Chap 20

Classification + Evolution of Organisms

How to name newly discovered organisms?

to Identify organisms accurately so that anyone in this world understood organism being discussed we use scientific naming.

Scientific identification of organisms involve 2 ≠ but related activities

1- Taxonomy: naming of organisms
2- Phylogeny: Showing how organisms are related through evolution.

Taxonomy: Science of naming organisms + grouping them into logical Categories.

taxonomy comes from greek word Taxis means arrangement.

1) Latin pt used as many as 15 words to describe a single organism but didn't work due to slow communication among scientists.

2) Binomial System of Nomenclature.

Modern system began in 1758 with Carolus Linnaeus he used 2 latin words for each Species of an organism

genus → Specific epithet (descriptive word)

A Species is a population of organism capable of inter breeding + producing fertile offsprings

Each organism is a member of a specie.

A genus (plural genera) is a group of closely related organisms

the Specific Epithet is a word added to the genus name to identify which one of several species within the genus we are refering to.

Binomial names are usually italicized or underlined. 1st letter of genus is Capitalized, specific epithet is always lower case.

example Thamnophis sirtalis (garter snake)

Since Linnaeus's system, International rules has been set to assure maintenance of the ordery system.

the 3 sets of rules are:

- International Rules for Botanical Nomenclature
- " " " Zoological "
- " " for Bacteriological code for "

~ 1.5 million species have been named so far
(1 million to come)

Species are organized in logical groups (2)

Species are placed in specific groups

First Division was → Plant Kingdoms
→ Animals

then divided each into smaller.

Now there are 3 major Categories of organisms called Domains

Eubacteria — oldest; Prokaryote
Archaebatera
Eucarya. — Eukaryote

organisms are separated based structural + Biochemical features of their cells.

Domain
↓
Kingdoms → Phylum

Domains are subdivided into Kingdoms

With Eubacteria + Archaebacteria, there are several Kingdoms

with Eucarya there are 4 Kingdoms → Plantae, Animalia, Fungi, Protista (protozoa + Algae)

A Phylum is a Subdivision of a Kingdom

All Kingdoms have more than 1 phylum.

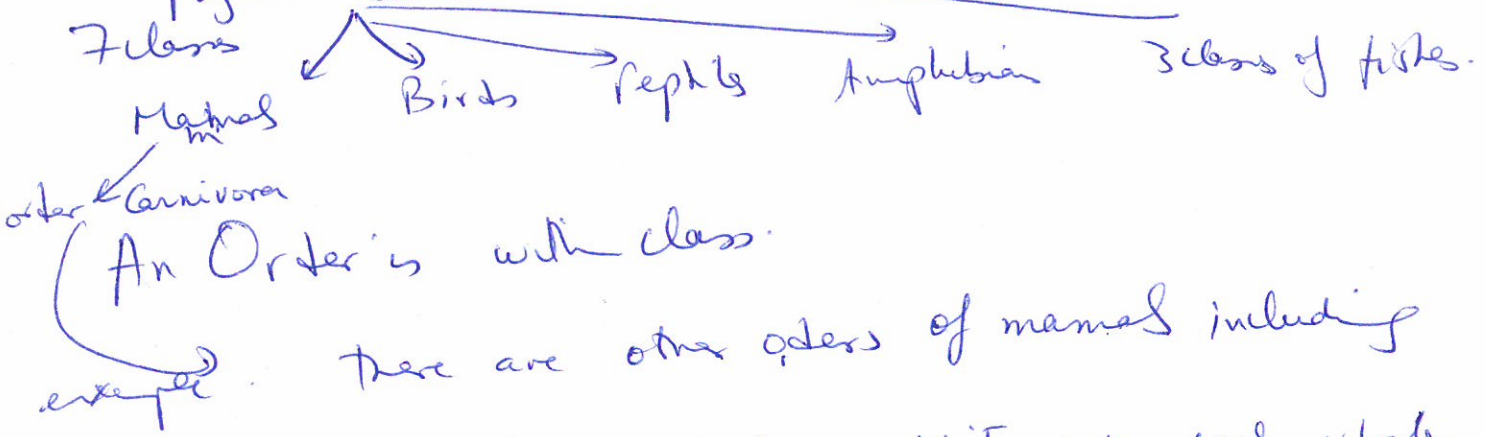
Example: Kingdom Plantae → Flowing plants, Conifer trees, moss, fern. + many others

organisms are placed in a phylum based on specific nature of their structure, metabolism + biochemistry

Phyla are divided into classes

Example Phylum Chordata

7 classes



order Carnivora

An Order is with class.

example There are other orders of mamals including horses, cattle, rodents, rabbits, bats, seals, whales, humans + ---.

A family is a subdivision of an order that is made of group of related genera which are in turn composed of groups of related species.

See table 20.1

+ read the Cat family Felidae (subgroup of order Carnivora) that is divided in many species in ≠ genera.

⋮

Phylogeny

It is the Science that explors the evolutionary relationships among organisms. to construct evolut history.

Taxonomic ranking should reflect the phylogenetic relationship among organism being classified.

Taxonomy + phylogeny should be always revised as new organism are always descovered

Evidence used by Phylogenetists

Fossils, comparative anatomy life cycle evolution, biochemical + Molecular evidence.

Evidence from fossils allow biologist to place organism in a time sequence.
older organism are in deeper layers

Life cycle evolution: Some organis gos in ≠ life stge
larval stage gives clus to the relatedness of organism

From all evidens, biologist developed a picture of how all organism are related

See Fig 20.8

10.2 Domains of Life

Members of Eubacteria + Archae are known as Bacteria. They're prokaryotic cells.

DNA analysis showed the ≠'s between Eubacteria + Archae.

Eubacteria evolved first then gave rise to Archae

Finally Eucarkya evolved.

Eubacteria

small, Prokaryotic, single celled organisms 1-10 μm in size.

cell wall has a pephdoglycan: (peptide + long polymer of sugar made of amino + acid sugar).

Shape: sphere, rod, spirals

No nucleus - genetic material DNA loop

asexual reproduction.

- some have flagella ≠ than eukaryotic flagella
- some move by gliding
- they're anaerobes.
- Nowadays we find aerobes + anaerobes.

Many heterotrophic Eubacteria are Saprophytes. They obtain energy by decomposition of dead organic material

others are Parasites needing a host to provide nutrients

- Others are mutualistics + beneficiall to host
- others are commensalistics (derive benefit from host without harming them) (4)
- Others are Autotrophic
  - Many are called Cyanobacteria, they have a pigment that allow them to do photosynthesis
  - Others uses inorganic chemical reactions for their energy source + called Chemosynthetic

Domain Archae:

derived Archaios mean Ancient.

Similar to Eubacteria:
Prokaryotic cell. but differ in:
No Peptidoglycan wall.
DNA is ≠ having many fens Not found in Eubacteria + Eucarya.
+ cell membrane is also ≠ fm

They exist as: rod, spher, spirals, filament, flat plate.

live in extreme environment. They're known as extremophiles. They're divided into 3 groups:
- Methanogens — Halobacteria — Thermophilic

- Methanogens are anaerobs. produce methane. found in sewage. + intstnd of ruminants + human.
- Halobacteria: live in salty environment. contain Chlorophyll + can do photosynthesis
- thermophilic., live in very High T. + rich in Sulfur

Domain Eucarya.

Thought to have evolved from prokaryotic cells through endosymbiosis.

Nit - chloro were ingested by larger cells. then their function become integrated with host cells + became essential for their survival.

Eukaryotic cells are larger than Prokaryotic
→ 1000x volume of prokaryotic cells.

Kingdom Protista:

Single celled organisms
Members are diversed in form, metabolism, reproductive methods. ~~St~~

3 lines of evolution with Protist are seen

- Fungi like heterotrophs slime molds
- Plant like Autotrophs Algae.
- Animal like heterotrophs protozoa

Ameba + Paramecium, are common example of Protozoa.

Kingdom Fungi:

Fungus is the common name for Kingdom Fungi.

Areas of Protista.

- They're Non-motile.
- have rigid - thin wall composed of chitin
- Are Non-Photosynthetic
- Eukaryotic. ~70,000 species are multicellular like mushrooms + Molds).
- Yeast are unicellular.
- Obtain their nutrients from organic sources (heterotrophs)
- Most are Saprophytes. (important decomposers in all ecosystems)
- Some fungi are parasitic - others are mutualistic
- Fungi harms plants, human (athlete's foot)
- Mutualistic fungi are important in lichens.

Kingdom Plantae:

green - Photosynthetic plants.
Non-motile - terrestrial - Multicellular containing chlorophyll + Make their own Nutrients.
All plant cells have a cellulose cell wall.

through Evolution Prokista → Non vascular Plants. like mosses.
Then Vascular plants evolved to give seed producing plants.

85% of Plants species are flowering plants.
14% Grass + Pea
1% cone bearers.

Life cycle of a plant is unique & Have diploid gametophyte generation give haploid sex cells by mitosis
+ Diploid sporophyte producing haploid spores by meiosis.
Plant may also do asexual reproduction as well.

Kingdom Animalia:

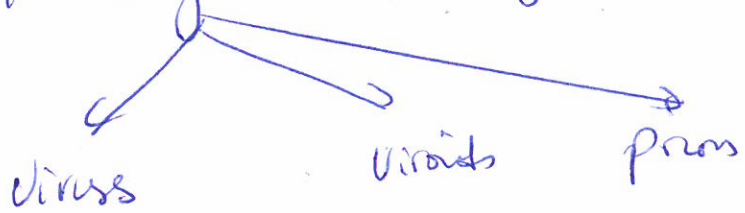
range in size from microscopic to huge animals.
→ All are eukaryotic cells.
- Heterotrophic
- Multicellular
- Motile (but some are sessile in a portion of their life cycle)
- Sexual reproduction (less complex one reproduce asexually)

23. Acellular Infectious Particles

Some particles show characteristics of life + cause diseases but do Not have a cell structure. We refer to them as acellular.

They enter cells + cause disease + passed on from 1 organism to another. (We call the Infectious Particles).

3 Kinds of acellular organisms



Viruses:

Consist of Nucleic Acid surrounded by a coat of Prote

they're obligate intracellular parasites. They can not propagate except inside a cell. Hence

- they're Not living

they show characteristic of life only inside cell.

they vary in size, shape,

- Rod-Shaped
- Spherical
- helical
-

- they are identified by disease they cause
- they're host-specific
- If cell has receptor for virus, it can be infected (a glycoprote receptor)

Once attached to cell, virus either enters or inject its DNA/RNA.
Nucleic acid may either stay free & integrate in host genome.
Virus with RNA genome have an enzyme called reverse transcriptase that change it DNA, the DNA is transcribed to RNA. with enough RNA + protein are made. They pack again in new viruses + are released of host. leading to host cell death. Are released, they infect other cells, ...
Some virus remain in cell. + are triggered to reproduce

See Fig 20.16.

Viroids: Infectious RNA
They do Not parasitize animals till now.
they infect plants. leading to plant death

Prions: Protein that can be transmitted from 1 organism to another leading to disease
they affect Brain leading to spongy appearance called Spongiform encephalopathies. Lead to abnormal behavior → death.
Example. Mad cow disease in cattle
Scrapie in Sheep + goat
Kuru in Human.
Creutzfeldt Jakob disease ≡ Mad cow disease