**Systematics**

**Meaning of Systematics:**

The term systematics is derived from the Latinised Greek word and ‘systema’ means ‘together’. The systematics partly overlap with taxonomy and originally used to des­cribe the system of classification prescribed by early biologists.

* Blackwelder and Boyden (1952) gave a definition that**“sys­tematics is the entire field dealing with the kinds of animals, their distinction, classifica­tion and evolution”.**
* C. G. Simpson (1961) considers that **“Systematics is the scientific study of the kinds and diversity of organ­isms and of any and all relationships among them”**.
* Christoffersen (1995) has de­fined systematics as **“the theory, principles and practice of identifying (discovering) systems, i.e., of ordering the diversity of organisms (parts) into more general systems of taxa according to the most general causal processes”.**

The systematics includes both taxonomy and evolution. Taxonomy includes classifi­cation and nomenclature but inclines heavily on systematics for its concepts. So study of systematics includes a much broader aspect that includes not only morphology and ana­tomy but also genetics, molecular biology, behavioural aspects and evolutionary biology.

#### Branches of Systematics:

**1. Numerical systematics:**

This type of systematics is based on bio-statistical method in identification and classifi­cation of animals. This branch is called biometry.

**2. Biochemical systematics:**

This branch of systematics deals with classification of animals on the basis of biochemical analysis of protoplasm.

**3. Experimental systematics:**

This branch of systematics deals with identification of various evolutionary units within a species and their role in the process of evolution. Here mutation is considered as evolutionary unit.

#### Application of Systematics in Biology:

1. Systematics is the study of diversity of organisms including past and present and relationships among living things. Relationships are established by mak­ing cladograms, phylogenetic trees and phylogenies. The phylogeny is the evolutionary history of an animal or plant, for a taxonomic group.

Phylogenies include two parts—the first part shows the group relationships and the second part indicates the amount of evolution. Phylogenetic trees of species and higher taxa are established by morphological, physi­ological and molecular characteristics, and the distribution of animals and their ancestors are related to geogra­phy. In this way the systematics is used to understand the evolutionary history of organisms.

2. The field of systematics provides scientific names of the organisms, de­scription of the species, ordering the organisms into higher taxa, classifica­tion of the organisms and evolution­ary histories.

3. Systematics is also important in imple­menting the conservation issues be­cause it attempts to explain the biodiversity which is related to differ­ent kinds of species and could be used in preservation and protect the endan­gered animals and plants.

4. The destruction or suppression of harm­ful pests or animals by the introduc­tion and increase of their natural en­emies is called biological control.

The natural enemies of pests are often in­troduced for biological control for the advantage of agriculture and forestry. The natural enemies include insectivorous spiders, centipedes, some insects, frogs and birds which are much more economical than the chemical control because they have no injurious side effects.

Some chrysopids are also preda­tory enemies of mealy bugs and plant lice. An egg parasite, *Trichogramma* sp. is utilized in India for the control of sugar cane borers and boll worms of cotton.

In all cases the proper identification of parasites and their hosts are necessary for the control of the pests. The systematists are involved in implement­ing the biological control programmes of the pests and diseases most effec­tively.

5. There are a lot of insects which act as vectors of various human diseases. For example, some species of *Anopheles* sp. are the vector of malaria diseases, *Aedes* *aegypti* spreads the virus of dengu fe­ver and phlebotomus argentipes spreads the pathogens of kala-azar fever.

So taxonomists play a vital role in iden­tification of the species of vectors, and control strategy programmes of the vectors should be planned in such a way that the target species is attacked.

**Taxonomy**

It comes from Greek word **“taxis”** meaning arrangement and **“nomos”** meaning law.

In order to make sense of the diversity of organisms, it is necessary to group similar organisms together and organize these groups in a non overlapping hierarchical arrangement. Taxonomy is the science of biological classification. In a broader sense it consists of three separate but interrelated parts: classification, nomenclature, and identification.

 **Classification** is the arrangement of organisms into groups or **taxa** (s., **taxon**) based on mutual similarity or evolutionary relatedness.

**Nomenclature** is the branch of taxonomy concerned with the assignment of names to taxonomic groups in agreement with published rules.

 **Identification** is the practical side of taxonomy, the process of determining that a particular isolate belongs to a recognized taxon.

Taxonomy is important for several reasons.

* It allows us to organize huge amounts of knowledge about organisms because all members of a particular group share many characteristics. The more accurate the classification, the more information-rich and useful it is.
* Taxonomy allows us to make predictions and frame hypotheses for further research based on knowledge of similar organisms. If a relative has some property, the microorganism in question also may have the same characteristic.
* Taxonomy places microorganisms in meaningful, useful groups with precise names so that microbiologists can work with them and communicate efficiently.
* Taxonomy is essential for accurate identification of microorganisms. Its practical importance in this respect can hardly be overemphasized. For example, it is essential to clinical microbiology treatment often is exceptionally difficult when thepathogen is unknown.

**Classification**

It is the grouping of organisms based on structural or functional similarity or evolutionary history. It is a process of establishing, defining and ranking taxa within hierarchical series of groups.

**Taxon**

 Any group or rank in a biological classification into which related [organisms](http://www.biology-online.org/dictionary/Organism) are classified. It is a taxonomic unit in the biological system of classification of [organisms](http://www.biology-online.org/dictionary/Organism), for example: a [phylum](http://www.biology-online.org/dictionary/Phylum), [order](http://www.biology-online.org/dictionary/Order), [family](http://www.biology-online.org/dictionary/Family), [genus](http://www.biology-online.org/dictionary/Genus), or [species](http://www.biology-online.org/dictionary/Species).

**Species**

The basic taxonomic group in microbial taxonomy is the **species.**

A **prokaryotic species** is a collection of strains that share many stable propertiesand differ significantly from other groups of strains. A species (genomospecies) is a collection ofstrains that have a similar G \_C composition and 70% or greater similarityas judged by DNA hybridization experiments.

Ideally a species also should be phenotypically distinguishable from other similar species. A species is given a two-part name: the [generic name](http://www.biology-online.org/dictionary/Generic_name) and the specific name (or [specific epithet](http://www.biology-online.org/dictionary/Specific_epithet)).

**Strain**

A **strain** is a population of organisms that is distinguishable from at least some other populations within a particular taxonomic category. It is considered to have descended from a single organism or pure culture isolate and thus is a genetic variant of a microorganism.

Strains within a species may differ slightly from one another in many ways.

**Biovars** are variant procaryotic strains characterized by biochemical or physiological differences.

**Morphovars** differ morphologically.

**Serovars** have distinctive antigenic properties.

One strain of a species is designated as the **type strain.** It is usually one of the first strains studied and often is more fully characterized than other strains.