YOUR MENTOR GURU

CSIR NET Life Sciences & Biotechnology — Unit 9

Diversity of Life Forms

Study & revision companion | Topic explanations, core facts, and active-recall questions

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How to use this guide

Read each topic, explain the key mechanism in your own words, then answer the self-check prompts without looking at the notes. Use your detailed textbook or class notes for full derivations and additional examples.

Topic overview

1. 1. Origins and Early Evolution
2. 2. Evolutionary Mechanisms and Speciation
3. 3. Taxonomy and Phylogenetics
4. 4. Bacteria, Archaea and Viruses
5. 5. Protists and Fungi
6. 6. Plant Diversity and Evolution
7. 7. Animal Diversity and Human Evolution

1. Origins and Early Evolution

Early Earth evolution involved prebiotic chemistry, compartmentalization and the emergence of heritable replication.

Endosymbiotic theory explains mitochondria and plastids, supported by bacterial-like genomes, ribosomes and division.

Molecular clocks estimate divergence times when calibrated and when rate assumptions are appropriate.

Phylogenetic trees represent hypotheses of shared ancestry, not ladders of progress.

Mutation, natural selection, genetic drift and gene flow change genetic variation across generations.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: drift has stronger stochastic effects in small populations.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

2. Evolutionary Mechanisms and Speciation

Natural selection changes allele frequencies through differences in reproductive success.

Genetic drift is stochastic and especially strong in small effective populations.

Gene flow moves alleles among populations; mutation introduces new variants.

Allopatric speciation involves geographic separation; sympatric divergence can arise without geographic barriers.

Reproductive isolation can arise geographically or ecologically; adaptive radiation and convergence produce distinct patterns.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: convergent similarity does not establish recent common ancestry.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

3. Taxonomy and Phylogenetics

Binomial nomenclature uses genus and species epithet; taxonomic ranks organize classification.

Homologous characters derive from shared ancestry; analogous characters can evolve independently.

Monophyletic groups include a common ancestor and all descendants.

Bootstrap support summarizes resampling stability of inferred groupings, not the probability that a clade is true.

Classification uses morphology and molecular evidence; monophyletic groups include an ancestor and all descendants.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only

an association. The central distinction to retain is: a tree topology differs from branch-length information.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

4. Bacteria, Archaea and Viruses

Bacteria commonly contain peptidoglycan; archaea generally lack bacterial peptidoglycan and have ether-linked membrane lipids.

Viruses require host cells for replication and may carry DNA or RNA genomes.

Lytic infections produce progeny and can lyse cells; lysogeny integrates or maintains a temperate viral genome.

Microbial diversity contributes to nutrient cycling, symbiosis and disease.

Bacteria and archaea are distinct lineages; viruses require hosts to replicate and vary in genome type.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: archaea are not simply bacteria without peptidoglycan.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

5. Protists and Fungi

Protists are evolutionarily diverse eukaryotes, not one natural monophyletic kingdom.

Diatoms possess silica-rich frustules; dinoflagellates include photosynthetic and heterotrophic forms.

Fungi absorb nutrients, typically have chitin-containing cell walls and form hyphae in many groups.

Ascomycetes form sexual spores in asci; basidiomycetes form basidiospores on basidia.

Protists comprise diverse eukaryotes; fungi are absorptive heterotrophs with varied reproductive cycles.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: slime molds are not true fungi.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

6. Plant Diversity and Evolution

Bryophytes lack true vascular tissue and have dominant gametophytes.

Ferns are vascular seedless plants with dominant sporophytes.

Gymnosperms produce seeds not enclosed in an ovary; angiosperms form flowers and fruits.

Alternation of generations switches between multicellular haploid and diploid phases.

Bryophytes, ferns, gymnosperms and angiosperms differ in vascular tissues, seeds, pollen and flowers.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: the dominant life-cycle generation varies among major

plant groups.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

7. Animal Diversity and Human Evolution

Bilaterians have bilateral symmetry ancestrally and distinct germ layers; major clades include protostomes and deuterostomes.

Arthropods possess jointed appendages and exoskeletons; chordates have a notochord at some stage.

Vertebrate evolution includes major changes in jaws, limbs, amniotic eggs and endothermy.

Human evolution is branching, with multiple hominin lineages rather than a linear sequence.

Animal relationships are inferred using symmetry, embryology, body plans and molecular characters.

When solving a question, distinguish the underlying mechanism from its observable outcome. Compare the normal situation with the altered condition, and check whether the evidence supports a direct effect or only an association. The central distinction to retain is: chordates possess a notochord at some stage.

Self-check: Explain the mechanism or relationship above; identify one common misconception; predict the effect of changing a key variable.

Active-recall practice

1. Explain the essential principles of 1. Origins and Early Evolution and give one experimental or real-world application.

2. Explain the essential principles of 2. Evolutionary Mechanisms and Speciation and give one experimental or real-world application.

3. Explain the essential principles of 3. Taxonomy and Phylogenetics and give one experimental or real-world application.

4. Explain the essential principles of 4. Bacteria, Archaea and Viruses and give one experimental or real-world application.

5. Explain the essential principles of 5. Protists and Fungi and give one experimental or real-world application.

6. Explain the essential principles of 6. Plant Diversity and Evolution and give one experimental or real-world application.

7. Explain the essential principles of 7. Animal Diversity and Human Evolution and give one experimental or real-world application.

Final revision checklist

- 1. Origins and Early Evolution
- 2. Evolutionary Mechanisms and Speciation
- 3. Taxonomy and Phylogenetics
- 4. Bacteria, Archaea and Viruses
- 5. Protists and Fungi
- 6. Plant Diversity and Evolution
- 7. Animal Diversity and Human Evolution

Further study

Use the corresponding unit notes, topic-wise detailed lessons, MCQs, practice tests and full-length mock tests on yourmentorguru.com. This compact PDF is a revision companion, not a replacement for full syllabus textbooks.