Anth 215

Biological Classification, Taxonomy

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 (taxes=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
corvergence (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, T₁, T₂, and T₃, 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