

Table of Contents

1. Diversity in the Living World
2. Nomenclature
3. Rules of Nomenclature
4. Classification
5. Systematics
6. Classification Taxonomic Hierarchy
7. Species
8. Genus
9. Family
10. Order
11. Class
12. Phylum
13. Kingdom
14. Taxonomic Suffixes
15. Introduction
16. What is Living?

Diversity in the Living World

Overview

- Living organisms include plants, insects, birds, animals, and microorganisms.
- Each distinct organism type is a species; known species number about 1.7-1.8 million.
- Biodiversity refers to the variety and number of organisms on Earth.

Memory Aids

- Biodiversity = variety of life forms on Earth.
- Species = distinct organism type.

Quick Checkpoints

- What defines a species?
- What is biodiversity?

Nomenclature

Key Points

- Local names vary; scientific names standardize organism identification worldwide.
- Nomenclature requires correct organism description and identification.
- Scientific names follow agreed principles: ICBN for plants, ICZN for animals.
- Each scientific name has two parts: generic name and specific epithet (binomial nomenclature).
- System introduced by Carolus Linnaeus, used globally.
- Technical names from Linnaeus' *Species Plantarum* (1753) and *Systema Naturae* (1758).

Memory Aids

- Binomial nomenclature = two-part naming system.
- ICBN = plants; ICZN = animals.
- Linnaeus = father of modern nomenclature.

Quick Checkpoints

- What is binomial nomenclature?
- Which codes govern plant and animal naming?

Rules of Nomenclature

Universal Rules

- Names are Latin or Latinized, written in italics.
- First word = genus (capitalized), second = specific epithet (lowercase).
- Example: *Mangifera indica* (mango).
- Handwritten names are underlined separately; printed names italicized.
- Author's abbreviated name follows specific epithet, e.g., *Mangifera indica* Linn.
- Tautonyms: same genus and species name, e.g., *Catla catla*.

Memory Aids

- Genus capitalized, species lowercase.
- Italicize or underline names.
- Author's name shows original describer.

Quick Checkpoints

- How are scientific names formatted?
- What is a tautonym?

Classification

Essentials

- Grouping organisms into categories (taxa) based on observable traits.
- Taxa exist at different levels: plants, animals, mammals, dogs.
- Classification process is taxonomy.
- Modern taxonomy uses external/internal structures, cell structure, development, ecology.
- Basic taxonomy processes: characterization, identification, classification, nomenclature.

Memory Aids

- Taxa = groups at any classification level.
- Taxonomy = science of classification.

Quick Checkpoints

- What is taxonomy?
- What are taxa?

Systematics

Key Concepts

- Systematics = systematic arrangement of organisms (from Latin 'systema').
- Includes identification, nomenclature, classification.
- Considers evolutionary relationships.
- Neosystematics (Julian Huxley, 1940) studies interrelationships among organisms.

Memory Aids

- Systematics = classification + evolution.

- Neosystematics = new systematics focusing on relationships.

Quick Checkpoints

- What does systematics include?
- What is neosystematics?

Classification Taxonomic Hierarchy

Hierarchy and Taxonomic Categories

- Classification is a hierarchy of ranks called taxonomic categories.
- Each category is a taxon (plural: taxa), a unit of classification.
- Common categories: Kingdom, Phylum/Division, Class, Order, Family, Genus, Species.
- Taxonomic groups are distinct biological entities, not just morphological groups.

Memory Aids

- Taxonomic hierarchy: Species < Genus < Family < Order < Class < Phylum/Division < Kingdom
- Each step groups organisms by shared features, increasing breadth upwards.

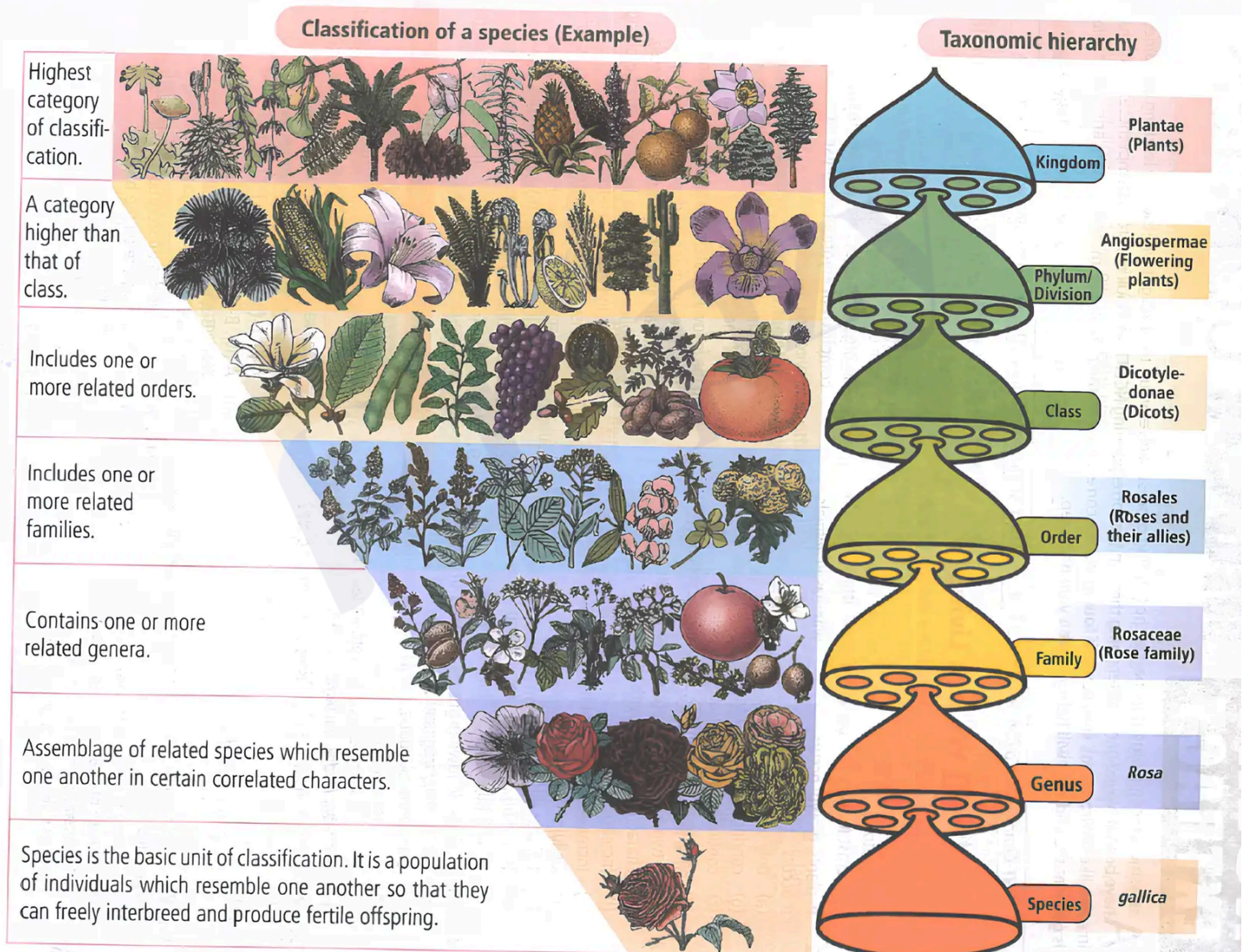
Quick Checkpoints

- What defines a taxonomic category?
- List the main taxonomic ranks in order.

Species

Definition and Characteristics

- Smallest taxonomic category.
- Group of individuals with similar morphology.
- Members can interbreed and produce fertile offspring.
- Ernst Mayr defined biological species concept.
- Example: *Rosa gallica* (a rose species).



Memory Aids

- Species = interbreeding group producing fertile offspring.
- Specific epithet follows genus in scientific names.

Quick Checkpoints

- What is the smallest taxonomic category?
- How is a species defined biologically?

Genus

Definition and Examples

- Group of related species sharing more characters than species of other genera.
- Example: Genus *Solanum* includes potato, tomato, brinjal.
- Genus *Panthera* includes lion, leopard, tiger.
- Monotypic genus: single species; polytypic genus: multiple species.

Memory Aids

- Genus groups closely related species.
- Monotypic = one species; polytypic = many species.

Quick Checkpoints

- What defines a genus?
- Difference between monotypic and polytypic genus?

Family

Definition and Characteristics

- Group of related genera with fewer similarities than genus level.
- Characterized by vegetative and reproductive features.
- Example: Family Solanaceae includes genera *Solanum*, *Petunia*, *Datura*.

- Family Felidae includes genera *Panthera* and *Felis*.
- Different families separate similar animals, e.g., Felidae (cats) and Canidae (dogs).

Memory Aids

- Family groups related genera by key features.
- Suffix for plant families: -aceae.

Quick Checkpoints

- What criteria define a family?
- Give examples of families and their genera.

Order

Definition and Examples

- Assemblage of families with few similar characters.
- Example: Order Polemoniales includes families Convolvulaceae, Solanaceae.
- Animal Order Carnivora includes families Felidae and Canidae.

Memory Aids

- Order groups families with shared traits.
- Suffix for orders: -ales.

Quick Checkpoints

- What is an order in taxonomy?
- Examples of orders and their families?

Class

Definition and Examples

- Category including related orders.
- Example: Class Mammalia includes orders Primata and Carnivora.

Memory Aids

- Class groups related orders.
- Suffix for classes: -opsida, -phyceae, -ae.

Quick Checkpoints

- What defines a class?
- Examples of classes and their orders?

Phylum

Definition and Examples

- Category including related classes.
- Example: Phylum Chordata includes fishes, amphibians, reptiles, birds, mammals.
- In plants, equivalent category is Division.

Memory Aids

- Phylum groups classes by major body plans.
- Suffix for divisions: -phyta.

Quick Checkpoints

- What is a phylum?
- Difference between phylum and division?

Kingdom

Definition and Characteristics

- Highest taxonomic category.
- Groups all organisms sharing broad common features.
- Examples: Plant Kingdom, Animal Kingdom.
- As category level rises, shared characteristics decrease.
- Taxonomic hierarchy ascending: Species → Genus → Family → Order → Class → Phylum/Division → Kingdom.

Common Name	Biological Name	Genus	Family	Order	Class	Phylum/Division
Man	<i>Homo sapiens</i>	<i>Homo</i>	Hominidae	Primata	Mammalia	Chordata
Housefly	<i>Musca domestica</i>	<i>Musca</i>	Muscidae	Diptera	Insecta	Arthropoda
Mango	<i>Mangifera indica</i>	<i>Mangifera</i>	Anacardiaceae	Sapindales	Dicotyledonae	Angiospermae
Wheat	<i>Triticum aestivum</i>	<i>Triticum</i>	Poaceae	Poales	Monocotyledonae	Angiospermae

Memory Aids

- Kingdom is the broadest group.
- Higher taxa have fewer shared traits.

Quick Checkpoints

- What is the highest taxonomic category?
- How does shared similarity change with taxonomic rank?

Taxonomic category

Division
Subdivision
Class
Order
Family

Suffix

phyta
phytina
opsida, phyceae, ae
ales
aceae

Taxonomic Suffixes

Common Suffixes for Categories

- Division: -phyta
- Subdivision: -phytina
- Class: -opsida, -phyceae, -ae
- Order: -ales
- Family: -aceae

Memory Aids

- Suffixes help identify taxonomic rank.
- Plant families end with -aceae, orders with -ales.

Quick Checkpoints

- What suffixes indicate family and order?
- How to recognize taxonomic rank from suffix?

Introduction

Overview of Biology

- Biology studies life forms and living processes.
- Living organisms inhabit diverse environments: mountains, forests, oceans, lakes, deserts, hot springs.
- Harvard evolutionary biologist known as 'The Darwin of 20th century' contributed to ornithology, taxonomy, evolution, zoogeography, systematics, and biology philosophy.

Memory Aids

- Biology = Study of life and living processes.
- Diverse habitats = key to organism variety.
- 20th-century Darwin = Harvard evolutionary biologist.

Quick Checkpoints

- What environments do living organisms inhabit?
- Who is called the Darwin of the 20th century?
- What fields did the Harvard biologist contribute to?

What is Living?

Characteristics of Living Organisms

- Distinctive features: growth, development, reproduction, metabolism, environmental sensing, responsiveness.
- Growth: increase in mass and number; unicellular growth via cell division (growth = reproduction).
- Higher plants/animals: growth (mass increase) and reproduction are separate.
- Growth types: indeterminate (plants, unlimited), determinate (animals, limited).
- Non-living growth by surface accumulation = accretion; living growth is internal.
- Growth alone is not a defining feature of life.

- Reproduction: ability to produce offspring; sexual or asexual.
- Examples: fungi produce asexual spores; yeast and *Hydra* reproduce by budding; *Planaria* regenerates lost parts; fragmentation in fungi, algae, mosses.
- Some organisms do not reproduce (mules, sterile bees, infertile humans).
- Reproduction is not an all-inclusive defining feature.
- Metabolism: sum of all chemical reactions in organisms.
- Two types: anabolism (building complex molecules), catabolism (breaking down molecules).
- Metabolism occurs in all plants, animals, fungi, microbes; absent in non-living objects.
- Isolated metabolic reactions in vitro are not living but are living reactions.
- Cellular organization is the defining feature of life.
- All organisms sense and respond to environmental stimuli (physical, chemical, biological).
- Plants respond to light, water, temperature, organisms, pollutants; photoperiod affects reproduction.
- All organisms are aware of surroundings; humans have self-consciousness.
- Consciousness is a defining property of living organisms.
- Brain-dead coma patients lack self-consciousness despite machine support.
- Living phenomena arise from interactions at cellular and molecular levels, producing emergent properties.
- Living organisms are self-replicating, evolving, self-regulating interactive systems.

Memory Aids

- Growth: internal in living, accretion in non-living.
- Reproduction: sexual or asexual, but not universal.
- Metabolism: anabolism + catabolism = life's chemical reactions.
- Cellular organization = hallmark of life.
- Consciousness = unique to living organisms, especially humans.
- Emergent properties arise from interactions.

Quick Checkpoints

- What distinguishes growth in living vs non-living?
- Why is reproduction not a universal life feature?
- Define metabolism and its types.
- What is the significance of cellular organization?
- How do organisms respond to environmental stimuli?

- What is unique about human consciousness?
- Explain emergent properties in living systems.

Prepzy