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Science & Tech



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SCIENCE & TECH

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Biology

Organisms

- A living thing with an organized structure that can:
 - React to **stimuli**
 - Reproduce
 - Grow
 - Adapt
 - Maintain homeostasis.
- Classified by taxonomy into groups:
 - o Multicellular animals, plants, and fungi or unicellular microorganisms
 - Eg. protists, bacteria, and archaea.
- All organisms made of cells.

Classification of Organisms

Based on the number of cells		Based on the subcellular structure	
•	Single-celled: Bacteria, archaea, and protists	•	Eukaryotes: Having a well-defined nucleus with
•	Multicellular: Animals and Plants		genetic material.
		•	Prokaryotes: Without nucleus but possess
		21	genetic material in a nucleoid.

Hierarchy of Classification- Groups





- Hierarchy sequence of categories in a decreasing or increasing order from kingdom to species and vice versa.
- Kingdom (highest rank) followed by division, class, order, family, genus and species (lowest rank).
 1. Species:





- Group of population similar in form, shape and reproductive features so that fertile sibling can be produced.
- 2. Genus:
 - A group of similar species.
 - Genera having only one species monotypic.
 - Genera having more than one species polytypic.
 - Eg. Lion & tiger are quite similar species placed under genus Panthera.
- 3. Family:
 - Collection of similar genera.
 - Separated from genera by reproductive and vegetative features.
 - Eg. cats and leopard family Felidae.
- 4. Order:
 - One or more than one similar families constitute order.
 - Eg. Family Felidae are included in the order Carnivora.
- 5. Class:
 - One or more than one order makes a class.
 - Eg. Class Mammalia includes all mammals bats, rodents, kangaroos, whales, great apes and man.
- 6. Phylum:
 - Collection of similar classes.
 - **Eg.** Phylum chordata of animals has class Mammalia along with birds, reptiles and amphibians.
- 7. Kingdom:
 - Top most taxonomic category.
 - Eg. all animals are included in Kingdom Animalia.

Taxon

Unit that denotes grouping of organisms based on observable features.

5 Kingdom classification







Comparison of Five Kingdom					
Criteria	Monera	Protista	Fungi	Plantae	Animalia
Cell Type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Leval of	Unicellular	Unicellular	Multicellular	Tissue/organ	Tissue organ/
organisation			and		organ system
			unicellular		
Cell wall	Present (made up	Present in some	Present	Present (made	Absent
	of peptidoglycan	(made up of	(made up of	up of cellulose)	
	and	cellulose, absent	chitin or		
	mucopeptides)	in other)	cellulose)		
Nutrition	Autotrophic	Autotrophic	Hetetrophic,	Autrophic	Heterotrophic
	(Phototrophic,	photosynthetic	Parastic or	(photosynthetic)	(holozoic)
	Chemoautrophic)	Hetetrophic	saprophytic		
	Hetetrophic				
	parastic and				
	saprophytic)				
Motility	Motile or non-	Motile or non-	Non-motile	Mostly Non-	Mostly motile
	motile	motile		motile	
Organisms	Archaebacteria,	Chrysophytes,	Yeast,	Algae,	Sponges,
	Eubacteria,	Dinoflagellates,	Mushrooms,	Bryophytes,	Invertebrates
	Cyanbacteria,	Euglanoids,	and molds	Pteridophytes,	and
	Actinomycetes	Slime molds,	()))	Gymnosperm	vertebrates
	and mycoplasma	Amoeba,	$\sim 0 v$	and Angiosperm	~~~
		Plasmodium,	ch th	toppo	ninvo
		Trypanosoma,	SU M	F LOPPE	r in yo
		Paramecium			

Plantae Kingdom



1. Thallophyta

- Unique features:
 - Plants that do not have well-differentiated body design.

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- **Commonly** called **algae**.
- Predominantly aquatic.
- Eg. Spirogyra, Ulothrix, Cladophora, Ulva and Chara.
- Reproduction : No specialised reproduction process

2. Bryophyta





- Sporophylls form compact structure called cones or strobili in som plants.
- Reproduction : Show true alternation of generation.



Cone of Equistem



- Dominant sporophyte produce spores by meiosis & gametophyte produces gametes by mitosis.
- Sporangia produce spores in the spore mother cells that germinate to give gametophytes. •
- Gametophytes are free-living, multicellular, photosynthetic Prothallus
- Male sex organ anteridia produce antherozoids & female sex organ is archegonia.
- **Reproduction procedure.**

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- o Antherozoids are released in water and come in contact with archegonia.
- Gametes fuse in the archegonium to produce zygote
- Zygote produces sporophyte after division.
- Spores : Homosporous or heterosporous
- In heterosporous plants, microspore & megaspore give rise to male & female gametephyte respectively.

Unleash the topper i 4. Gymnosperms Consist of pines & deodar Gymno-naked: sperma - seed Gymnosprem : Plants with naked seeds that do not bear flower & fruits Seeds are visible as cones & develop on surface of reproductive structure. Cycas Con **Unique Features** Wind is the major source of pollination. Leangth : Medium to large tree & few are shrubs Vascular & Complete differentiation into leaves, steam & roots Leaves: Needle-like with thick cuticle & sunken stomata. Roots Taproot system • Some from mycorrhiza (e.g. pinus) Some form specialized roots called coralloids roots (e.g. Cycas) **Reproduction:** Taproo Male & female cones can be same (e.g. Pinus) or different (e.g. : cycas) plants. • Heterosporous plants that produce haploid microspores & megaspores. Male cones: Contain microsporophyll, few of which develop into pollen grains & rest degenerate. Female Cones: Several megasporophyll cluster to form female cone. Female cone bears ovule with megasporangium & give rise to haploid megaspores & a megaspore



5. Angiosperms

Angiosperms

DUSNÓLUS Unleash the topper in you

- The family of flowering platns.
- Vascular fauna dominating across the globe.
- Called phanerogams due to the presence of flowers
- Seeds (ovules) are enclosed inside hollow ovary (which forms the fruit)

Unique Features

- Well differentiated plant body with fully developed root & shoot system.
- Survive in various habitats.
- Length : Microscopic Wolfia to > 100 m tall Eucalphytus
- Vast diversity including woody trees, shrubs & herbs.
- Leaves, steam & roots are adapted as per habitat

Reproduction:

• Flower is the reproductive structure can be unisexual or bisexual

Structure of an idealized flower



- Alternation of genetation haploid gametophyte alternates with the diploid sporophyte.
- Double fertilization is characteristic to Angiosperms Syngamy & triple fusion.
- Post-fertilziation ovary forms the fruit & ovules form the seeds & remaining parts with off.





hrub

Herb



Vascular and Nonvascular Plants

	Vascular Plants	Non - Vascular Plants
Definition	 Possess vascular system to conduct food and water throughout the plant 	 Lack vascular systems
Diversity	Higher	• Low
Vascular System	Present	Absent
True stem, Roots & Leaves	• Yes	 No; a stem and leaf-like structures and rhizoids, instead of true structures.
Plant Strength	 Xylem tissues contain lignified tissues provide support and rigidity to the plant. 	 No water conducting tissues Tender and shorter than vascular plants
Reproduction	Sporophytes	Gametophytes
Examples	• Ferns, conifers, and flowering plants.	 Bryophytes, including liverworts, mosses, and hornworts.
Drought Resistance	Almost all are drought resistant	 Susceptible to drought. Associated with swamps

Sporophytes	Gametophytes	
Use the process of meiosis	Use the process of mitosis	
Results- formation of spores	Results - production of gametes	
Diploid plants	Haploid plants	
Have two sets of chromosomes	Have a single set of chromosomes	
Reproduce asexually	Reproduce sexaully	

Animalia:





- 1. Porifera
 - Non mobile animals attached to some solid support.
 - Holes or pores all over the body.
 - A canal system circulating water throughout body to bring in food and O2.
 - Mainly found in marine habitats.
 - Commonly k/a sponges
- 2. Coelenterata
 - Animals living in water.
 - Diploblastic: body is made up of two layers of cells.
 - Some live in colonies while others have a solitary life
 - Eg. span (Hydra) jellyfish .
- 3. Platyhelminthes
 - **Triploblastic**: 3 layers of cells from which different tissues can be made.
 - Some degree of tissues formation.
 - Either free living or parasitic.
 - **Eg.** Planarians, liver flukes.
- 4. Nematode
 - Bilaterally symmetrical and triploblastic.
 - Body is cylindrical rather than flattened.
 - Tissues, but no real organs,
 - A sort of **body cavity** or a **pseudocoelom**, is **present**.
 - K/a **parasitic** worms causing diseases, such as worms causing **elephantiasis** (filarial worms) or worms in the intestines (**roundworm** or **pinworms**).
- 5. Annelida
 - Have true body cavity.
 - Allows true organs to be packaged in body structure.
 - Extensive organ differentiation.
 - Eg- Earthworms, leeches.
- 6. Arthropods
 - Open circulatory system and so the blood does not flow in well defined blood vessels.
 - Have joint legs.
 - Eg- prawns, butterflies, houseflies, spiders, scorpions and crabs.



- 7. Mollusca
 - Have an **open circulatory system** and **kidney like organs** for **excretion**.
 - Little segmentation.
 - A foot is used for moving around.
 - Eg- snails, and mussels, octopus.
- 8. Echinodermate
 - Spiny skinned organisms.
 - Exclusively free living marine animals.
 - Have a water driven tube system that they use for moving around.
 - Have hard calcium carbonate structure that they use as skeleton.
 - **Eg-** starfish, sea cucumber.
- 9. Protochordats
 - Marine animals.
 - Eg. balanoglossus, hardemania and amphioxus.

10. Vertebratia

- Have a true vertebral column & internal skeleton.
- Bilaterally symmetrical
- Triploblastic
- Coelomic and segmented
- **Complex differentiation** of body tissues and organs.
- All chordates possess the following features:
 - have a **notochord**
 - have a **dorsal nerve cord**
 - Triploblastic
 - Paired gill pouches
 - Coelomate.
- Grouped into six classes:
 - A. Cyclostomes
 - Jawless vertebrates.
 - Have an elongated eel-like body, circular mouth, slimy skin
 - Scaleless.
 - Ectoparasites or borers of other vertebrates.
 - Eg. Petromyzon (Lamprey) and Myxine (Hagfish)
 - B. Pisces
 - Exclusively aquatic animals.
 - Skin is covered with scales/ plates.
 - Obtain oxygen dissolved in water by using gills.
 - Body is streamlined, and a muscular tail for movement. T
 - Cold-blooded
 - Hearts have only two chambers.
 - Lay eggs.
 - Eg. sharks, tuna or rohu

- C. Amphibia
 - No scales
 - Have mucus glands in the skin,
 - 3 chambered heart.
 - **Respiration** through **either gills** or **lungs**.
 - Lay eggs.
 - Found both in **water** and **on land**.
 - Eg. Frogs, toads and salamanders
- D. Reptilia
 - Cold-blooded
 - Have scales and breathe through lungs.
 - Most have a three-chambered heart
 - Exception: crocodiles- 4 heart chambers.
 - Lay eggs with tough coverings.
 - **Do not need** to **lay** their **eggs** in **water**, unlike amphibians.

DUSUSUS

• Eg. Snakes, turtles, lizards and crocodiles

E. Aves

- Warm-blooded animals
- 4-chambered heart.
- Lay eggs.
- An outside covering of feathers; 2 forelimbs modified for flight.
- Breathe through lungs.
- Eg. All birds
- F. Mammalia
 - Warm-blooded animals with four-chambered hearts.
 - Have mammary glands for production of milk.
 - Skin has hairs& sweat and oil glands.
 - Produce live young ones.
 - Few like platypus and echidna lay egg
 - Kangaroos give birth to very poorly developed young ones.
 - Eg. human, monkeys, whale etc

Microorganisms





- Very small in size & cannot be seen with naked eye.
- Can be seen only with the help of a microscope.
- aka microbes.
- Microbiology- Branch of science dealing with study of microorganisms.
- Found in : air, water (ponds, lakes, rivers and oceans), soil and even inside our bodies.
- 5 categories.

Virus	A tiny particle made up of genetic material and protein.
	 Intermediate between living and non living things.
	Intracellular obligatory parasites.
	• Virology- study of viruses.
	• 10,000 times smaller than bacteria.
	• Can be rod shaped , spherical or of other shapes.
	• Contains a core DNA or RNA.
	Core surrounded with a protein coat
	• Protein coat is sometimes covered by an envelope of proteins, lipids, and
	carbohydrates.
	• Causes diseases to plants, animals and human beings.
Bacteria	Single-celled prokaryotes(cells without nuclei).
	Considered 1st living organisms on earth.
	• Grouped under the kingdom Monera.
	Bacteriology- study of bacteria.
	 Size - 1μm to 5μm(micrometer).
	• 2 types based on respiration :
	 Aerobic bacteria (requires oxygen),
	• Anaerobic bacteria (does not require oxygen).
	• An outer covering k/a cell wall.
	• Other cell organelles (mitochondria, golgi body, endoplasmic reticulum etc.,) are
	absent.
	• Eg: E.coli, Bacillus anthracis, Vibrio cholera etc.
Fungi	Eukaryotic organisms that lack chlorophyll.
	• Grow in dark environments .
	• Either unicellular (like Yeast) or multicellular (like Penicillium).
	• Found in all kinds of habitats.
	Included under kingdom Fungi.
	Mycology- study of fungi.
	• Some are macroscopic (Eg. Mushroom).
	• Around 70,000 species of fungi in the world.
Algae	Very simple plants like eukaryotic organisms.
	Found in moist habitats.
	Rich in chlorophyll
	• Seen as thin film on surface of lakes and ponds.
	○ aka 'grass of water'.



	Autotrophic and produce their own food(with help of chloroplast).
	Algology/ phycology- study of algae.
	• Size - 1 micron to 50 meter.
	• Eg : Chlamydomonas, Volvox, Ulothrix, Fristschiella etc.
Protozoa	Single celled eukaryote.
	Included under the kingdom Protista.
	Protozoology- Study of protozoa.
	• Found in ponds, ocean, in moist soil , and in the cells and tissues of plants and
	animals - causing diseases.
	• Range - 2 to 200 microns.
	• Eg : Paramecium, Euglena, Amoeba, Plasmodium etc.

Animals

- Any eukaryotic multicellular organism of kingdom Animalia.
- Heterotrophic, motile & with specialized sensory organs,
 - Lacking a cell wall & growing from a blastula during embryonic development.

Characteristics

Multicellular	 Body composed of several cells performing specific functions. Cells organized into various animal tissues, Eg: Epithelial tissues, connective tissues, etc.
Eukaryotic	 Contain a membrane-bound nucleus. Nucleus -organelle containing chromosomes that bear genes. Other organelles suspended in the cytoplasm of an animal cell, Eg. Golgi apparatus, endoplasmic reticulum, lysosomes, and peroxisomes,
Heterotrophic	• Depend on other organisms for food.
Motile	 Capacity to move at will. by muscles and locomotory structures(e.g. arms, legs, wings, fins, tails, etc.)
Specialized sensory organs:	 Eg: eyes, ears, nose, skin, and tongue. Vital in recognizing and responding to stimuli in environment. Contains common and specialized receptors.
Reproduce sexually	 Produce a haploid sperm cell (a male sex cell) & a haploid ovum (a female sex cell) Unite at fertilization to form a diploid zygote. Capable of asexual reproduction. Eg: some cnidarians produce a genetic clone by budding.
Aerobic Respiration	 Inhale oxygen and release carbon dioxide . Oxygen important to cell respiration for synthesis of energy.