TAXONOMY

 The term is derived from the Greek taxis (“arrangement”) and nomos (“law”). Taxonomy is  the methodology and principles of systematic botany and zoology and sets up arrangements of the kinds of plants and animals in hierarchies of superior and subordinate groups.

 The first great generalizer in classification was Aristotle, who virtually invented the science of logic, of which for 2,000 years classification was a part. Aristotle and his pupil in botany,  Theophrastus, had no notable successors for 1,400 years.

Carolus Linnaeus, who is usually regarded as the founder of modern taxonomy and whose books are considered the beginning of modern botanical and zoological nomenclature, drew up rules for assigning names to plants and animals and was the first to use binomial nomenclature consistently (1758). Linnaeus introduced the standard hierarchy of class, order, genus, and species, his main success in his own day was providing workable keys, making it possible to identify plants and animals from his books.

  The name of the species is binomial (e.g., Canis lupus) and that of the subspecies trinomial (C. lupus occidentalis for the northern timber wolf, C. lupus lupus for the northern European wolf), all other names are single words. In zoology, convention dictates that the names of superfamilies end in -oidea, and the code dictates that the names of families end in -idae, those of subfamilies in -inae, and those of tribes in -ini.

The internationally accepted taxonomic nomenclature is the Linnaean system, which, although founded on Linnaeus’s rules and procedures, has been greatly modified through the years. There are separate international codes of nomenclature in botany (first published in 1901), in zoology (1906), and in microbiology (bacteria and viruses, 1948).

Stages of Taxonomy

A complex nomenclature is applied to the different sorts of type specimens.

 The holotype is a single specimen designated by the original describer of the form (a species or subspecies only) and available to those who want to verify the status of other specimens.

When no holotype exists, as is frequently the case, a neotype is selected and so designated by someone who subsequently revises the taxon, and the neotype occupies a position equivalent to that of the holotype. The first type validly designated has priority over all other type specimens.

 Paratypes are specimens used, along with the holotype, in the original designation of a new form; they must be part of the same series

WHAT IS THE IMPORTANCE OF TAXONOMY IN BIOLOGY:

1. Taxonomy aims to classify living creature: There are millions of organisms on the Earth of different physical, physiological, regional differences. Taxonomy helps to classify these millions of organisms scientifically into some categories like family, genus, species etc. for ease of study and understanding.

2. Taxonomy helps to ascertain the number of living species on the earth. We have discovered till now some thousands of plants and animal species and are recorded as per taxonomy.

3. Taxonomy helps in getting an idea of what type of characters are present in the plant or animal possess even before seeing or studying them in detail.

In animals: If a living creature is mentioned under mollusc’s, it means the animals has some sort of hard shell as a protective factor (like snail). If an animal is called a mammal, it means the creature gives birth to well formed babies and also rears them with milk during growth.

4. Taxonomy gives an ideas level of physical development: Taxonomy gives an idea of how far an animal has physical and mental development and its position in the evolution tree of organisms.

Ex: When you hear the word bacteria, you get an idea of single celled organism and fungi as a multi-celled organism yet both or microbes. Physically & evolutionary wise, fungi are advanced  than bacteria.

5. Gives an idea of local fauna: Not all plants and animal species are found in all regions of the earth. Example kangaroo is limited to Australia  like wise kiwi to New-Zealand etc. Even plants like Neem named as Azadirachta Indica (Indica= India) due its prominent presence in India. Hence taxonomy helps to identify or ascertain the types of plants and animals that can be found in particular region. This helps new scientists to go to the place of existence of the species to collect them in case they need to experiment on them.

a. Domain: 1. Archea (no nucleus, no organelles in cell), 2. Bacteria  No well formed nucleus but has organelles 3. Eukarya: which means well formed nucleus and cell organelles.

b. Kingdom: gives ideas as 1. Animal 2. plant. 3. Fungi 4. protista.

c. Phylum: For zoology it gives idea if it is a insect type or worm type etc.

d. Class: Specifies the organism as mammal, bird, reptile etc.

e. Order: If you consider mammal it say whether it is a herbivore or carnivore etc.

f. Family: In botany plants are categorized or leguminous,  solanaceae, euphorbeacea etc.families where in the plants in one family have few set of common physical characters.

g. Genus: This keeps the animals more specific ex: Frog as “Rana”

h. Species: This gives even specificity and in the above example of frog it sayplace of existence or physical character like

So taxonomy for Frog is as

Kingdom: Animalia- Means it is “animal type” and not a plant.

Phylum: Chordata- Means has “Spinal cord

Subphylum: Vertebrata- Has vertebral column dorsally.

Class: Amphibia- Can live both in watter and on land (Amphi- two; Bia- living)

Order: Anura – No tail (An= No; Ura = Tail)

Suborder: Neobatrachia- New type of frogs (Neo= new)

Family:Ranidae

Genus:Rana

Species: Tigrina (etc. based on the region where frog is found)

Aim and Tasks of a Taxonomist

The primary aim of a taxonomist must be the construction of classes of living things about which scientifically useful inductive generalisations can be made. Many workers have enumerated various aims and tasks of a taxonomists.

1. To catalogue the diversity of life on earth and to preserve large samples, both of extant and extinct organisms, drawn from the diversity in various sorts of collection.

2. To differentiate the various kinds of organisms and to point out their characteristics (both qualitatively and quantitatively) through descriptions, keys, illustrations, etc.

3. To provide names for each kind of organisms, so that all concerned can know what they are talking about and so that information can be recorded, stored and retrieved when needed.

4. To develop a set of principles in regard to the choice and relative importance of characters with the ultimate aim of arranging species in hierarchy of higher categories.

5. To estimate genetic and phylogenetic relationships among organisms.

6. To contribute towards the understanding of evolutionary process.

7. To integrate the data from all fields of biology, like behaviour, genetics, physiology etc., and to detect and then summarise significant patterns possibly with the help of modern electronic computers.

8. To document and preserve specimens to provide a useful reservoir of data.

9. To help in clarifying the place of systematics or taxonomy in general biology by revising their aims and priorities, realistically restructuring the efforts in applied taxonomy and reaffirming faith in taxonomy.

Taxonomical Keys

Biologists use a taxonomic key, also known as a dichotomous key, to identify unknown organisms by their physical characteristics. Taxonomic keys work on a base-two premise: The organism either has the characteristic or does not. The resulting answer then directs the biologist to the next set of questions until all the characteristics have been accounted for and the organism is identified. The following Binomial classification illustration is a fictitious key that demonstrates the process.

Try using the following taxonomic key to identify which organism is a “dumlop.”

Characteristic

Organism

1a. It has two legs.Zembo

1b. It has more than two legs. Go to 2

2a. It is shaded. Go to 3

2b. It is not shaded. Go to 4

3a. It has a round head.Dumlop

3b. It does not have a round head.Gorgot

 Backtracking from the dichotomous key, a dumlop is an organism that has more than two legs, is shaded, with a round head. Most dichotomous keys are quite lengthy, to account for all the features that a set of organisms may possess. The broadest keys begin at the kingdom level and proceed to the more specific genus and species levels.

**Zoological Nomenclature:**

 Names are given to all animals. The name of a particular animal differs in different languages. Even within the same country one animal is known in different names in differ­ent regions. To avoid this intricacy of names, it was proposed to give them a scientific name.

 The term nomenclature comes from the two Latin words [L. nomen = name and clatura = calling (from ‘calare’ = to call)] and means literally to call by name. Animals are iden­tified by names, and scientific names for the animals are necessary for the immediate access of a particular taxon.

 The application of suitable designations to the units and to different groups are called naming or nomenclature. So the definition for nomenclature given by Simpson (1961) is the application of distinctive names to each of the groups recognised in any given zoo­logical classification.

 According to Mayr and Ashlock (1991), a biological clas­sification is the“ordered grouping of organ­isms according to their similarities and consistencies with their inferred descent”. This definition makes classification natural because it reflects the evolutionary pathway of the organisms.

The purpose of classification:

(i) Identification of the animals and to arrange the different types of animals into groups on the basis of relation­ships;

(ii) To express the degree of genetic rela­tionships or affinity between the dif­ferent types of animals.

Holotype: the one specimen\* or illustration used by the author, or designated by the author as the nomenclatural type.

Isotype: any duplicate specimen of the holotype.

Lectotype: a specimen or illustration designated as the type when no holotype was indicated at the time of publication. If possible, the lectotype should be selected from the syntypes or original material.

Isolectotype: any duplicate specimen of the lectotype.

Syntype: any one of two or more specimens cited in the protologue when no holotype was designated, or any one of two or more specimens simultaneously designated as types in the original description. Monographers are urged to select a lectotype from among the syntypes whenever possible.

Isosyntype: a duplicate specimen of a syntype.

Neotype: a specimen or illustration selected as the type when all of the material on which the name of the taxon was based is missing.

Isoneotype: any duplicate specimen of the neotype.

Paratype: a specimen cited in the protologue that is neither the holotype, isotype, nor one of the syntypes. These are often listed as representative specimens in the original description.

Epitype: "a specimen or illustration selected to serve as an interpretative type when the holotype, lectotype, or previously designated neotype, or all original material associated with a validly published name, is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name of a taxon." (ICBN Ch. 2, Sec. 2, Art. 9.7) The holotype, lectotype, or neotype that the epitype supports must be explicitly cited when the epitype is designated (see Art. 9.18).