Chapter 11
BIOSTATISTICS

After studying this chapter, students will be able to:

- Define biostatistics and its uses.
- Define and calculate mean, median and mode.
- Sketch a bar chart for a given set of biological data.

You know that the scientific work often involves statistical methods. In the field of biology, scientist collect, analyse, and interpret data for getting results and for understanding various phenomena. In this chapter, we will study the main uses and principles of biostatistics.

11.1- Introduction of Biostatistics

Biostatistics is a branch of statistics that applies statistical methods to biological sciences. Biostatistics is essential for designing biological experiments, clinical trials, and epidemiological studies.

Uses of Biostatistics

The major uses of biostatistics include:

1- Designing Experiments and Studies

Biostatistics helps in planning and structuring experiments to ensure that the data collected will be relevant and sufficient to answer the research questions. For instance, in a clinical trial testing a new drug, biostatisticians determine the sample size needed to detect a significant effect.

2- Analysing Biological Data

Biostatistics involves applying statistical techniques to analyse data. This analysis can uncover trends, correlations, and patterns. For example, analysing the growth rates of plants under different environmental conditions can reveal how factors like light and water affect growth.

3- Interpreting Results

After analysing data, biostatistics helps to interpret the results in a meaningful way. For example, interpreting the results of a survey on the prevalence of a disease in a population can guide public health interventions.

4- Predicting Outcomes

Biostatistics can be used to create models that predict future outcomes based on current data. For instance, predicting the spread of an infectious disease within a population helps in planning vaccination campaigns and allocating resources.

5- Public Health and Policy Making

In public health, biostatistics provides evidence-based insights that guide policy decisions and health guidelines. For example, statistical analysis of data on COVID-19 rates can lead to the implementation of COVID-19 vaccination campaign.

Examples of the Uses of Biostatistics

1- Epidemiology

Epidemiologists use biostatistics to study the distribution and determinants of health and diseases in populations. For example, analysing data on COVID-19 infection rates, recovery rates, and the effectiveness of vaccines involves biostatistical methods.

2- Genetics

Biostatistics is used in genetic research to analyse the inheritance of traits and the association of genetic variations with diseases. For instance, genetic studies use biostatistics to identify genetic markers linked to diseases like diabetes and cancer.

3- Agriculture

In agricultural research, biostatistics helps in analysing crop yields, the effectiveness of fertilizers, and the resistance of plants to pests and diseases. For example, comparing the yield of different wheat varieties under various farming practices involves statistical analysis.

4- Clinical Trials

Biostatistics is crucial in the design and analysis of clinical trials that test new treatments and drugs. For instance, determining whether a new medication is more effective than a placebo requires rigorous statistical testing to ensure the results are statistically significant.

11.2- MEAN, MEDIAN, AND MODE

The mean, median, and mode are the measures that help summarize and understand data sets. The mean provides an overall average, the median gives the middle value, and the mode highlights the most frequent value.

Mean

The mean, also known as the average, is the sum of all the values in a data set divided by the number of values. It represents the central value of a data set.

Formula

$$\text{Mean} = \frac{\text{Sum of All Data Points}}{\text{Number of Data Points}}$$

Example

Consider the following data set representing the heights (in cm) of five students:

150, 160, 165, 155, 170.

$$\text{Mean} = \frac{150 + 160 + 165 + 155 + 170}{5} = \frac{800}{5} = 160$$

So, the mean height is 160 cm.

2- Median

The median is the middle value of a data set when the values are arranged in ascending or descending order. If the number of values is odd, the median is the middle value. If the number of values is even, the median is the average of the two middle values.

Steps to Calculate Median

1. Arrange the data in ascending order.
2. If the number of values (n) is odd, the median is the value at the position $\frac{n+1}{2}$.
3. If the number of values (n) is even, the median is the average of the values at positions $\left(\frac{n}{2}\right)$ and $\left(\frac{n}{2}+1\right)$.

Example

Consider the data set: 150, 160, 165, 155, 170.

1. Arrange in ascending order: 150, 155, 160, 165, 170.
2. Number of values (n) = 5 (odd).
3. Median is the value at position $\left(\frac{5+1}{2}\right) = 3$.

So, the median height is 160 cm.

For an even number of values, consider the data set: 150, 160, 165, 155.

1. Arrange in ascending order: 150, 155, 160, 165.
2. Number of values (n) = 4 (even).
3. Median is the average of the values at positions $\left(\frac{4}{2}\right) = 2$ and $\left(\frac{4}{2}+1\right) = 3$.

$$\text{Median} = \frac{155+160}{2} = \frac{315}{2} = 157.5$$

So, the median height is 157.5 cm.

3- Mode

The mode is the value that appears most frequently in a data set. A data set may have one mode, more than one mode, or no mode at all.

Steps to Calculate Mode

1. Count the frequency of each value in the data set.
2. The value with the highest frequency is the mode.

Example 1

Consider the data set: 150, 160, 165, 155, 160.

- Frequencies: 150 (1), 160 (2), 165 (1), 155 (1).
- The value with the highest frequency is 160.

So, the mode of the data set is 160.

Example 2

Consider the data set: 150, 160, 160, 155, 155.

- Frequencies: 150 (1), 160 (2), 155 (2).
- The values with the highest frequency are 160 and 155.

So, the data set is bimodal with modes 160 and 155.

Example 3

Consider the data set: 150, 160, 165, 155, 170.

- Frequencies: 150 (1), 160 (1), 165 (1), 155 (1), 170 (1).
- All values have the same frequency.

So, this data set has no mode.

11.3- BAR CHART

A bar chart is a graphical representation of data using bars of different heights or lengths. It is used to compare the quantities of different categories. Bar charts are effective for comparing different categories and visually representing the distribution of data.

Steps to Create a Bar Chart:

1. Gather the data to be represented in the bar chart.
2. Arrange the data into categories and their corresponding values.
3. Draw a horizontal axis (x-axis) and a vertical axis (y-axis).
4. Label the x-axis with the categories and the y-axis with the values.

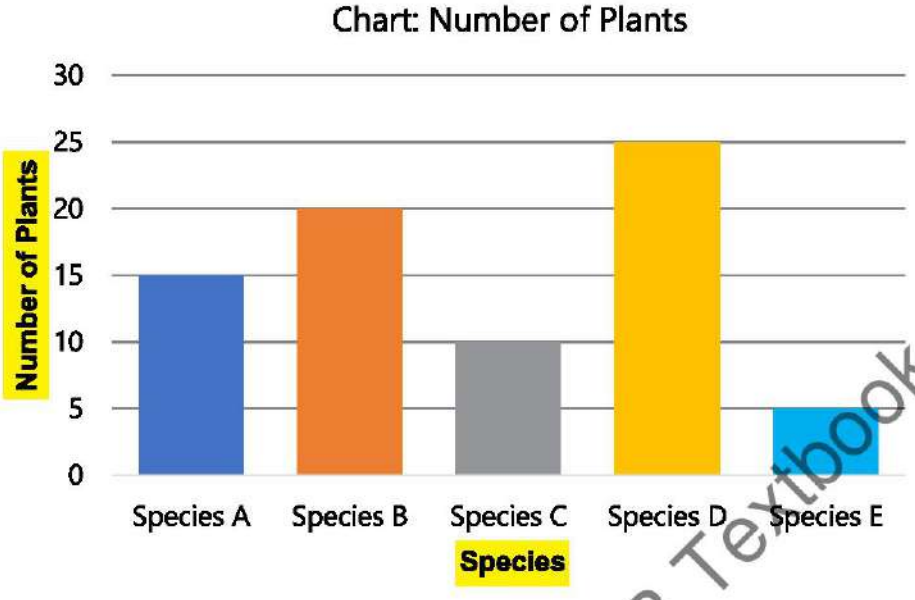
5. Determine the scale for the y-axis based on the range of values in the data set. Divide the axis into equal intervals.
6. For each category, draw a bar with a height corresponding to its value. Ensure the bars are of equal width and are spaced evenly.
7. Label each bar with its category name and value.

Example

Consider the following data representing the number of plants belonging to different species found in a field survey:

Species	Number of Plants
Species A	15
Species B	20
Species C	10
Species D	25
Species E	5

1. Collect Data: The data is already collected in the table above.
2. Organize Data: Data is organized in the table with species and their corresponding number of plants.
3. Draw Axes: Draw the x-axis and y-axis.
4. Label the x-axis with the species: A, B, C, D, E. Label the y-axis with the values i.e., number of plants.
5. Scale the Axes: The highest value is 25. Use a scale with intervals of 5 i.e., 0, 5, 10, 15, 20, 25.
6. Draw Bars: For each species, draw a bar up to the corresponding number of plants.
7. Label the Bars: Label each bar with the species name and its value.



KEY POINTS

- Biostatistics is the application of statistical methods to biological sciences.
- Biostatistics helps in designing experiments, analysing data, interpreting results, predicting outcomes, and informing public health policy.
- Mean is the sum of all values divided by the number of values.
- Means provides an overall average, useful for understanding general trends.
- Median is the middle value when data is ordered. If even number of values, the median is the average of the two middle values.
- Median is useful for understanding the middle value, especially with skewed data.
- Mode is the value that appears most frequently.
- Mode highlights the most common value, useful for categorical data analysis.
- Bar charts help compare different categories.

EXERCISE

A. Select the correct answers for the following questions.

1. What is the primary purpose of biostatistics?
   a) To analyse financial data
   b) To apply statistical methods to biological sciences
   c) To design engineering models
   d) To study historical events
2. In biostatistics, which method is used to predict future outcomes based on current data?
   a) Designing experiments
   b) Drawing charts
   c) Taking average
   d) Analysing data
3. Which of the following best describes the mean of a data set?
   a) The most frequently occurring value
   b) The middle value when data is ordered
   c) The sum of all values divided by the number of values
   d) The difference between the highest and lowest values
4. If the data set is 5, 8, 12, 15, 20, what is the median?
   a) 8
   b) 12
   c) 15
   d) 20
5. What is the mean of the data set: 7, 8, 9, 10, 11?
   a) 7
   b) 8
   c) 9
   d) 10
6. When the number of values in a data set is even, how is the median calculated?
   a) By choosing the middle value
   b) By taking the average of the two middle values
   c) By selecting the most frequent value
   d) By adding all values and dividing by the total number of values
7. In a data set with values 3, 3, 6, 7, 8, 9, 9, what is the mode?
   a) 3
   b) 6
   c) 7
   d) Both 3 and 9
8. If a data set has no repeated values, what is the mode?
   a) The highest value
   b) The average of the data set
   c) There is no mode
   d) The median value

9. In a bar chart, what does the height or length of each bar represent?
   a) The total number of categories
   b) The value of the corresponding category
   c) The average of all values
   d) The difference between the highest and lowest values
10. When constructing a bar chart, which axis usually represents the categories?
   a) Vertical axis (y-axis)
   b) Horizontal axis (x-axis)
   c) Both axes equally represent the categories
   d) Neither axis represents the categories

B. Write short answers.

1. Define biostatistics.
2. What is the median of a data set?
3. How is the mean calculated?
4. What does the height of a bar in a bar chart represent?
5. What is the mode of a data set?

C. Write answers in detail.

1. Explain the importance of biostatistics in the field of public health. Provide examples of how it is used to inform public health decisions.
2. Discuss the differences between mean, median, and mode. Include examples where each measure is most appropriate to use.
3. Describe the steps involved in creating a bar chart using Excel. Include a discussion on how to customize the chart for better visualization and interpretation of data.
4. Provide a detailed example of how to calculate the mean, median, and mode of a data set. Use the following data set for your calculations: 12, 15, 22, 8, 19, 25, 15.
5. You are given the following data set, create a bar chart to represent the number of different types of fruits sold at a market in one week:
   - Apples: 30
   - Bananas: 45
   - Oranges: 20
   - Grapes: 25
   - Mangoes: 15

   Ensure to label the axes and provide a title for the chart.

Glossary

A

Active site: A small cleft or depression on the surface of enzyme molecule; location at which catalysis occurs.

Adhesion: The sticking together of molecules of different kinds.

Aerobic respiration: Type of cellular respiration; complete breakdown of glucose molecule in the presence of oxygen.

Alcoholic fermentation: The type of anaerobic respiration in which pyruvic acid is further broken down into ethanol and carbon dioxide.

Anabolism: The set of metabolic processes that involve the synthesis of larger molecules from smaller ones.

Anaerobic respiration: Type of cellular respiration that does not require oxygen.

Anaphase: A phase of mitosis during which the spindle fibres contract and shorten and exert pulling the sister chromatids apart towards opposite poles of the cell.

Anatomy: The branch of biology deals with the internal structure and organization of living organisms.

Amino acids: The building blocks of proteins. 20 different amino acids are commonly found in proteins, each with a unique chemical structure.

Animal husbandry: It concerns with the care, management, and breeding of domestic animals e.g., cattle, sheep etc. for various purposes, such as agriculture, research or conservation.

Animalia: Kingdom that includes eukaryotic multicellular organisms without cell walls. They are heterotroph consumers.

Asexual reproduction: Reproduction that does not involve fusion of gametes; requires a single parent which gives rise to offspring.

ATP, adenosine triphosphate: A nucleotide and a crucial molecule that serves as the primary energy carrier in cells.

B

Binary fission: Method of asexual reproduction in which parent simply divides into two identical offspring; happens in bacteria, some protists, some lower animals.

Binomial nomenclature: The way of giving scientific names to organisms; consists of two names (species name and genus name).

Biochemistry: Branch that deals with the study of chemical processes occurring in living organisms.

Biodiversity: All kinds of organisms found in an area.

Bio-economics: The study of organisms from economical point of view.

Bioenergetics: Study of the energy relationships and energy transformations in biological systems.

Biogeography: The study of the distribution of living organisms in different geographical regions of the world.

Biology: The scientific study of living organisms and their interactions with the environment.

Biomolecules: The molecules produced by organisms; e.g., carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA).

Biostatistics: The study of the principles of statistics which are applicable to biology to analyse and interpret data related to living organisms.

Biophysics: The study of principles and techniques of physics which are applicable to biological phenomena.

Biotechnology: The use of living organisms or their components to produce useful products.

Botany: The field of biology that deals with the study of plants.

Budding: A type of asexual reproduction in which a new organism develops from a small outgrowth or "bud" on the parent.

Bulbs: Modified short underground stems with stored food.

C

Catabolism: The metabolic processes that involve the breakdown of larger molecules into smaller ones.

Cell: The fundamental unit of life.

Cell cycle: The series of events that a cell grows, replicates its DNA, and divides into two daughter cells.

Cell wall: The protective and rigid structure that surrounds the cell membrane of many types of cells, including plant cells, bacterial cells, and fungal cells.

Cell membrane: The coat of lipids and proteins, surrounds and encloses a cell.

Cellular respiration: The oxidation of food (glucose) that occurs in cells to get energy (ATP).

Centriole: Cylindrical (tube-like organelles) composed of microtubules: present in the cells of animals and most protists.

Chiasmata: The complexes formed by the joining (attachment) of two non-sister chromatids of homologous chromosomes during meiosis-I.

Chloroplast: Organelle in the cells of plants and algae where photosynthesis takes place.

Chromatin: The complex of DNA and proteins that makes up a eukaryotic chromosome.

Chromosome: Coiled structure made of DNA and proteins.

Chromoplasts: The plastids that store pigments other than chlorophyll, such as carotenoids.

Class: The taxonomic rank; formed by dividing a phylum/division; consists of a group of related orders.

Classification: The process of organizing and classifying living organisms based on their similarities and differences.

Coenzymes: Cofactors, which are non-protein organic molecules, loosely attached with enzyme; participate in enzyme catalysed reactions.

Cofactor: Non-protein component of enzyme; participate in enzyme catalysed reactions.

Cohesion: The sticking together of molecules of the same kind.

Companion cells: Cells of phloem tissue that provide energy to sieve elements.

Competitive inhibitor: Inhibitor that resembles the substrate and competes with it for the same binding site on enzyme.

Crossing over: The exchange of genetic material between non-sister chromatids during prophase-I of meiosis-I.

Cytokinesis: The division of the cytoplasm.

Cytology: The study of the structure of cells and cell division.

Cytoplasm: The material inside the cell membrane of a cell (excluding organelles).

Cytoskeleton: Filaments and tubules in the cytoplasm that make the internal framework of cell.

D

Dark reactions: Reactions in which carbon from CO_2, energy from ATP, and hydrogen ions from NADPH are used to make sugar molecules.

Deduction: The logical result from a hypothesis; involves using logical reasoning to derive specific consequences from a hypothesis.

Deoxyribonucleic Acid (DNA): The hereditary material present in almost all organisms; a double-stranded molecule composed of nucleotides.

Disaccharides: Carbohydrates that are made from two monosaccharide units; less sweet in tases and less soluble in water.

Domain: The highest level of classification; there are three domains: Bacteria, Archaea, and Eukarya.

Double helix: The form of DNA, referring to its two polynucleotide strands wound into a spiral shape.

E

Ecology: The study of how organisms interact with their environment.

Electron Transport Chain (ETC): Series of electron-transport molecules that pass high-energy electrons from molecule to molecule and capture their energy.

Endodermis: A single layer of cells surrounds the pericycle.

Embryology: The study of the developmental stages of an organism.

Embryo sac: The female gametophyte of angiosperms; consists of eight haploid nuclei; formed from megaspore.

Emergent properties: The properties that arise when the interaction of individual component produce new functions.

Endoplasmic reticulum: A network of interconnected channels that extends from the cell membrane to the nuclear envelope.

Enzymes: Biological catalysts made of proteins that catalyse (i.e. speed up) biochemical reactions without themselves being changed.

Epidermis: The outermost plant tissue; form a protective barrier against the environment.

Erythrocytes (Red blood cells): Blood cells that carry oxygen from the lungs to the body's tissues and transport carbon dioxide back to the lungs for exhalation.

Evolution: The process through which populations and species of organisms change over time.

Excretion: The disposal of nitrogen-containing waste products from the body.

F

Family: Taxonomic rank formed by the division of an order.

Fatty acids: Building blocks of lipids; consist of a long hydrocarbon chain with a carboxyl group at one end.

Fertilization: The union of haploid gametes to produce a diploid zygote.

Fungi: Eukaryotic, multicellular (mushrooms and molds) or unicellular (yeasts) heterotrophs which obtain nutrients by absorbing organic matter from environment.

G

Gamete: A haploid cell, such as an egg or sperm. Gametes unite during sexual reproduction to produce a diploid zygote.

Gap 1 (G1) Phase: The first phase of the interphase; phase of extensive metabolic activity and growth, increases in number of organelles.

Gap 2 (G2) Phase: The phase of interphase in which cell continues to grow and prepares proteins essential for mitosis.

Genetics: The study of genes, heredity and variation in living organisms.

Gene: A discrete unit of hereditary information consisting of a specific nucleotide sequence in DNA (or RNA, in some viruses).

Genus: The taxonomic rank formed by the division of a family; a genus is a group of related species.

Glycerol: An alcohol having 3 carbon atoms. Each carbon has a hydroxyl group.

Glycolysis: First stage of cellular respiration in which glucose is split into two molecules of pyruvate (pyruvic acid).

Golgi apparatus: Organelle in eukaryotic cells that processes proteins and prepares them for use both inside and outside cell.

Grana (singular, granum): Structures in chloroplast, consist of sac-like membranes, known as thylakoids.

Guard cells: Bean-shaped cells in the epidermis of leaves; two guard cells surround a stoma.

H

Histology: The microscopic study of tissues of living organisms.

Homeostasis: The ability to maintain the internal conditions constant.

Homologous chromosomes: Chromosome pairs of the same length and centromere position that possess genes for the same characters.

Horticulture: Science that deals with gardening.

Human Genome Project: An international collaborative effort to map and sequence the DNA of the entire human genome.

Hydrophytes: The plants which live in freshwater.

Hypothesis: Tentative statement that may be the answer of the scientific problem.

I

Immunology: The study of the immune system of animals, which protects the body against infections, diseases, and other harmful substances.

Inhibitor: Chemical that interferes and blocks an enzyme's activity.

interphase: The phase of cell cycle during which the cell is not dividing but it carries out its normal functions like it grows in size, and prepares for cell division.

K

Karyokinesis: The division of a nucleus.

Kingdom: Taxonomic rank formed by the dividing a domain; e.g., Animalia, Plantae, Fungi, Protista.

Kreb's cycle: Second stage of aerobic respiration in which two pyruvic acid molecules are broken to make ATP, NADH and $FADH_2$.

L

Lactic acid fermentation: The type of anaerobic respiration in which pyruvic acid is converted into lactic acid.

Leucoplasts: Plastids that have no pigments; involved in the storage of starches, lipids, and proteins.

Light reactions: First stage of photosynthesis in which light energy from the sun is captured and changed into chemical energy that is stored in ATP and NADPH.

Lysosome: Spherical membrane-bounded organelle: contain digestive enzymes.

M

Macronutrients: Mineral nutrients that plants need in relatively large amounts.

Marine biology: The study of organisms, ecosystems, and processes in oceans.

Mesophyll cells: Cells in leaves; responsible for photosynthesis.

Messenger RNA (mRNA): A type of RNA, synthesized from DNA; attaches to ribosomes and specifies the primary structure of a protein.

Mesophytes: The plants that live in land habitats with moderate supply of water.

Meiosis: The type of cell division in which the number of chromosomes in daughter cells is reduced to half as compared to the parent cell.

Metabolism: The sum of all chemical reactions taking place within a cell in order to maintain life.

Microbiology: The study of microorganisms such as bacteria and microscopic fungi etc.

Microfilament: Part of cytoskeleton, solid rods made of actin protein.

Micronutrients: The nutrients that are needed by plants in very small amounts.

Microtubule: Part of cytoskeleton, hollow cylinder made of tubulin protein.

Mitochondria: Organelles in eukaryotic cell that makes energy available to the cell in the form of ATP.

Mitosis: The type of cell division in which the daughter cells have the same number of chromosomes as were present in the parent cell.

Molecular biology: The study of the structure and function of macromolecules (e.g., carbohydrates, proteins, nucleic acids).

Monosaccharides: The simplest carbohydrates and consist of a single sugar molecule.

Morphology: The study of the size, shape, and structure of living organisms.

N

Neuron: A nerve cell; the fundamental unit of the nervous system, having structure and properties that allow it to conduct signals.

Non-competitive Inhibitor: Inhibitor that has no structural similarity to substrate; it binds the enzyme outside the active site and alters the shape of enzyme.

Non-disjunction: The failure of chromosome pairs or sister chromatids to separate properly during cell division; results in an abnormal number of chromosomes (aneuploidy)l daughter cells.

Nuclear envelope: Double membrane that encloses the contents of the nucleus.

Nucleoid: A dense region of DNA in a prokaryotic cell.

Nucleolus: Darkly stained structure in nucleoplasm; manufactures the subunits of ribosomes.

Nucleoplasm: Semi-fluid matrix found inside the nucleus.

Nucleus: Organelle inside eukaryotic cells that contains acts as a control centre of the cell.

O

Organ: Structure made up of more than one type of tissues having related functions that work together.

Organ system: A collection of different organs that work together to perform a related function.

Organelles: Components of a cell e.g., mitochondria, ribosomes, lysosomes.

Ovary: (1) In flowers, the portion of a carpel in which the egg-containing ovules develop. (2) In animals, the structure that produces female gametes.

P

Palaeontology: The study of fossils.

Palisade mesophyll: The mesophyll located just beneath the upper epidermis; consists of tightly packed cells, is rich in chloroplasts; primary site of photosynthesis.

Pathology: The study of diseases caused by microorganisms such as bacteria, viruses, fungi etc.

Pharmacology: The study of drugs and their effects on the body.

Phloem: Vascular tissue in higher plants; transport food from where it is produced or stored to other parts of the plant.

Photosynthesis: The process in which carbon dioxide and water combine to make glucose in the presence of sunlight and chlorophyll.

Phragmoplast (cell plate): The dividing plate formed during cytokinesis in plant cells; formed by the fusion of small vesicles from Golgi apparatus.

R

Rhizomes: Underground stems that grow horizontally; have scale leaves.

Ribonucleic Acid (RNA): Type of nucleic acid that serves as a messenger between DNA and ribosomes during protein synthesis.

Ribosomal RNA (rRNA): A type RNA; makes the structure of ribosomes.

Rough Endoplasmic Reticulum: Endoplasmic Reticulum covered with ribosomes, involved in the production and processing of proteins.

S

Saturated fatty acids: fatty acids which have no double bonds between carbon atoms.

Scientific method: A systematic approach used by scientists to investigate and understand nature.

Sexual reproduction: Type of reproduction that involves the fusion of gametes.

Sieve elements: Cells of phloem tissue that transport food.

Smooth Endoplasmic Reticulum: Endoplasmic reticulum that lacks ribosomes; involved in production of lipids, carbohydrate metabolism, and detoxification.

Species: A group whose members possess similar anatomical characteristics and have the ability to interbreed.

Speciation: The process by which new species arise from existing ones.

Sperm: The male gamete.

Spongy mesophyll: Mesophyll present below the palisade layer; consists of loosely arranged cells with air spaces between them.

Substrates: The molecules that undergo a chemical reactions catalysed by enzymes.

Synapsis: The pairing of homologous chromosomes during meiosis-I.

Synthesis phase or S phase: Phase of interphase of cell cycle in which DNA replication occurs.

Sympatric Speciation: A type of speciation that occurs when a new species arises within the same geographical area without geographic isolation.

T

Taxonomy: The study of the naming and classification of organisms into groups and subgroups based on their similarities and differences.

Telophase Phase of mitosis; marks the completion of the separation of the duplicated chromosomes.

Tetrad: The bivalent made of two homologous chromosomes (four chromatids).

Theory: The hypotheses that stand the test of time (often tested and never rejected).

Thylakoid: The inner membrane in a chloroplast where the light reactions of photosynthesis occur.

Tissue: A group of similar cells that work together to perform a specific function.

Transcription: The synthesis of RNA on a DNA template.

Transfer RNA (tRNA): A type of RNA that transfers specific amino acids to the ribosomes during protein synthesis.

Translation: The synthesis of a polypeptide using the genetic information present on mRNA molecule.

Transpiration: The loss of water from plant surface through evaporation.

U

Unsaturated fatty acids: The fatty acids which have one or more double bonds between carbon atoms.

V

Vacuole: Sac-like organelle that stores and transports materials inside a cell.

X

Xerophytes: The plants that live in dry conditions

Xylem: Vascular tissue responsible for transporting water and minerals absorbed by the roots from the soil to the rest of the plant.

Z

Zoology: The field of biology deals with the study of animals.

Zygote: The diploid product of the union of haploid gametes; a fertilized egg.