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KINDS OF TAXONOMIC CATEGORIES

The 20 or more categories that are used by the taxonomist in his classification .Essentially there are three kinds of categories:

1. The species
2. Groups of populations within species (= infraspecific categories, *e.g.*, subspecies)
3. Groupings of species (collective categories = higher categories).

Lower categories:(the species and the interspecific categories)

The species

The species is the most important taxonomic category, not only for the taxonomist but also for the general biologist .Species are a group of individuals which are similar in their structure, capable of interbreeding and producing fertile off spring, but at the same time reproductively isolated from other groups. The species concept of the biologist goes back to J. Ray, who in his *Historia plantarum* (1686) used the term species much as it was used later by Linnaeus and the nineteenth-century taxonomists. The scientific name for a species consists of 2 parts - it is binomial, with a generic name followed by a trivial (or specific) name. It is always given in italics, and both names begin with a capital letter, such as *Apis mellifera* .

Subspecies: Ecological or ecological race of the species. Subspecies are groups at the first stage of speciation; individuals of different subspecies sometimes interbreed, but they produce many sterile male offspring. At the second stage are incipient species, or semispecies; individuals of these groups rarely interbreed, and all their male offspring are sterile.

Subspecies is an aggregate of phenotypically similar populations of a species, inhabiting a geographic subdivision of the range of a species and differing taxonomically from other populations of the species. More than one subspecies of any one polytypic species can exist in breeding condition in any one area. When the species concept was developed by

Ray and Linnaeus, the species was first thought to be something stable and uniform, composed of individuals that conform to the type. Individuals that did not agree with the type were segregated as "varieties." Subsequently it was found that the "variety was a composite concept, including both variant individuals and variant populations. The name variety for the latter category was eventually replaced by the term subspecies .e.g. Head lice , *Pediculus humanus capities*.

Polytypic species

A category containing two or more immediately subordinate categories, as a genus with several species or a species with several subspecies. Or species that consist of two or more subspecies . Recognition of the significance of polytypic species was one of the most important developments of the new systematics. It is therefore appropriate to discuss the polytypic species in more detail.

Monotypic species

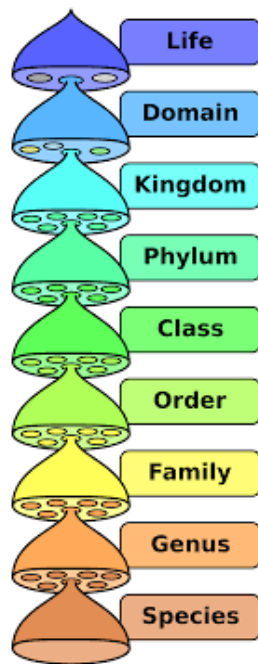
Species which have no subspecies or which, to be more precise, consist of only a single subspecies.

THE TAXONOMIC HIEARARCHY AND HIGHER CATEGORIES : (GENUS -KINGDOM CATEGORIES)

THE TAXONOMIC HIEARARCHY

Taxonomy Hierarchy is a scientific procedure/ process used for the proper identification as well as for the classification of all animals on the earth. Also is the arrangement of various categories in successive levels of the biological classification . Each of this level is called as the taxonomic category or rank. The famous Swedish scientist Carlous Linnaeus was the developer of this renowned system in the 18th century era. The group of the organisms which lie at the top of the Animal Taxonomy Hierarchy contains larger number of the organisms as compared to the organisms which lie at the lower levels. The Animal Taxonomy Hierarchy by Linnaeus consists of two prime features that play a crucial reason behind the successful usage of Animal Taxonomy Hierarchy for the naming, classification and grouping of the animals. The first main feature being the Binomial Nomenclature means the scientific name of an organism consists of a unique combination of just two terms,

not more than that whereas the second feature corresponds to the ordering of all the animals in broad divisions.



Rank	Name
Kingdom	Animalia
Subkingdom	Eumetazoa
Phylum	Arthropoda
Subphylum	Hexapoda
Class	Insecta
Order	Coleoptera
Suborder	Polyphaga
Infraorder	Cucujiformia
Superfamily	Tenebrionoidea
Family	Tenebrionidae
Subfamily	Alleculinae
Genus	<i>Podonta</i> Solier 1835
Species	<i>nigrita</i> (Fabricius, 1794)

Fig. Taxonomic Hierarchy

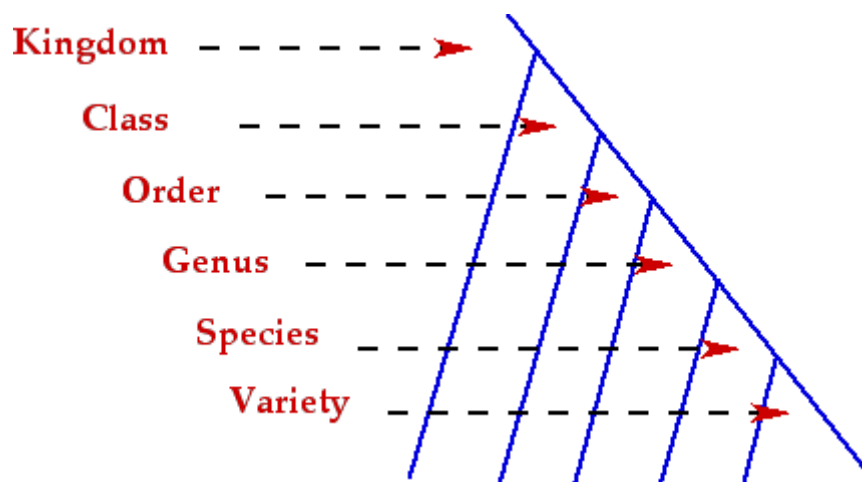


Fig. *Podonta nigrita* (Photo :Nabeel A. Mawlood , 2016)

Linnaean Hierarchy

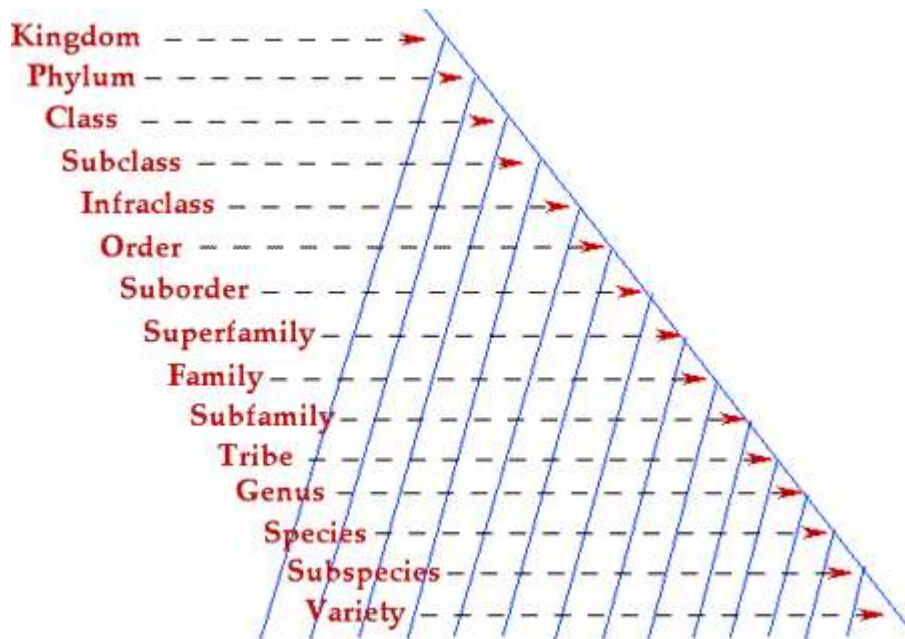
This is a system of categories that connote taxonomic rank. The same thing could be achieved through a system of indentation (see below) or a system of numbers connoting rank in a hierarchy. However, these latter systems are generally more difficult to represent and remember by the user. With the Linnaean system one only needs to know the general categories and know rank order in the hierarchy! .

The original Linnaean system had a limited set of categories that successfully reflected a nested set of groups within groups. Linnaean Hierarchy in 10th Edition of *Systema Naturae* (1758)



Later many authors began to incorporate categories above and below these original categories. Some classifications contain well in excess of 10 different categories, as can be see below.

Categories Used in More Modern Classifications



Proper Usage of Taxonomic Categories

Taxonomic Category	Singular	Plural
Kingdom	Kingdom	Kingdoms
Phylum	Phylum	Phyla
Class	Class	Classes
Order	Order	Orders
Family	Family	Families
Genus	Genus	Genera
Species	Species	Species

The Species : It is the lowest level of classification and shows the high level of similarities among the organisms.

Species Names

In the hierarchical system developed by Linnaeus species are referred to by two different "names". Historically, predecessors of Linnaeus referred to species in descriptive phrases, in Latin. Binominal consists of a genus and species name (epithet). Each species is placed into a genus.

Generic names are Latin nouns. Names of species are Latin adjectives in agreement with the nouns (Generic epithet) (or are nouns in apposition). Generic names (epithets) always begin with a capital letter; species names (epithets) always begin with lower-case letter. *Musca domestica* L. .Both names are set apart from the accompanying text:

Author's names

All generic and specific epithets have authors, the name(s) of the person(s) who first officially described them in a publication. You will often see scientific names with an author's name following it. This is often confusing to non-taxonomists but is really important because it is very useful in tracing the history of applications of names through time. Scientific names with very similar spellings can usually be distinguished from one another when an author's names is included. *Musca domestica* Linnaeus ,1758

Dates of authorship

Dates of official descriptions can also be included with scientific names to further clarify situations and locate relevant literature.

e. g. *Musca domestica* Linnaeus,1758

The genus

A taxonomic category intermediate between the species and family , which contain a single species or monophyletic group of species ,which is separated from other taxa of the same rank (other genera) by a decided

gap. The genus also a group of species having some definite similar characters or relationships .

So the generic name refers to the genus, which is a group of species that are fairly closely related - such as the genus *Chrysomyia* which includes several species, such as the *Chrysomyia bezziana* and *Chrysomyia albiceps* (Screw worm).

The generic name can be used alone, to describe a genus, whereas the specific name is always used with the generic name - it is meaningless when used alone.

The generic name always begins with a capital letter, and generic and species names are always printed in italic (or underlined when writing or typing, when italic is not available).

Tribe

A taxonomic category intermediate between the genus and subfamily ,
Examples : Calliphorini , Meloini

Subfamily

A taxonomic category of family group subordinate to family ,
Examples

Calliphorinae , Tenebrioninae

Family

A taxonomic category intermediate between the genus and order , which contain single genus or monophyletic group of genera , and separated from other families by a decided gap. Genera are grouped into families, which are major groups of generally similar organisms; such as Culicidae, which includes all Mosquito , some of these transmission the pathogen to humans leopard. The taxonomic term familia was first used by French botanist Pierre Magnol in his *Prodromus historiae generalis plantarum, in quo familiae plantarum per tabulas disponuntur* (1689) where he called the seventy-six groups of plants he recognised in his tables families (familiae). The concept of rank at that time was not yet settled, and in the preface to the *Prodromus* Magnol spoke of uniting his families into larger genera, which is far from how the term is used today. Carolus Linnaeus used the word familia in his *Philosophia botanica* (1751) to denote major groups of plants: trees, herbs, ferns, palms, and so on. He used this term only in the morphological section of the book, discussing the vegetative and generative organs of plants. Subsequently, in French botanical

publications, from Michel Adanson's *Familles naturelles des plantes* (1763) and until the end of the 19th century, the word *famille* was used as a French equivalent of the Latin *ordo* (or *ordo naturalis*). In nineteenth-century works such as the *Prodromus* of Augustin Pyramus de Candolle and the *Genera Plantarum* of George Bentham and Joseph Dalton Hooker this word *ordo* was used for what now is given the rank of family. Families can be used for evolutionary, palaeontological and generic studies because they are more stable than lower taxonomic levels such as genera and species (Sarda & Michael, 2008; Sarda, et al., 2010). Family names always end in the letters *idae*, but are not printed in any special way. The family is a worldwide distribution. e.g. *Muscidae* (House fly), *Aphidae* (plant lice), *Meloidae* (blister beetle), *Blattidae* (Kockroach).

Order

A taxonomic category intermediate between the family and class, which contains single family or monophyletic group of family, and separated from other by a decided gap. The classification starting from order has less similarities as a result, they are categories based on aggregates of characteristics. Families are grouped into orders, whose individuals may vary in many ways. The Linnaean orders were used more consistently. That is, the orders in the zoology part of the *Systema Naturae* refer to natural groups. Some of his ordinal names are still in use (e.g. *Lepidoptera* for the order of moths and butterflies, or *Diptera* for the order of flies, mosquitoes, midges, and gnats). Orders begin with a capital and usually end in "a" - but not always, so it is not always easy to tell what is an order by very decided characters, Examples: Order: *Orthoptera*, *Isoptera*, *Hemiptera*.

Class

A taxonomic category contain single order or monophyletic group of order, which is separated from other classes by very decided characters. The class as a distinct rank of biological classification having its own distinctive name was first introduced by the French botanist Joseph Pitton de Tournefort in his classification of plants that appeared in his *Eléments de botanique*, 1694. The class is a major division within the animal Kingdom, and form the basis on which most fossil study is based. For example, the phylum *Arthropoda* contains mor than 5 classes: the *Insecta*, *Crustacea*, *Archnida*, *Chilopoda* and *Diplopoda*.

Phylum

Classes are grouped into phyla (the plural of phylum), and phyla into Kingdoms.

There are approximately 35 phyla in the animal kingdom, and only about a dozen of these (including Mollusca and Brachiopoda) leave any fossil remains. Thus, the vast majority of life has left no evidence for us to find. Within the animal Kingdom, the most common phyla are:

Phylum Porifera - They are primitive organisms, most of them are salt-water sponges. They do not have organs or nerve cells or muscle cells.

Approximately,

8,000 species exist today. Examples : *Sycon*, *Euspongia*, *Spongilla*.



Fig. *Sycon ciliatum* (Photo : Robet Keen)

Phylum Coelentrata (Cnidaria) - This group is composed of jelly-fish and other lower aquatic animals. Approximately, 15,000 species exist today. e.g: *Aurelia*, *Adamsia*.



Fig. *Aurelia* (Photo : John Pickering)

Phylum Platyhelminthes - This group consists of flat worms. They inhabit both marine and fresh water habitats and they are mostly endoparasites found in animals. e.g: *Taenia*, *Fasciola*.

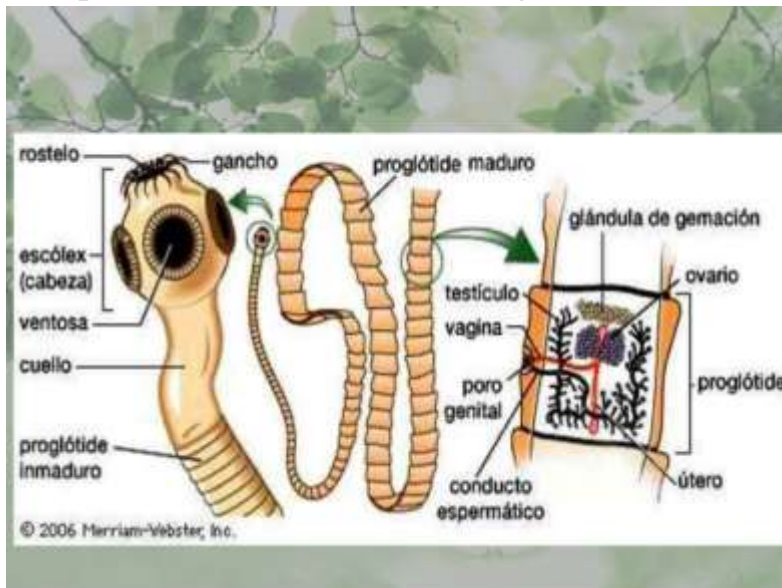


Fig. *Taenia solium* (Photo Merriam Webster)

Phylum Aschelmeintnes - It is a group of round worms, most of them are parasites. This phylum consists of about 80,000 parasitic worms . e.g. *Ascaris lumbricoides*



Fig. *Ascaris Lumbricoides* (Male)

Phylum Annelida - They are present in aquatic, terrestrial and are free-living or parasitic in nature. This phylum comprises of segmented worms. Example: Earthworm , *Lumbricus terrestris* ; Leech etc.



Fig. *Lumbricus terrestris* (Photo : Malcolm Storey)

Phylum Arthropoda - This is the largest phylum which consists of insects. There are over 1 million species of insects existing today. Example: Locusts, Butterfly, Scorpion, Prawn.



Fig. Butterfly , *Papilio machaon* Female

Phylum Mollusca - It is the second largest phylum. They are terrestrial and aquatic. Example: *Pila*, *Octopus*.



Fig. *Wonderpus octopus*, Ethan Daniels/Getty Images

Phylum Echinodermata - This consists of sea stars and sea urchins. There are about 6,000 species. Example: *Asteria*, *Ophiura*.



Fig. *Ophiura albida*

Phylum Chordata - Animals of this phylum have a characteristic feature of presence of notochord, a dorsal hollow nerve cord and paired pharyngeal gill slits. Within this phylum advanced group called vertebrates which include fish, amphibians, reptiles, birds and mammals. Chordata: the phylum which contains the vertebrates. As with the Arthropoda, some taxonomists regard this as a Superphylum, with three phyla. Here, the chordata has three sub-phyla:

Urochordata: the tunicates.

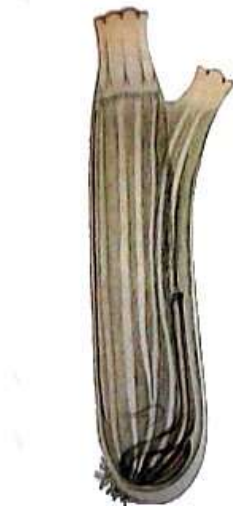


Fig. *Ciona intestinalis* from Tomiyama et al., 1970.

Cephalochordata: the lanceletes, such as the former *Amphioxus*.

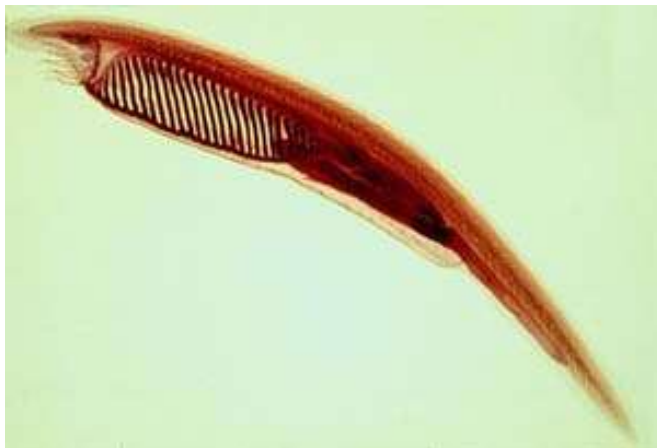


Fig . *Amphioxus* sp.

Craniata or : the vertebrates. About 60,000 species recognised.

Vertebrates are generally divided into two major groups: Agnatha (jawless vertebrates) and Gnathostomata (jawed vertebrates). The tetrapods (amphibians, reptiles, birds, and mammals) are placed in Gnathostomata, as well as those fish with hinged jaws. The lampreys (Petromyzontiformes) are placed in Agnatha, as well as several extinct orders of jawless vertebrates. Hagfish are generally classified in Agnatha, despite the lack of vertebrae. In some classification schemes, Agnatha and Gnathostomata are considered superclasses, and in other schemes Agnatha is considered a class.

Traditionally, seven classes of extant (living) vertebrates are recognized, three of fish and four of tetrapods (Benton, 2004) :

- Class Agnatha (jawless vertebrates, lampreys)
- Class Chondrichthyes (cartilaginous fish)
- Class Osteichthyes (bony fish)
- Class Amphibia (amphibians)
- Class Reptilia (reptiles)
- Class Aves (birds)
- Class Mammalia (mammals)

Vertebrate

Chordates (Phylum Chordata)