Contents

(Blocks Substitution Matrix)

- Sequence analysis tools - BLAST: principles and applications.
- Concepts of similarity, identity, and homology.
- **Phylogenetic Analysis:**
  - Properties and types of phylogenetic trees.
  - Tree-Building Methods:
    - Distance-based approaches: UPGMA (Unweighted Pair Group Method using Arithmetic Mean), Neighbour Joining, Minimum Evolution, and Least Squares methods.
    - Character-based approaches: Maximum Parsimony and Maximum Likelihood methods.
- Methods of phylogeny and software used for phylogenetic analysis
- Consistency and validation of molecular phylogenetic predictions

- Amino Acids and Protein Structure:
  - Classification and structure of amino acids.
  - Levels of protein structure: primary, secondary, tertiary, and quaternary.
  - Ramachandran plot: concept, interpretation, and applications in protein modelling.
- Homology Modelling of Proteins:
  - Concept, methodology, and applications in structure prediction.
  - Template identification, alignment, model building, and validation.
- Protein Interactions:
  - Overview of protein-protein and protein-ligand interactions.
  - Significance of interaction on networks in biological systems.

- Concept and applications of statistics in biological sciences
- Importance of Biostatistics in biological research
- Sampling methods
- Types of data: primary and secondary
- Nature of data: qualitative vs. quantitative; discrete vs. continuous
- Collection, tabulation, and graphical representation (Pie chart, Bar diagram, Histogram, Frequency polygon).

- Measures of central tendency: Mean, Median, Mode
- Measures of dispersion: Variance, Standard Deviation, Standard Error, Coefficient of Variation
- Analysis of Variation (ANOVA): One-way and Two-way ANOVA.
- Distribution on patterns: Binomial, Poisson, and Normal distributions. Normal, Binomial and Poisson distributions,
- Skewness, and Kurtosis

- Probability concepts and applications.
- Hypothesis testing: Null and Alternative hypotheses
- Tests of significance: t-test, F-test, and Chi-square test, Correlation Coefficient, Correlation and Regression Analysis.
- Confidence intervals and confidence levels

- Microscopy:
    - Working principle and uses of optical microscopy (resolving power, brightfield, darkfield)
    - Electron microscopy (SEM, TEM)
    - Phase-contrast microscopy
    - Fluorescence Microscopy
    - Confocal Microscopy
- Tracer Techniques:
- Principles and applications of:
    - Autoradiography
    - Radioimmunoassay (RIA)
- Immunological Techniques:
- Immunodiffusion and Immunoelectrophoresis
- Enzyme Linked Immunosorbent Assay (ELISA)
- Chromatographic Techniques:
    - Paper, Thin-Layer (TLC), Ion Exchange, Adsorption, Partition, Gel Filtration, Affinity Chromatography, High-Performance Liquid Chromatography (HPLC) and Column chromatography
- Centrifugation:
- Principles and types
- Density gradient and unit gravity methods
- Tissue processing and sub-cellular organelle separation
- Cryopreservation: methods and applications
- Colorimetry and Spectrophotometry:
    - Colorimeter, UV-Vis spectrophotometer (components, principle, applications, precautions)
- Electrophoresis and Blotting:
    - Gel electrophoresis,
    - Blotting techniques: Southern, Northern, and Western blotting
- DNA Sequencing:
    - Sanger's method and principle

1. Compute Coefficient of Variance (CV) from collected data and measure variability.
2. Collect data on biological parameters (e.g., height/weight of plant or animal samples) and test the significance between mean, median, and mode.
3. Performing a two-sample t-test for a given dataset.