Chapter 18: Classification

Class Biology

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18.1 — Finding Order in Diversity

Assigning Scientific Names

Taxonomy: a branching classification of all organisms based on shared characteristics that changes as new discoveries are made

- How biologists identify/organized biodiversity
- Universally-accepted rules for identifying and naming each species
  - *Common names* can vary from place to place

Latin/Greek names were used originally.

- Confusing with too much detail
  - Detail varied across scientists

Dichotomous keys → identifies organisms based from paired statements or questions

Binomial Nomenclature

Binomial Nomenclature → each species is assigned a two-part scientific name

- Developed by Carl Linnaeus
- *Written in italics*, first word is capital & second word is lowercase

1st part → **genus** (a group of similar species)

2nd part → species (unique for each species)

Classifying Species into Larger Groups

Systematics: the science of naming and grouping organisms

- Organizes living things into *groups that have biological meaning* (**taxa**)

The Linnaean Classification System

- Hierarchy of ordered ranks
  - Species, genus, family, order, class, phylum, kingdom
- Grouped based on anatomical similarities and differences

Family: several genera (*plural of genus*) that share many similarities

Order: closely-related families

Class: similar orders

Phylum: groupings of classes (share important characteristics)

Kingdom: the largest and most inclusive taxonomic category

Classification Changes

Fertile offspring → belong to the species

- Larger taxonomic groups are decided by scientists

18.2 — Modern Evolutionary Classification

Evolutionary Classification

Phylogeny: the evolutionary history of lineages

- *Phylogenic systematics/evolutionary classification* → groups species into larger categories that reflect lines of evolutionary descent (rather than overall similarities and differences)

Common Ancestors

Large taxon → Farther back the members shared a common ancestor

Clades

Clade: a group of species that includes a single common ancestor and all descendants of that ancestor (living and extinct)

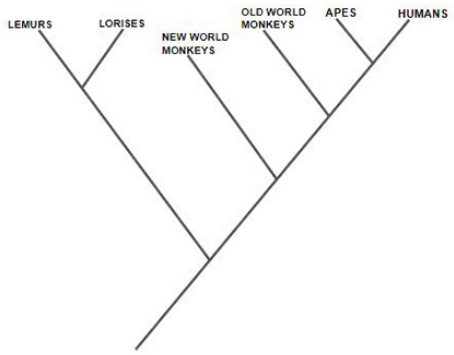
- Must be a **monophyletic group** (a single common ancestor and all its descendants)

Paraphyletic → has a common ancestor but excludes some descendants

Cladograms

Cladistic analysis → compares carefully-selected traits to determine the order in which groups of organisms branched off from their commn ancestors

- Diagram → **cladogram** (shows lineages and their branches from the ancestors)



CLADOGRAM OF PRIMATES

Derived Characters

Derived Characters: traits that arise in the most recent common ancestorof a particular lineage and passed along to descendants

> Scientists must be careful when categorizing species to keep in considering the *abscence* of traits over time.

DNA in Classification

Genes as Derived Characters

> All organisms have **DNA** as their genetic information.

The more derived genetic characters two species share, the more recently they shared a common ancestor.

18.3 — Building The Tree of Life

Changing Ideas about Kingdoms

Linnaeus → animals, plants

- Nowadays, there are many more categories

5 Kingdom system: *Monera* (bacteria), *Protista* (single-cell eukaryotic organisms), *Fungi*, *Plantae*, *Animalia*

6 Kingdom system: *Monera* → *Archaebacteria* & *Eubacteria*

CLASSIFICATION OF LIVING THINGS

DOMAIN	Bacteria	Archaea	Eukarya			
KINGDOM	**Eubacteria**	**Archaebacteria**	**"Protista"**	**Fungi**	**Plantae**	**Animalia**
CELL TYPE	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls with peptidoglycan	Cell walls without peptidoglycan	Cell walls of cellulose (some have chloroplasts)	Cell walls of chitin	Cell walls of cellulose w/ chloroplasts	No cell walls or chloroplasts
# OF CELLS	Unicellular	Unicellular	Most unicellular, some colonial, some multicellular	Most multicellular, some unicellular	Most multicellular, some green algae unicellular	Multicellular
MODE OF NUTRITION	Autotroph or heterotrophy	Autotroph or heterotrophy	Autotroph or heterotrophy	Heterotroph	Autotroph	Heterotroph
EXAMPLES	*Streptococcus*, *Escherichia coli*	Methanogens, halophiles	*Ameoba*, *Paramecium*, slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

Three Domains

Domain: a large, more inclusive category than a kingdom

- *Bacteria*, *Archaea*, *EukaryaE*

The Tree of All Life

Tree of life → current hypotheses and evolutionary relationships

Domain Bacteria → unicellular, prokaryotic, cell walls with peptidoglycan, ecologically-diverse (*Eubacteria*)

Domain Archaea → unicellular, prokaryotic, extreme environments, cell walls without peptidoglycan (*Archaebacteria*)

Domain Eukarya → all organisms with a nucleus ("*Protista*", *Fungi*, *Plantae*, *Animalia*)

- **"Protista"** → paraphyletic, unicellular eukaryotes
- **Fungi** → mostly heterotrophs, cell walls with chitin, feed of decaying organic matter,
- **Plantae →** autotrophs, cell walls with cellulose, carry photosynthesis using chlorophyll, *nonmotile* (cannot move from place to place)
- **Animalia** → multicellular, heterotrophic, no cell walls, can most, great amount of diversity