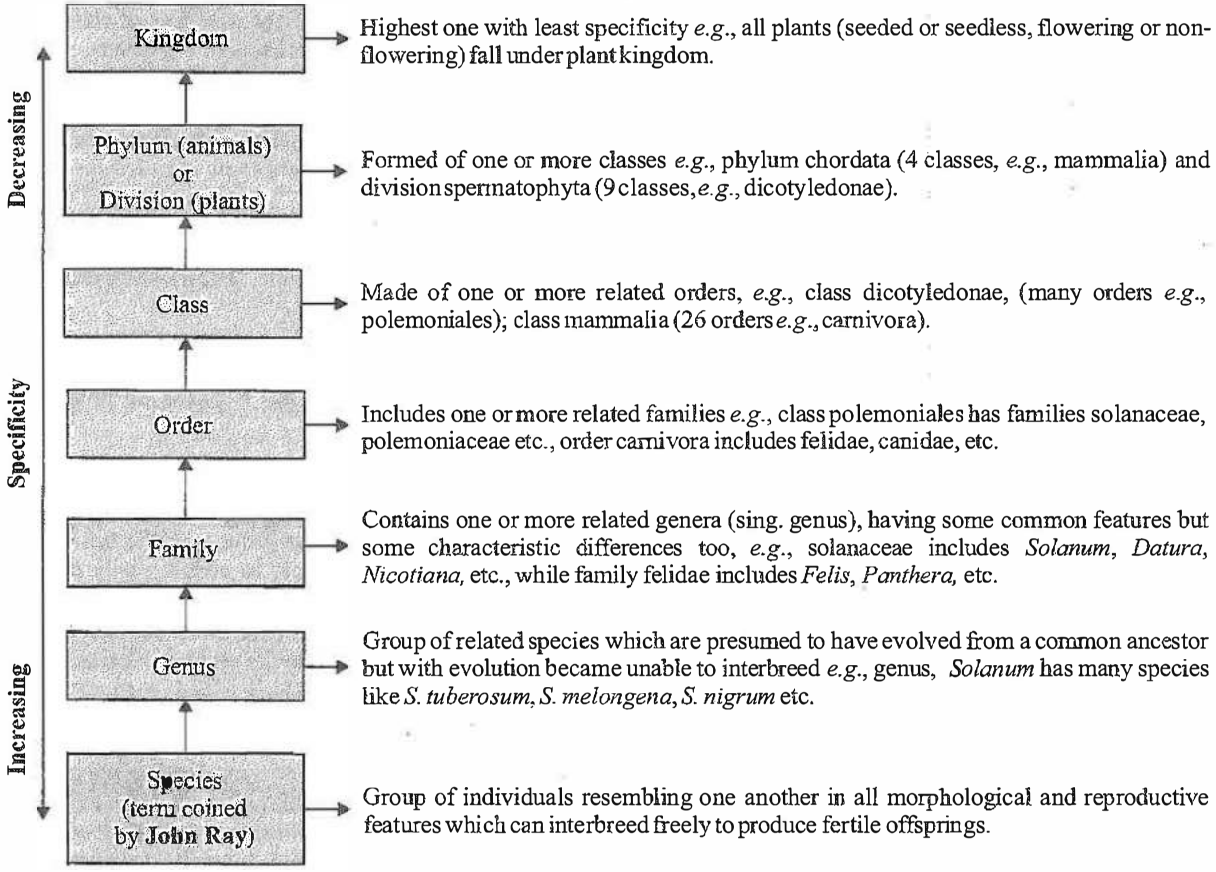
Nomenclature

- Nomenclature is the science of providing distinct and proper names to organisms as per the established universal practices and rules. Every taxonomists has to follow these rules.

- **Binomial nomenclature** is a system of classification introduced by Carolus Linnaeus, the 18th century Swedish naturalist, in which each species is given two names.
- The first is the **generic name**, written with a capital letter, which designates the genus to which the species belong and the second is the **specific name** or specific epithet, indicating the species and then the name of the discoverer in full or in abbreviation. Example, *Mangifera indica Linn*.
- The scientific name is printed in italics. It is underlined in handwritten description.
- The name of the author is kept in Roman script.
- The original names were taken from Latin and Greek languages. New names are now derived either from Latin language or are latinised. This is because Latin language is dead and therefore, it will not change in form or spellings with the passage of time.
- There are five codes of nomenclature :
  - ICBN – International Code of Botanical Nomenclature.
  - ICZN – International Code of Zoological Nomenclature.
  - ICBacN – International Code of Bacteriological Nomenclature.
  - ICVN – International Code of Viral Nomenclature.
  - ICNCP – International Code of Nomenclature for Cultivated Plants.

Taxonomical hierarchy

- Taxonomical hierarchy (introduced bylinnaeus) is arrangement of various taxonomic levels. One above the another in descending order, starting from kingdom upto species.
- The hierarchy indicates the various levels of kinship. The number of similar characters of categories decreases from lowest rank to highest rank *i.e.*, from species to kingdom.
- It includes 7 obligate categories in the following order:



- To make taxonomic position of some species more precise **intermediate categories** like sub division, super order, suborder etc. have been added.
- Each category, referred to as a unit of classification represents a rank and is commonly termed as a *taxon* (pl. : taxa), *e.g.*, taxon bryophyta belongs to category division, taxon *Zea mays* belongs to category species.

Taxonomic aids

- Techniques, procedures and stored information that are useful in identification and classification of organisms are called taxonomic aids.

THE THREE DOMAINS OF LIFE

- Advent of molecular biology led **Carl Woese** (1977) to introduce three domain system dividing life forms into **Archaea**, **Bacteria** and **Eukarya**.
- He separated prokaryotes into **Archaea** (**archae** = ancient, one of the oldest living beings) and **bacteria** based on the differences in their 16S *r*RNA genes.
- The three domain system adds a level of classification (the domains) above the kingdoms present in 5 or 6 kingdom systems.