Unit 17 · Introduction to Biology

STUDY NOTES

WHAT NEB'S GRADE 11 EXAM ASKS

- **CDC's grid (2077):** Introduction to Biology (Unit 17): 1 of 75 marks; in one group with Units 1–3, 11–12, 27–31 (21 marks)
- **The paper:** 11 MCQs × 1 · 8 short × 5 · 3 long × 8; 3 hours; 1 mark per expected point
- **CDC's model paper:** MCQ: red rust of tea, caused by an alga: which branch explains it (phycology: algae)
- **MCQ (1 mark)**
  - biology = life science
  - study of plants, insects, fish
  - internal structure of a plant → anatomy
  - biogeography; epidemiology
  - X-ray diffraction relies on physics
  - earthworms in soil → vermiculture
  - biochemistry: chemistry of life
  - radiation, hunger → human well-being
- **Short (5 marks, in parts)**
  - define biology; its scopes; an overview
  - biology and chemistry, physics, geography, mathematics; interdisciplinary, with examples
  - three main branches; anatomy vs physiology; what ecology studies and why
  - one scope in agriculture; protecting forests and wildlife
  - match branches with what they study

Key terms

Biology (*bios* life + *logos* study): the science of all forms of life; also **life science**; molecules → cells → organisms → populations, ecosystems.

Botany: plants; **zoology**: animals; **microbiology**: microorganisms (bacteria, many fungi and protists, viruses).

Scope: what a subject covers and what it is used for.

Vector: animal that carries a germ from person to person without falling ill itself.

Euthenics: better human well-being through better **surroundings** (food, housing, sanitation, schooling).

Eugenics: "improving" the human race through **heredity**; rejected today.

People

- word "biology": **Lamarck** (France) and **Treviranus** (Germany), **1802**
- **Aristotle** (384–322 BC): father of **biology** and of **zoology**
- **Theophrastus**: father of **botany** (~500 plants)
- **Hippocrates**: father of **medicine**
- **Robert Hooke**: named **cells** in cork (1665)
- **Linnaeus**: binomial nomenclature
- **Darwin**: natural selection (1859)
- **Mendel**: laws of inheritance (1866)

General branches

- **Anatomy**: internal structure
- **Physiology**: functions, processes
- **Morphology**: external form
- **Paleontology**: fossils
- **Cytology**: cells
- **Histology**: tissues
- **Embryology**: embryo
- **Genetics**: heredity, variation
- **Evolution**: change over generations
- **Ecology**: organisms + environment
- **Taxonomy**: identify, name, classify
- **Biochemistry**: chemistry of life
- **Limnology**: fresh water
- **Karyology**: nucleus
- **Biogeography**: distribution
- **Ethnobiology**: how cultures use and understand plants and animals (biology + anthropology)
- **Biotechnology**: organisms or their products made useful to people
- **Genetic engineering**: changing genes directly (a gene from another organism)

Branches of zoology

- **Entomology**: insects
- **Ichthyology**: fishes
- **Ornithology**: birds
- **Herpetology**: reptiles, amphibians
- **Protozoology**: protozoans
- **Parazoology**: sponges
- **Cnidology**: cnidarians
- **Helminthology**: worms
- **Araneology**: spiders
- **Aphidology**: aphids
- **Malacology**: mollusks
- **Batrachology**: frogs, toads
- **Ophiology**: snakes
- **Saurology**: lizards
- **Mammalogy**: mammals
- **Ethology**: behavior
- **Anthropology**: humans: origin, evolution, bodies, cultures

Branches of botany

- **Phycology**: algae

- **Mycology**: fungi
- **Bryology**: bryophytes
- **Pteridology**: ferns
- **Bacteriology**: bacteria
- **Virology**: viruses
- **Pomology**: fruits
- **Anthology**: flowers (old word)
- **Floriculture**: flower growing
- **Horticulture**: fruits, vegetables, ornamentals
- **Agronomy**: field crops, soil
- bacteria, viruses: listed under botany in old books; today **microbiology**

Medical branches

- **Epidemiology**: spread and control of disease in populations
- **Immunology**: defense
- **Parasitology**: parasites
- **Enzymology**: enzymes
- **Cardiology**: heart
- **Hematology**: blood
- **Osteology**: bones
- **Endocrinology**: hormones
- **Nephrology**: kidneys
- **Neurology**: brain, nerves
- **Pathology**: diseases: causes, changes

Relation with other sciences

Science	Field	Why
Chemistry	biochemistry	organic and inorganic compounds; energy in glucose, ATP; photosynthesis, respiration, metabolism = reactions; DNA, RNA, enzymes, hormones are chemicals
Physics	biophysics	diffusion, osmosis, sap rise, blood flow, nerve signals; microscopes, chromatography, X-ray diffraction (DNA's structure); light intensity; eye = lenses, ear = sound
Geography	biogeography	altitude, temperature, rainfall, barriers, history → where species live; Nepal: Terai rhino and sal → alpine snow leopard; Oriental + Palearctic species
Mathematics	biostatistics, biometrics	analyze data; statistics for fair conclusions; models of population growth, gene frequencies
Sociology	sociobiology	social groups (bees, elephants, langurs); ethics of research; biology of human behavior

- photosynthesis: $CO_2 + H_2O$ + light → glucose + O_2; respiration: glucose + O_2 → $CO_2 + H_2O$ + energy (ATP)
- compound microscope: objective → real, inverted, enlarged image; eyepiece magnifies again; total = product ($40\times \times 10\times = 400\times$)
- Mendel: 787 tall : 277 dwarf ≈ 2.84 ≈ **3 : 1**: pattern seen only by counting

Scopes of biology

- **Health, medicine**
  - how the body works; disease, epidemics
  - vectors: *Anopheles* → malaria; sandfly → kala-azar; tsetse → sleeping sickness; housefly → typhoid, cholera, dysentery
  - vaccines (Jenner, cowpox, 1796; smallpox gone 1980), antibiotics; drugs tested in lab and animals first
- **Agriculture** (applied biology)
  - improved, hybrid varieties: yield, disease and drought resistance
  - earthworms: fertility, porosity; **vermiculture**, vermicompost
  - bees pollinate; bacteria, fungi decompose; nitrogen-fixers in bean roots
  - pests → **integrated pest management**; sustainable agriculture
- **Industry**
  - antibiotics (penicillin), herbs, honey and wax (**apiculture**), silk (**sericulture**), lac, pearls, leather, wool
  - ivory, rhino horn, turtle shell: trade banned (Nepal's 1973 Act; CITES, joined 1975)
- **Forestry**
  - forest ecology; plant diversity; soil microbes, **mycorrhiza**; conservation biology; community forests
- radiation and hunger: they harm living things → biology for human well-being

COMMON MISTAKES

✗ Euthenics = improving the race through heredity
✓ that is **eugenics**; euthenics = better surroundings.

✗ Morphology = internal structure
✓ morphology **external** form; anatomy internal.

✗ Anatomy and physiology the same
✓ anatomy = **structure**; physiology = **function**.

✗ Herpetology = reptiles only
✓ reptiles **and amphibians**.

✗ Bacteria and viruses are plants
✓ studied in **microbiology** today.