



## NMAT Biology

### Suggested Study Plan

#### ❖ UNITY AND DIVERSITY OF LIFE

##### Week 1

Suggested Time Plan: 4 hrs

*Principles of Evolution*

- Evolution and Natural Selection
- Driving Forces of Evolution
- Patterns of Evolution
- Coevolution
- Evidences of Evolution
- Evolutionary Processes

*How New Species Form*

- Definition of Species. Principles of Speciation.
- Sympatric vs Allopatric Speciation
- Gene Flow
- Genetic Drift
- Extinction of Species

*Biodiversity and Classification Systems*

- Biodiversity and Taxonomy
- Domains of Life
- Prokaryotes vs Eukaryotes; Unicellular vs Multicellular Organisms.
- Autotrophs vs Heterotrophs
- Differences between Plants and Animals
- Animal Classification and Animal Phyla
- Major Plant Characteristics and Classification Groups
- Asexual vs Sexual Reproduction
- Viruses

## ❖ **CELLS AND CELLULAR PROCESSES**

### **Week 1 (cont)**

Suggested Time Plan: 8 hrs

#### *Eukaryotic Cell Structure*

- Key Organelles of a Typical Animal Cell
- Key Organelles of a Typical Plant Cell

#### *Cell Transport*

- Passive vs Active Transport. Diffusion and Osmosis.
- Osmosis and Concentration of Solutions.
- The Plasma Membrane and its Channel Proteins

#### *Cell Division*

- The Cell Cycle, Mitosis, and Cytokinesis
- Meiosis
- Gametes, Sexual Reproduction, and Genetic Variation

#### *The Genetic Code and Protein Synthesis*

- Genes and DNA
- DNA Replication
- Genetic Code and The Central Dogma.
- Steps in Protein Synthesis
- Mutations

#### *Biochemical Compounds*

- Major Biomolecules and their Functional Groups
- Polymers
- Sugars, Carbohydrates, and their Derivatives
- Amino Acids and Protein Structure
- Fatty Acids, Lipids, Fats, and their Derivatives
- Nucleic Acids and their Derivatives

*Cellular Respiration*

- Glycolysis
- Krebs Cycle
- Oxidative Phosphorylation and the Electron Transport Chain
- ATP Yield in Cellular Respiration
- Anaerobic Respiration and Fermentation
- Enzyme Action in Cells

❖ **GENETICS**

**Week 2**

Suggested Time Plan: 8 hrs

*Inheritance and Genes*

- Mendel's Inheritance Experiments. Monohybrid Cross. Punnett square.
- Genotype vs. Phenotype
- Rules of Inheritance. Dominant and Recessive Alleles.
- Genotypic and Phenotypic Ratio
- Codominance and Incomplete Dominance
- Pedigree Chart Analysis

*Inheritance and Chromosomes*

- Chromosome Theory of Inheritance. Chromosome Behavior During Meiosis.
- Haploid and Diploid Number of Chromosomes. Homologous Chromosomes. Crossing Over in Meiosis.
- Errors in Meiosis. Genetic Abnormalities.
- Sources of Genetic Variation: Crossing Over and Random Segregation
- Sex Chromosomes. Barr Bodies.
- Sex-Linked Genes

*Population Genetics*

- Principles of Population Genetics. Allele Frequency. Gene Pool.
- Changes to Allele Frequency. Evolution in Populations.
- The Hardy Weinberg Principle.

*Genetic Engineering*

- Recombinant DNA Technology. Restriction Enzyme, Ligase, and Plasmid.
- Natural Gene Transfer in Prokaryotes. Transformation, Transduction, and Conjugation
- Gene Therapy. Vector. Adenovirus.

❖ **ORGANISMS AND THEIR ENVIRONMENT**

**Week 2 (Cont)**

Suggested Time Plan: 2 hrs

*Populations and Community Interactions*

- Populations and Population Growth
- Ecological Community and Symbiotic Relationships
- Ecological Competition
- Ecological Succession

*Ecosystems*

- Biotic and Abiotic Factors in Ecosystems
- Energy Flow and the Ecological Pyramid
- Threats to Ecosystems
- Biomes

❖ **DEVELOPMENT**

**Week 3**

Suggested Time Plan: 2 hrs

*Animal Reproduction*

- Sexual vs Asexual Reproduction
- External vs Internal Fertilization. Human Fertilization
- Female Reproductive System
- Male Reproductive System
- Oogenesis and Spermatogenesis
- Female and Male Reproductive Cycles
- Hormones of Puberty

*Animal Development*

- Direct and Indirect Development. Embryogenesis.
- Amniote Characteristics
- Cell Differentiation. Organogenesis in Vertebrates.

❖ **LIFE PROCESSES**

**Week 3 (Cont)**

Suggested Time Plan: 6 hrs

*Circulation and Gas Exchange*

- Blood Pathway through the Human Heart
- Cardiac Cycle
- Blood Pathway through the Blood Vessels
- Blood Components
- The Lymphatic System
- Gas Exchange
- Mechanics of Breathing

*Digestion and Regulation of Metabolic Wastes*

- Digestive Mechanisms
- Major Endocrine Glands
- The Kidneys and Osmoregulation
- Nephron Anatomy and Ultrafiltration

*Nervous Control and the Neuromuscular Function*

- Organization of the Vertebrate Nervous System
- The Central Nervous System: Brain and Spinal Cord
- Brain Anatomy
- The Spinal Cord and the Reflex Arc
- The Peripheral Nervous System: Somatic and Autonomic Divisions, Sympathetic and Parasympathetic Nerves/Stimulations
- Neuron Anatomy: Soma, Axon, Dendrite. Myelin Sheath, Nodes of Ranvier, Schwann Cells
- Neuron Synapses and Nerve Impulses
- Membrane Potentials of the Neuron
- Neuromuscular Junction
- Skeletal Muscle Microanatomy and Contraction (Sliding Filament Hypothesis)

❖ **LIFE PROCESSES (cont)**

**Week 4**

Suggested Time Plan: 6 hrs

*Hormonal Control*

- Hormone-Target Cell Interaction
- Nervous System vs Endocrine System
- Important Hormones
- The Hypothalamus
- The Pituitary Gland
- Major Glands and their Hormones
- Homeostasis: Negative and Positive Feedback Mechanisms

*The Immune System*

- Innate and Adaptive Immunity
- External Barriers of the Body
- Phagocytosis
- The Immune Response: Antigen-Antibody Interaction
- Lymphocytes: B and T Cells
- Natural vs Artificial Immunity; Types of Vaccines

*Plant Physiology*

- Root and Shoot Systems
- Plant Adaptations
- Primary and Secondary Plant Growth
- Plant Tissue Types: Dermal, Ground, and Vascular
- The Stomata and Gas Exchange in Plants
- Photosynthesis: Light-Dependent and Light-Independent Reactions
- Plant Growth Hormones
- Plant Tropisms
- Angiosperm Life Cycle

❖ **Take Biology Practice Tests and Mock Exams**

Suggested Time Plan: 6 hrs