

diversity of life: 13-14 living species?

Adaptive radiation

*"the relatively rapid expansion and diversification of an evolving group of organisms as they adapt to new ecological niches. Adaptive radiation is the process by which one species evolves into two or more species. This occurs as a result of different populations becoming reproductively isolated from each other, usually by adapting to different environments."*

Systematics: study of the kinds and diversity of organisms and any and all relationships among taxa

Taxonomy: theory and practice of classifying organisms

Classification: actual ordering and placement of organisms into groups or categories based on certain criteria

Nomenclature: formal system of naming

Classification

hierarchical classification or classification by subordination

Linnaean system of classification: 10th edition *Systema Naturae* (1758)

Kingdoms

Phylum

Class

Order

Family

Genus

Species

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Primates

Family: Hominidae

Genus: Homo

species: *Homo sapiens*

Taxon (taxa= plural) names: e.g., *Homo sapiens* is the name of the species category for humans and Primates is the name of the Order category to which we belong. *Homo sapiens* and Primates are taxa names.

rank of the category

Classification: an inductive process

Identification: a deductive procedure

typology

two types of similarities: analogies and homologies

analogies e.g., the wings of a bird and a butterfly (same function)

homologies: similar structures inherited from a common ancestor (e.g., forelimb of lizard, wing of bird, human arm)

homoplasies: nonhomologous structural similarities between species which are due to independent acquisition in separate evolutionary lines

parallelism (or parallel evolution) e.g., South American and Africa monkeys

convergence (or convergent evolution)

species category (biological definition of the species)

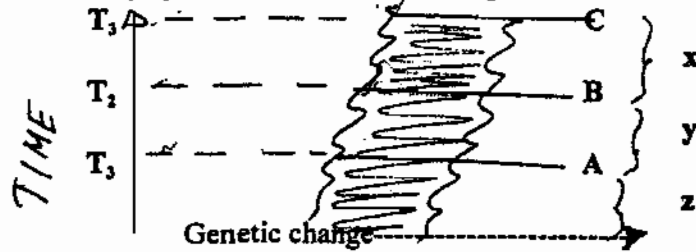
"Species comprise a homogenous community whose members closely resemble one another in

general morphological (anatomical) structure and are capable of interbreeding freely and producing fully fertile offspring".

**Sympatric species:** different species living in the same or overlapping areas (home ranges), non-geographic species

**Allopatric species:** species occupying separate non-overlapping geographic areas (geographic species) time-successive, evolutionary or paleospecies. offspring.

The relationship of biological species (i.e. the definition we use to define living organisms) and evolutionary species is shown in this diagram:



This diagram represents a lineage evolving through time. A, B & C are biological species that existed at times, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. x, y, z are paleospecies whose temporal boundaries are indicated by these arbitrary segments drawn between the biological species.

**Speciation (allopatric or geographic)**

cladogenesis or branching or divergent evolution

anagenesis or straight line or sequential evolution

**Causes of speciation:**

1. Reproductive isolation
2. Behavioral (ethological)
3. Temporal or seasonal isolation-- i.e. mating occurs at different times of the year.
4. Mechanical isolation-- e.g., morphology of the genitalia among some insects prevents populations

thus providing a basis for the origin of new species.

allopatric species/sympatric species

Higher Categories (e.g., genus)

Nomenclature

International Code of Zoological Nomenclature 1901.

binomial names (species) e.g., *Homo sapiens*,

rule of priority

type specimen.

The endings of higher category names are consistent:

Infraorder -iformes

Superfamily -oidea

Family -idae

Subfamily -inae

primitive or derived traits

Primitive traits: inherited from an earlier form (ancestral traits)

Derived traits: traits that have changed substantially from an ancestral state

shared derived traits

Classification

Phenetics: classification on the basis of overall similarities.

Cladistics: focus on evolutionary relationships that use only shared derived traits