

Unit 2 - Biodiversity

- Chapters 4-6

Diversity of Organisms and Classification



Taxonomy

- The branch of Biology that names and classifies all organisms into groups.

Historical Development of Modern Classification

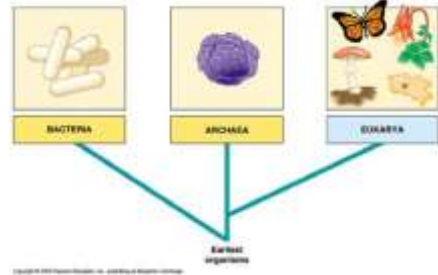
- Aristotle – Greek philosopher
 - Classified living things into plants and animals
- Microorganisms were discovered
 - new grouping required (plants, animals, protists)
- Fungi recognized as distinct from plants and animals
- Bacteria identified as fifth kingdom (Monera)
- Archea discovered and separated from bacteria (Six Kingdoms)

Domains

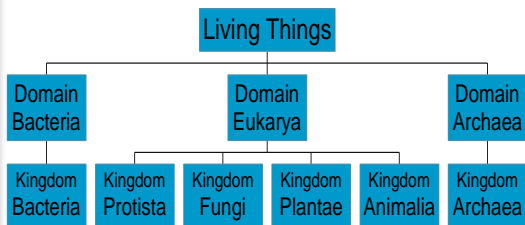
- The six main groups of living things are called Kingdoms
- Kingdoms are further grouped into three Domains based on their cell structure

Classification of Organisms

- **The Three Domain Classification Scheme** (based on cell structure)



Domains

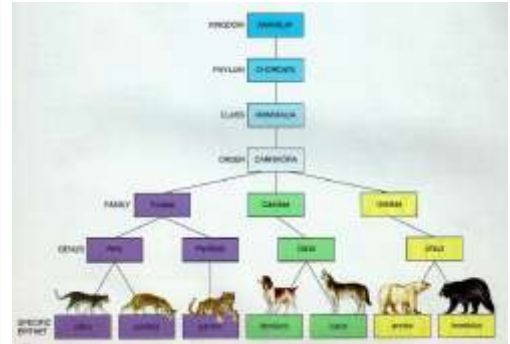


Classification of Organisms

Levels of Classification – taxa (s. taxon)



HOW TO REMEMBER THAT: KING PHILIP CAME OVER FOR GOOD SOUP



- Note – Similarity among organisms increases as we move down the hierarchy - variety decreases
- Last group (species) identifies only one kind of organism

Binomial Nomenclature



- System developed [by Linnaeus](#)
 - Allows for communication across various languages and cultures
 - Common names for organisms vary in different areas.
- Each species given a 2-word identifier
(Genus name + specific name)

Species

- The smallest group of organisms classified which can interbreed with each other to produce fertile offspring
- Scientific name : unique to each species
 - e.g. scientific name of human :
Homo sapiens

Classification of Organisms



Example - Daffodil

Kingdom Plantae

Division Anthophyta

Class Monocotyledonae

Order Liliales

Family Amaryllidaceae

Genus Narcissus

Species *pseudonarcissus*

Kingdom

Phylum / Division

Class

Order

Family

Genus

Species

Example -Frog

Kingdom Animalia

Phylum Chordata

Class Amphibia

Order Salientia

Family Ranidae

Genus Rana

Species *pipens*



Dichotomous Keys

- Used to identify unknown creatures or objects by choosing from a series of connected pairs of options.
- Each pair of options contains contrasting traits (usually observable features)
- To identify an organism using the key, start at Statement 1A and follow the steps

Bean Key



- 1a. Bean round
- 1b. Bean elliptical or oblong

Garbanzo bean
Go to 2

- 2a. Bean white
- 2b. Bean has dark pigments

White northern
Go to 3

- 3a. Bean evenly pigmented
- 3b. Bean pigmentation mottled

Go to 4
Pinto bean

- 4a. Bean black
- 4b. Bean reddish-brown

Black bean
Kidney bean

Making a Key

Decide upon one feature that will let you divide up your group of creatures into two smaller groups.

Take each smaller group and repeat step one until each creature is alone in a group.

Number each dividing feature and assign the letters a and b to the options for that feature.

Assemble into a table.

Evidence used to Classify Organisms

Evidence: Fossil Record

- Using radioactive carbon-14 during the age of a fossil can be determined
 - C-14 decays at a known rate, the amount remaining in a fossil can be used to calculate the age
- This evidence shows that major taxa are not as different from each other as they appear



Archaeopteryx shares features with both birds and reptiles. The organism is believed by many to be a modern descendant of birds. That is to say the intermediate between dinosaurs and birds.

Evidence: Anatomy

- Comparisons are made between the structures of different organisms
- Bone structures are similar in many species, even though their sizes and proportions have been modified for different modes of transportation



See Fig. 4.9 - pg 114

Evidence: Embryology

- Comparisons of early embryological development between different species provides evidence as to how closely related they are
- Ernest Haeckel drew embryos of different species for comparison



Haeckel's Embryo Drawings



Evidence: DNA / RNA Analysis

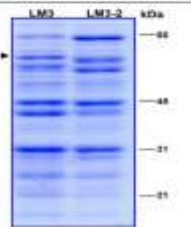
- Mixing single strands of DNA from two different species to determine percentage of relationship
- The greater the bonding between complementary base pairs, the more closely the two are related
- This is done using DNA from the mitochondria because it is passed down from mother to offspring (from the egg)



99% of human - chimp DNA bonds while only 9% of human rhesus monkey rhesus DNA bonds
 To which species are we more closely related?

Evidence: Biochemical

- Many genes are simply instructions for making proteins
- By comparing these genes and finding similarities means that different species may be related since they have the same proteins
- Many species have been reclassified based on their biochemistry
 - Guinea pigs
 - Horseshoe crabs

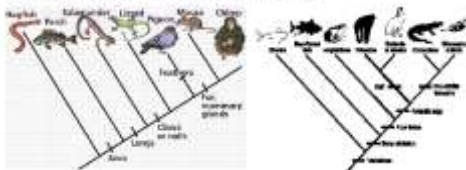


Phylogeny & Cladistics

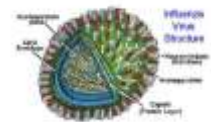
- **Phylogeny** – The whole evolutionary history of a species or other taxonomic group. (Figure 4.14 pg. 116).
 - At the base of the tree is the oldest ancestor
 - Forks in branches represent divergences of new species
 - The top of the tree represents the most recent time, so from the base to the top of a branch is a progression through time.
- **Cladistics** – A classification scheme based on phylogeny and the idea that any one group of related organisms was derived from a common ancestor

Phylogenetic Trees

Cladogram – A diagram similar to a phylogenetic tree that does not take into account the time of a divergence.



Viruses

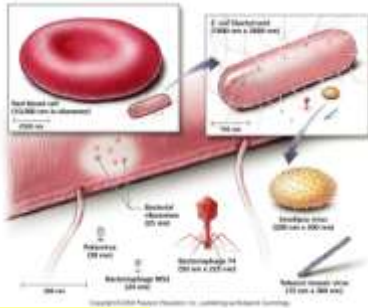


Non-living particles of DNA or RNA encased in a protein coat called a capsid.

Capsid - helps to protect the virus from the host cell's defensive enzymes
-has proteins to match receptors on host cell

DNA/RNA – contains the genetic information of the virus for making proteins

How big are Viruses?



Cells Alive Link

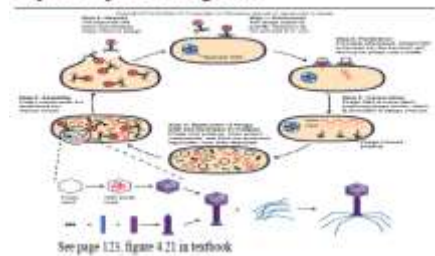
Why Viruses are non-living

1. No cell structures
2. No cytoplasm, organelles or cell membranes
3. No cellular respiration
4. Can only reproduce inside a host cell

Virus Life Cycle - Lytic Cycle

- ATTACHMENT** – virus attaches to a receptor site on the host cell membrane.
- ENTRY** – virus injects its DNA/RNA into the host cell (T4 virus) OR the cell may engulf virus, forming a vacuole
- REPLICATION** – virus uses host cell metabolism to copy its DNA/RNA and its proteins
- ASSEMBLY** - New virus particles are assembled inside the host cell
- LYSIS AND RELEASE** - The host cell breaks (lyses) open, releasing the new virus particles

Lytic Cycle Diagram



Kingdom Archea – the archaeobacteria

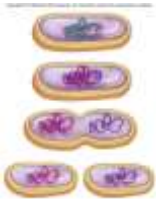
- Unicellular; prokaryotic, heterotrophic
- Cell wall present
 - does not contain *peptidoglycan*
- Found in environments such as salt lakes, hot springs, animal stomachs
 - “extremeophyles”
- Reproduce asexually

Kingdom Eubacteria (or Monera) – the true bacteria

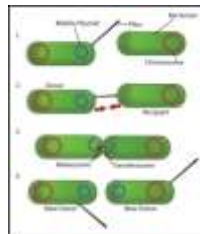
- Unicellular, microscopic, Prokaryotic
- Most are heterotrophic (except blue-green algae)
 - Saprophytes (decomposers) or parasites
- Cells have a cell wall of *peptidoglycan*
- Reproduce asexually by *binary fission*
- Reproduce sexually by *conjugation*

Bacteria - Reproduction

Asexual: Binary Fission



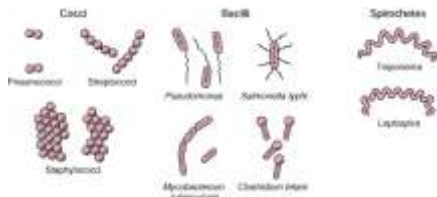
Sexual: Conjugation



Kingdom Eubacteria

- Bacteria are classified by shape
 - Three main shapes:
 - Spherical = coccus (eg. *Streptococcus* – causes “strep” throat)
 - Rod-shaped = bacillus (eg. Tuberculosis bacteria)
 - Spiral-shaped = spirillum (eg. *Treponema pallidum* causes syphilis)

Bacteria



Protists

- Many unicellular; microscopic
- Nucleus present (Eukaryotic)
- Autotrophic or heterotrophic
- Two main groups:
 - Protozoa – animal-like protists
 - Algae – plant-like protists

Protozoa

- Microscopic animal-like protists
- Mostly aquatic
- Move by means of cilia or flagella, or amoeboid movement
- Examples: Amoeba, Paramecium, Plasmodium



Algae

- Aquatic
- Simple unicellular or multicellular plant-like protists
- No root, stem or leaf
- Contain photosynthetic pigments (e.g. chlorophyll) for photosynthesis
- Includes kelp and seaweeds



Fungi

- Eukaryotic
- Main body is a mycelium
 - a mass of thin filaments called hyphae
- No root, stem and leaf
- No chlorophyll
 - Saprophytic or parasitic
- Reproduce by forming spores



Animals

- Eukaryotic
- Divided into two groups according to the presence or absence of backbone:
 - Invertebrates : without backbone
 - Vertebrates : with backbone

Invertebrates

Phylum Porifera - sponges



Phylum Platyhelminthes - flatworms



Phylum Nematoda - roundworms



Phylum Annelida - segmented worms



Invertebrates – Phylum Arthropoda

Class Diplopoda - millipedes



Class Crustacea – crabs, lobster, shrimp



Class Arachnida – spiders, scorpions



Class Insects - insects



Invertebrates

Phylum Mollusca – snails, clams, squid, octopi



Phylum Echinodermata – starfish, sea urchins



Vertebrates

- Divided into 5 groups:
 - Fish
 - Amphibians
 - Reptiles
 - Birds
 - Mammals

Fish

- Aquatic
- Cold-blooded
- Body covered with wet and slimy scales
- Streamline body for easy movement through water
- Fins for balance and to control movement
- Gills for breathing
- External fertilization



Amphibians

- Cold-blooded
- Moist, scaleless skin
- Limbs present
 - tetrapods
- Larvae (tadpoles) use gills for breathing; adults use lungs
- External fertilization



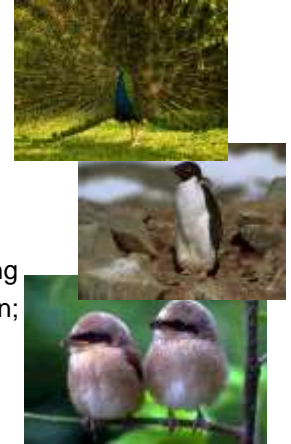
Reptiles

- Cold-blooded
- Body covered with dry, hard scales
- Live on land
- Breathe with lungs
- Internal fertilization; lay shelled eggs



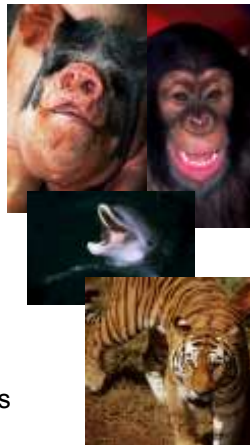
Birds

- Warm-blooded
- With feathers
- With wings
- Beak for feeding
- Lungs for breathing
- Internal fertilization; lay shelled eggs



Mammals

- Warm-blooded
- Hairs on skin
- Females have mammary glands for producing milk
- Lungs for breathing
- Diaphragm present
- Internal fertilization; embryos develop inside mothers' bodies



Plants

- Eukaryotic
- Most plants contains photosynthetic pigments (e.g. chlorophyll) for photosynthesis
 - Autotrophic
- Can be divided into two groups:
 - Vascular Plants
 - Non-vascular Plants

Non-vascular plants



Mosses – Phylum (Division) Bryophyta

- have no conducting tissues
- No true roots stems or leaves
- Need water for reproduction (sperm swims to egg)
- Life cycle shows an alternation of generations
 - Monoploid gametophyte and diploid sporophyte

Mosses

- With simple leaves and stems
- No root
 - with rhizoids for anchorage and absorption of water
- No vascular tissues
- Reproduce by spores
- Found in damp area



Ferns

- With true roots, stems, leaves and vascular tissues
- Reproduce by spores
- Live in damp places



Gymnosperms

- Reproduction by producing seeds
 - Seeds develop in cones, not enclosed by fruits
 - ⇒ naked seeds
- Needle-shaped leaves to reduce water loss



Angiosperms (Flowering plants)

- With flowers for reproduction
- Seeds are produced inside the fruit (matured ovary)



Two groups of flowering plants

	Dicotyledons	Monocotyledons
Cotyledons	Two	One
Leaf venation	Netted	Parallel
Root system	Tap root system	Fibrous root system