M.Sc.1st Semester; Course Code: **Zoo-01-CR;** Unit: **II**

2.1. Taxonomic ranks and categories

A given rank subsumes under it less general categories, that is, more specific descriptions of life forms. Above it, each rank is classified within more general categories of organisms and groups of organisms related to each other through inheritance of traits or features from common ancestors. The rank of any *species* and the description of its *genus* is *basic*; which means that to identify a particular organism, it is usually not necessary to specify ranks other than these first two. Consider a particular species, the red fox *Vulpes vulpes*: its next rank, the genus *Vulpes*, comprises all the 'true foxes'. Their closest relatives are in the immediately higher rank, the family Canidae, which includes dogs, wolves, jackals, all foxes, and other caniforms such as bears, badgers and seals; the next higher rank, the order Carnivora, includes feliforms and caniforms (lions, tigers, hyenas, wolverines, and all those mentioned above), plus other carnivorous mammals. As one group of the class Mammalia, all of the above are classified among those with backbones in the Chordata phylum rank, and with them among all the animals in the Animalia kingdom rank. Finally, all of the above will find their earliest relatives somewhere in their domain rank Eukarya. The *International Code of Zoological Nomenclature* defines rank as:

The level, for nomenclatural purposes, of a taxon in a taxonomic hierarchy (e.g. all families are for nomenclatural purposes at the same rank, which lies between superfamily and subfamily)

Main Ranks

`In his landmark publications, such as the *Systema Naturae*, Carolus Linnaeus used a ranking scale limited to: kingdom, class, order, genus, species, and one rank below species. Today, nomenclature is regulated by the nomenclature codes. There are seven main taxonomic ranks: kingdom, phylum or division, class, order, family, genus, species. In addition, the *domain* (proposed by Carl Woese) is now widely used as one of the fundamental ranks, although it is not mentioned in any of the nomenclature codes. A taxon is usually assigned a rank when it is given its formal name. The basic ranks are species and genus. When an organism is given a species name it is assigned to a genus, and the genus name is part of the species name. The species name is also called a binomial, that is, a two-term name. For example, the zoological name for the human species is *Homo sapiens*. This is usually italicized in print and underlined when italics are not available. In this case, *Homo* is the generic name and it is capitalized; *sapiens* indicates the species and it is not capitalized.

Main Taxonomic Ranks			
Latin		English	
Region		Domain	
Regnum		Kingdom	
phylum	*Division*	phylum (in Zoology)	division (in Botany)
Classis		Class	
Ordo		Order	
Familia		Family	
Genus		Genus	
Species		Species	

Ranks in Zoology

There are definitions of the following taxonomic ranks in the International Code of Zoological Nomenclature: superfamily, family, subfamily, tribe, subtribe, genus, subgenus, species, subspecies. The International Code of Zoological Nomenclature divides names into "family-group names", "genus-group names" and "species-group names". The Code explicitly mentions:

Superfamily
Family
Subfamily
Tribe
Subtribe

Genus
Subgenus

Species
Subspecies

The rules in the code apply to the ranks of superfamily to subspecies, and only to some extent to those above the rank of superfamily. In the "genus group" and "species group" no further ranks are allowed. Among Zoologists, additional terms such as *species group*, *species subgroup*, *species complex* and *superspecies* are sometimes used for convenience as extra, but unofficial, ranks between the subgenus and species levels in taxa with many species (e.g. the genus *Drosophila*). At higher ranks (family and

above) a lower level may be denoted by adding the prefix "*infra*", meaning *lower*, to the rank. For example, *infra*order (below suborder) or *infra*family (below subfamily).

Names of Zoological Taxa

i) A taxon above the rank of species has a scientific name in one part (a uninominal name).
ii) A species has a name composed of two parts (a binomial name or binomen): generic name + specific name; for example *Canis lupus*.
iii) A subspecies has a name composed of three parts (a trinomial name or trinomen): generic name + specific name +subspecific name; for example *Canis lupus familiaris*. As there is only one possible rank below that of species, no connecting term to indicate rank is needed or used.

Ranks in botany

According to Art 3.1 of the International Code of Nomenclature for algae, fungi, and plants (ICN) the most important ranks of taxa are: kingdom, division or phylum, class, order, family, genus, and species. According to Art 4.1 the secondary ranks of taxa are tribe, section, series, variety and form. There is an indeterminate number of ranks. The ICN explicitly mentions:

primary ranks
secondary ranks
further ranks

---

kingdom (*regnum*)
subregnum
division or **phylum** (*divisio*, *phylum*)
subdivisio or *subphylum*
class (*classis*)
subclassis
order (*ordo*)
subordo

---

family (*familia*)
subfamilia
tribe (*tribus*)
subtribus
genus (*genus*)
subgenus
section (*sectio*)
subsection
series (*series*)
subseries
species (*species*)

subspecies
variety (*varietas*)
subvarietas
form (*forma*)
subforma

There are definitions of the following taxonomic categories in the Plants: cultivar, cultivar, grex. The rules in the ICN apply primarily to the ranks of family and below, and only to some extent to those above the rank of family. Also see descriptive botanical names.

Names of botanical taxa

Taxa at the rank of genus and above have a botanical name in one part (unitary name); those at the rank of species and above (but below genus) have a botanical name in two parts (binary name); all taxa below the rank of species have a botanical name in three parts (an infraspecific name). To indicate the rank of the infraspecific name, a "connecting term" is needed. Thus *Poa secunda* subsp. *juncifolia*, where "subsp." is an abbreviation for "subspecies", is the name of a subspecies of *Poa secunda*. Hybrids can be specified either by a "hybrid formula" that specifies the parentage, or may be given a name. For hybrids getting a hybrid name, the same ranks apply, prefixed with *notho* (Greek: 'bastard'), with nothogenus as the highest permitted rank.

Outdated names for botanical ranks

If a different term for the rank was used in an old publication, but the intention is clear, botanical nomenclature specifies certain substitutions:

i) If names were "intended as names of orders, but published with their rank denoted by a term such as": "cohors" [Latin for "cohort"], "nixus", "alliance", or "Reihe" instead of "order" (Article 17.2), they are treated as names of orders.
ii) "Family" is substituted for "order" (ordo) or "natural order" (ordo naturalis) under certain conditions where the modern meaning of "order" was not intended. (Article 18.2)
iii) "Subfamily is substituted for "suborder" (subordo) under certain conditions where the modern meaning of "suborder" was not intended. (Article 19.2)
iv) In a publication prior to 1 January 1890, if only one infraspecific rank is used, it is considered to be that of variety. (Article 37.4) This commonly applies to publications that labelled infraspecific taxa with Greek letters, α, β, γ, ...

Examples:

Classifications of five species follow: the fruit fly so familiar in genetics laboratories (*Drosophila melanogaster*), humans(*Homo sapiens*), the peas used by Gregor Mendel in his discovery of genetics (*Pisum sativum*), the "fly agaric" mushroom *Amanita muscaria*, and the bacterium *Escherichia coli*. The ranks of higher taxa, especially

intermediate ranks, are prone to revision as new information about relationships is discovered. For example, the flowering plants have been downgraded from a division (Magnoliophyta) to a subclass (Magnoliidae), and the superorder has become the rank that distinguishes the major groups of flowering plants.[6] The traditional classification of primates (class Mammalia—subclass Theria—infraclass Eutheria—order Primates) has been modified by new classifications such as McKenna and Bell (class Mammalia—subclass Theriformes—infraclass Holotheria) with Theria and Eutheria assigned lower ranks between infraclass and the order Primates. See mammal classification for a discussion. These differences arise because there are only a small number of ranks available and a large number of branching points in the fossil record.

Within species further units may be recognised. Animals may be classified into subspecies (for example, *Homo sapiens sapiens*, modern humans) or morphs (for example *Corvus corax varius* morpha *leucophaeus*, the Pied Raven). Plants may be classified into subspecies (for example, *Pisum sativum* subsp. *sativum*, the garden pea) or varieties (for example, *Pisum sativum* var. *macrocarpon*, snow pea), with cultivated plants getting a cultivar name (for example, *Pisum sativum* var. *macrocarpon* 'Snowbird'). Bacteria may be classified by strains (for example *Escherichia coli* O157:H7, a strain that can cause food poisoning).

Terminations of names

Taxa above the genus level are often given names based on the type genus, with a standard termination. The terminations used in forming these names depend on the kingdom (and sometimes the phylum and class) as set out in the table below. There is an indeterminate number of ranks, as a taxonomist may invent a new rank at will, at any time, if they feel this is necessary. In doing so, there are some restrictions, which will vary with the nomenclature code which applies. The following is an artificial synthesis, solely for purposes of demonstration of relative rank, from most general to most specific:

- **Domain** *or*
  Empire
  Subdomain (biology)
- **Hyperkingdom**
- **Superkingdom**
- **Kingdom**
- Subkingdom
- Infrakingdom
- Parvkingdom
- Superphylum (*or* Superdivision *in botany*)
- **Phylum** (*or* **Division** *in botany*)
- Subphylum (*or* Subdivision *in botany*)
- Infraphylum (*or* Infradivision *in botany*)
- Microphylum
- Superclass

- **Class**
- Subclass
- Infraclass
- Parvclass
- Superdivision (*zoology*)
- Division (*zoology*)
- Subdivision (*zoology*)
- Infradivision (*zoology*)
- Superlegion (*zoology*)
- Legion (*zoology*)
- Sublegion (*zoology*)
- Infralegion (*zoology*)
- Supercohort (*zoology*)
- Cohort (*zoology*)
- Subcohort (*zoology*)
- Infracohort (*zoology*)
- Gigaorder (*zoology*)
- Magnorder *or* Megaorder (*zoology*)
- Grandorder *or* Capaxorder (*zoology*)
- Mirorder *or* Hyperorder (*zoology*)
- Superorder
- Series (*for fish*)
- **Order**
- Parvorder (*position in some zoological classifications*)
- Nanorder (*zoology*)
- Hypoorder (*zoology*)
- Minorder (*zoology*)
- Suborder
- Infraorder
- Parvorder (*usual position*) *or* Microorder (*zoology*)
- Section (*zoology*)
- Subsection (*zoology*)
- Gigafamily (*zoology*)
- Megafamily (*zoology*)
- Grandfamily (*zoology*)
- Hyperfamily (*zoology*)
- Superfamily
- Epifamily (*zoology*)
- Series (*for Lepidoptera*)
- Group (*for Lepidoptera*)
- **Family**
- Subfamily
- Infrafamily

- Supertribe
- Tribe
- Subtribe
- Infratribe
- **Genus**
- Subgenus
- Section (*botany*)
- Subsection (*botany*)
- Series (*botany*)
- Subseries (*botany*)
- Superspecies *or* Species-group
- **Species**
- Subspecies (*or* Forma Specialis *for fungi, or* Variety *for bacteria*)
- Variety (*botany*) or Form / Morph (*zoology*)
- Subvariety (*botany*)
- Form (*botany*)
- Subform (*botany*)

Significance and problems

Ranks are assigned based on subjective dissimilarity, and do not fully reflect the gradational nature of variation within nature. In most cases, higher taxonomic groupings arise further back in time: not because the rate of diversification was higher in the past, but because each subsequent diversification event results in an increase of diversity and thus increases the taxonomic rank assigned by present-day taxonomists. Furthermore, some groups have many described species not because they are really very diverse, but due to the fact of being more easily sampled and studied than other groups. Of these many ranks, the most basic is species. However, this is not to say that a taxon at any other rank may not be sharply defined, or that any species is guaranteed to be sharply defined. It varies from case to case. Ideally, a taxon is intended to represent a clade, that is, the phylogeny of the organisms under discussion, but this is not a requirement.

Classification, in which all taxa have formal ranks, cannot adequately reflect our knowledge about phylogeny; at the same time, if taxon names are dependent on ranks, rank-free taxa can't be supplied with names. This problem is dissolved in cladoendesis, where the specially elaborated rank-free nomenclatures are used. There are no rules for how many species should make a genus, a family, or any other higher taxon (that is, a taxon in a category above the species level). It should be a natural group (that is, non-artificial, non-polyphyletic), as judged by a biologist, using all the information available to them. Equally ranked higher taxa in different phyla are not necessarily equivalent (e.g., it is incorrect to assume that families of insects are in some way evolutionarily comparable to families of mollusks). For animals, at least the phylum rank is usually associated with a certain body plan, which is also, however, an arbitrary criterion.