INTRODUCTION TO BIOLOGY

Notes chapter 1

SINDH TEXT BOOK BOARD
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- **Definition:** Biology is the branch of natural sciences that deals with the study of living organisms.
- **Word origin:** From Greek
  - *Bios* = life
  - *Logos* = study/reasoning
    → Biology = "Study of life"

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2. What is Life?

Life is difficult to define, but it can be identified by **life processes**:

- Digestion
- Respiration
- Metabolism
- Movement
- Growth
- Development
- Excretion
- Irritability (response to stimuli)
- Reproduction

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3. Divisions of Biology

1. **Zoology:** Study of animals (*Zoon = animal*)
2. **Botany:** Study of plants (*Botane = plant*)
3. **Microbiology:** Study of microscopic organisms (e.g., bacteria)

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4. Branches of Biology

- **Morphology:** External form and structure
- **Anatomy:** Internal structure (by dissection)
- **Cell Biology:** Study of cell and organelles
- **Histology:** Study of tissues
- **Physiology:** Functions of living organisms
- **Taxonomy:** Classification and naming of organisms
- **Genetics:** Heredity and variation
- **Developmental Biology:** Embryo formation & development
- **Environmental Biology:** Interaction of organisms with environment
- **Paleontology:** Study of fossils (ancient life)

- **Biotechnology:** Gene manipulation for useful products
- **Sociobiology:** Social behavior of organisms
- **Parasitology:** Study of parasites
- **Pharmacology:** Action of drugs
- **Molecular Biology:** Study of biological molecules

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5. Biology and Other Sciences

Biology is an **interdisciplinary science** linked with:

- **Biophysics:** Physics laws applied to biology (e.g., ultrasound, carbon dating)
- **Biomathematics / Biometry:** Use of mathematics in biology & research data
- **Biochemistry:** Study of biomolecules (proteins, lipids, nucleic acids)
- **Biogeography:** Distribution of organisms in different regions
- **Bioeconomics:** Study of economically important organisms and production

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6. Careers in Biology

- **Medicine & Surgery:** Diagnosis, treatment, and organ repair
- **Agriculture:** Crop & dairy production
- **Horticulture:** New plant varieties and products
- **Forestry:** Development & preservation of forests
- **Farming:** Fish farms, poultry farms, cattle farms
- **Animal Husbandry:** Breeding & care of useful animals
- **Fisheries:** Increasing fish production (protein source)
- **Biotechnology:** Production of medicines (insulin, hormones, interferons)

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7. Quran and Biology

- **Life from water:**
  - "We made every living thing from water." (Surah Ambiya, 30)
- **Diversity of animals:**
  - "Allah has created every animal from water: some creep, some walk on two legs, some on four." (Surah Al-Nur, 45)
- **Plants watered with one water:**
  - "We have made some of them excel others in fruit." (Surah Al-Ra'd, 4)

☞ Shows importance of **water, diversity, plant growth**.

8. Contributions of Muslim Scientists

1. **Jabir Bin Hayan (722–817 A.D):** Books on plants (*Al-Nabatiat*) and animals (*Al-Haywan*)
2. **Abdul Malik Asmai (741–828 A.D):** Zoologist; books on horses, camels, sheep, wild animals, human body
3. **Bu Ali Sina (Avicenna) (980–1037 A.D):** Founder of medicine, discovered diseases like TB & meningitis, wrote *Al-Qanoon fil Tib* and *Al-Shifa*

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9. Levels of Biological Organization

1. **Atomic level:** Bioelements (C, H, O, N, S, P are basic)
2. **Molecular level:** Biomolecules (micro: glucose, amino acids; macro: proteins, carbohydrates, lipids)
3. **Cellular level:** Cell = basic unit of life
4. **Tissue level:** Group of similar cells
5. **Organ level:** Different tissues forming an organ
6. **Organ system level:** Organs working together
7. **Organism level:** Complete living being
8. **Population level:** Members of same species in an area
9. **Community level:** Populations of different species in one area
10. **Ecosystem:** Community + environment (biotic & abiotic interaction)
11. **Biosphere:** All ecosystems on Earth

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10. Examples

- **Frog (Rana tigrina):** Multicellular, amphibian, organ systems (digestive, respiratory, circulatory, excretory, reproductive, nervous)
- **Amoeba:** Unicellular, irregular shape, moves by pseudopodia, has nucleus, food vacuoles, contractile vacuole
- **Volvox:** Colonial green alga, spherical colonies (up to 50,000 cells), photosynthetic, harmless to humans

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11. Summary

- Biology = study of life

- Life identified by certain processes
- Three major divisions: Zoology, Botany, Microbiology
- Many specialized branches (e.g., genetics, physiology, biotechnology)
- Linked with physics, chemistry, math, geography, economics
- Careers in medicine, agriculture, forestry, fisheries, biotechnology
- Quran emphasizes origin of life, water, plants, and animals
- Muslim scientists made great contributions to biology
- Levels of organization: atom → biosphere
- Examples: Frog (multicellular), Amoeba (unicellular), Volvox (colonial)