SIMPLIFY YOUR ACADEMIC JOURNEY WITH NERDS EXAMINATIONS BOARD

ADVANCED LEVEL BIOLOGY REVISION - UACE 2025 PREPARATION

WEEK 1 OF 40 REVISION GUIDE

1. **(a) What is meant by negative feedback control?**
   Negative feedback control is a biological regulatory mechanism where a change in a controlled variable triggers a response that counteracts the initial change, thus maintaining homeostasis. It's like a thermostat in your house: when the temperature rises, the thermostat turns on the AC to cool it down, and vice versa.

Explain how negative feedback works with respect to the secretion of:

i) **Thyroxine (T4) secretion: (**How negative feedback works in hormone secretion):

- ✓ When body temperature drops, the hypothalamus stimulates the pituitary gland to release Thyroid-Stimulating Hormone (TSH).
- ✓ TSH triggers the thyroid gland to produce more T4.
- ✓ T4 increases metabolic rate, generating heat and raising body temperature.
- ✓ Once the desired temperature is reached, the increased T4 levels inhibit the hypothalamus and pituitary, reducing TSH secretion and T4 production.
- ✓ Oestrogen secretion:
- ✓ During the menstrual cycle, rising oestrogen levels stimulate the release of Luteinizing Hormone (LH) from the pituitary gland.
- ✓ LH surge triggers ovulation.
- ✓ After ovulation, the corpus luteum produces progesterone, which inhibits LH release and prevents further ovulation.
- ✓ This negative feedback loop ensures that only one dominant follicle matures and ovulates per cycle.

(b) By what methods does the hypothalamus control the basic bodily functions? Give examples of each.

The hypothalamus controls bodily functions through:

- ✓ **Hormonal control:** It secretes hormones that regulate the pituitary gland, which in turn controls other endocrine glands.
- ✓ Example: Hypothalamus releases Gonadotropin-Releasing Hormone (GnRH), stimulating the pituitary to produce LH and Follicle-Stimulating Hormone (FSH) for reproductive function.
- ✓ **Neural control**: It directly influences the autonomic nervous system, controlling heart rate, blood pressure, and body temperature.
- ✓ Example: Hypothalamus signals the sympathetic nervous system to increase heart rate during stress.
- ✓ **Bodily fluid control**: It regulates water balance and body temperature by controlling thirst and sweating.
- ✓ Example: Hypothalamus triggers thirst sensation when the body is dehydrated.

(c) With a diagram show the location of the endocrine glands in the human body and the secretions of each gland.

(d) (i) Give differences between animal and plant sensitivity.

Animal Sensitivity	Plant Sensitivity
Fast response due to nervous system	Slow response due to chemical signaling
Directed movement (e.g., muscles)	Growth movements (e.g., tropisms)
Complex behaviors and learning	Limited behavioral responses
Sensory organs (e.g., eyes, ears)	Receptors in cells and tissues

(ii) Why does a plant have an enzyme system for destroying auxins?

- ✓ Auxins are plant hormones that regulate growth and development. However, excessive auxin levels can inhibit growth and cause damage. Therefore, plants have an enzyme system, auxin oxidase, to break down auxins when their concentration becomes too high, maintaining a balanced growth and development.

(e) Explain why the term plant growth substance is preferred to plant hormones.

The term "plant growth substance" is preferred over "plant hormone" because:

- ✓ **Specificity:** Plant hormones in animals have specific target organs and elicit specific responses. In plants, the effects of growth substances are often more complex and influenced by factors like concentration, tissue type, and environmental conditions.
- ✓ **Diversity:** Plant growth substances include a wider range of compounds than animal hormones, including not only hormones but also growth regulators and inhibitors.

2. (a) Using examples, explain the meaning of displacement activity.

Displacement Activity:

Displacement activity is a behavior that appears out of context and seems unrelated to the current situation. It's often seen when an animal is experiencing conflict or frustration due to competing internal drives.

Example: A bird attempting to build a nest but unable to find suitable materials might start preening its feathers or pecking at the ground. This preening or pecking is a displacement activity, a way to release pent-up energy and reduce stress caused by the frustration of not being able to build the nest.

(b) What is the importance of each of the following forms of behavior for the survival of organisms in a community?

i) Territorial Behavior:

- ✓ Importance: Territorial behavior plays a crucial role in resource allocation and reducing conflict within a community. By establishing and defending territories, organisms ensure access to essential resources like food, mates, and nesting sites. This helps to maintain a stable population and prevent overexploitation of resources.

ii) Courtship Behavior:

- ✓ Importance: Courtship behavior is vital for successful reproduction. It allows individuals to assess potential mates, strengthen pair bonds, and synchronize reproductive cycles. This ensures that mating occurs between compatible individuals, increasing the chances of producing healthy offspring.

iii) Orientation Behavior:

- ✓ Importance: Orientation behavior enables organisms to navigate their environment, find food sources, locate shelter, and avoid predators. This is crucial for survival as it allows individuals to efficiently utilize resources and reduce the risk of predation.

3. (a) Describe the process of protein synthesis in a cell.

Protein Synthesis is the process of creating proteins from the information stored in DNA. It involves two main steps:

Transcription:

- ✓ The DNA sequence containing the gene for the desired protein is copied into a messenger RNA (mRNA) molecule.
- ✓ This occurs in the nucleus with the help of the enzyme RNA polymerase.
- ✓ The mRNA then moves out of the nucleus into the cytoplasm.
  Translation:
- ✓ The mRNA sequence is read by ribosomes in the cytoplasm.

- ✓ Ribosomes translate the mRNA code into a sequence of amino acids.
- ✓ Transfer RNA (tRNA) molecules bring specific amino acids to the ribosome based on the mRNA codons.
- ✓ Amino acids are linked together by peptide bonds to form a polypeptide chain.
- ✓ The polypeptide chain may undergo further modifications, such as folding and chemical modifications, to become a functional protein.

(Make more research about protein synthesis)

(b) How is the structure of proteins related to their functions?

The structure of a protein determines its function. Proteins are made up of chains of amino acids folded into specific 3D shapes. These shapes are crucial for their ability to interact with other molecules and carry out their roles.

- ✓ **Primary Structure**: The linear sequence of amino acids in a protein.
- ✓ Secondary Structure: Local folding patterns like alpha-helices and beta-sheets, stabilized by hydrogen bonds.
- ✓ **Tertiary Structure:** The overall 3D shape of a single protein chain, determined by interactions between side chains of amino acids (e.g., hydrophobic interactions, disulfide bonds).
- ✓ **Quaternary Structure:** The arrangement of multiple protein subunits into a larger complex.
- ✓ Changes in even a single amino acid can alter the protein's shape and, consequently, its function.

(c) Discuss the role played by proteins in the life of organisms.

Proteins are essential for virtually all biological processes:

- ✓ **Enzymes**: Catalyze biochemical reactions, speeding up metabolic processes.
- ✓ Structural Proteins: Provide support and shape to cells and tissues (e.g., collagen, keratin).
- ✓ **Transport Proteins**: Carry molecules across cell membranes (e.g., hemoglobin, glucose transporters).
- ✓ **Hormones:** Regulate physiological processes (e.g., insulin, growth hormone).
- ✓ **Antibodies**: Defend the body against pathogens.
- ✓ **Receptors:** Receive and transmit signals from the environment.

(d) Show how mutation can cause a change in the production of a polypeptide.

Mutations are changes in the DNA sequence. If a mutation occurs within a gene, it can alter the mRNA sequence during transcription. This can lead to:

- ✓ **Missense Mutation:** A single nucleotide change that results in a different amino acid being incorporated into the protein. This can affect the protein's structure and function.
- ✓ **Nonsense Mutation:** A change that introduces a premature stop codon, leading to a truncated and likely non-functional protein.

- ✓ **Frame shift Mutation:** The insertion or deletion of nucleotides, which shifts the reading frame of the mRNA, altering the amino acid sequence downstream of the mutation.

These changes in the amino acid sequence can disrupt the protein's folding, alter its interaction with other molecules, or completely inactivate it.

4. (a) Describe the structure and formation of cartilage and bone.

Cartilage:

- ✓ Structure: Cartilage is a flexible connective tissue composed of:
- ✓ Chondrocytes: Cartilage-producing cells.
- ✓ Extracellular matrix: A firm but pliable gel-like substance containing collagen fibers and proteoglycans.
- ✓ Formation (Chondrogenesis):
- ✓ Mesenchymal cells differentiate into chondroblasts.
- ✓ Chondroblasts secrete the extracellular matrix and become trapped within it, transforming into chondrocytes.
- ✓ Cartilage growth occurs through interstitial growth (within the cartilage itself) and appositional growth (from the outer surface).

Bone:

Structure: Bone is a rigid connective tissue composed of:

- ✓ Osteoblasts: Bone-forming cells.
- ✓ Osteoclasts: Bone-resorbing cells.
- ✓ Osteocytes: Mature bone cells.
- ✓ Extracellular matrix (Bone Matrix): A hard, mineralized substance containing collagen fibers and calcium phosphate crystals.
- ✓ Formation (Ossification):
- ✓ Intramembranous Ossification: Bone forms directly from mesenchymal tissue (e.g., flat bones of the skull).
- ✓ Endochondral Ossification: Bone forms by replacing a pre-existing cartilage model (e.g., long bones).

(b) Describe, with reference to skeletal connective tissue, the relationship between structure and function.

- ✓ Skeletal connective tissues, like cartilage and bone, exhibit a strong correlation between their structure and their functions:
- ✓ Cartilage:

- ✓ Structure: Flexible and resilient due to the extracellular matrix containing collagen fibers and proteoglycans.
- ✓ Function: Provides support, cushioning, and flexibility in structures like the nose, ears, and joints.
- ✓ Bone:
- ✓ Structure: Rigid and strong due to the mineralized extracellular matrix containing calcium phosphate crystals.
- ✓ Function: Provides structural support, protects vital organs, enables movement, and stores minerals.

(c) What seems to be the requirements of any mechanism of locomotion?

Any mechanism of locomotion requires:

- ✓ A source of energy: To power the movement (e.g., ATP from cellular respiration).
- ✓ A means of generating force: To overcome friction and gravity (e.g., muscle contraction).
- ✓ A rigid structure: To provide support and leverage for movement (e.g., skeleton in animals).
- ✓ A mechanism for controlling movement: To coordinate actions and ensure efficient locomotion (e.g., nervous system).

(d) Describe the mechanism of muscle contraction in a mammal.

Muscle contraction in mammals is based on the sliding filament theory:

- ✓ **Action Potential:** A nerve impulse triggers the release of calcium ions from the sarcoplasmic reticulum (SR) into the muscle fiber.
- ✓ **Calcium Binding:** Calcium ions bind to troponin, a protein complex on the actin filament.
- ✓ **Myosin Binding Sites Exposed:** Troponin-calcium binding causes tropomyosin to move, exposing myosin-binding sites on the actin filament.
- ✓ **Cross-Bridge Formation**: Myosin heads bind to the exposed actin sites, forming cross-bridges.
- ✓ **Power Stroke:** Myosin heads swivel, pulling the actin filaments toward the center of the sarcomere, shortening the muscle fiber.
- ✓ **Cross-Bridge Release:** ATP binds to the myosin head, causing it to release from the actin filament.
- ✓ **Myosin Reset:** ATP is hydrolyzed, providing energy for the myosin head to return to its original position (cocked state).
- ✓ **Cycle Repeats:** The cycle of cross-bridge formation, power stroke, release, and reset continues as long as calcium ions are present and ATP is available.

(e) How does a skeletal muscle differ from a smooth muscle?

Skeletal Muscle	Smooth Muscle
Location: Attached to bones	Found in internal organs (e.g., blood vessels, digestive tract)
Structure: Striated (striped) appearance due to organized arrangement of sarcomeres	Non-striated (smooth) appearance
Control: Voluntary (conscious control)	Involuntary (unconscious control)
Contraction: Fast and forceful contractions	Slow and sustained contractions
Innervation: Innervated by somatic motor neurons	Innervated by the autonomic nervous system

5. (a) Outline the changes in cell structure which lead to the formation of mature vascular tissues in higher plants.

Mature vascular tissues in higher plants arise from a region called the vascular cambium. This is a layer of meristematic cells (undifferentiated cells) that undergo cell division and differentiation to form new vascular tissues. Here's an outline of the key changes:

- ✓ Cell Division: Cambium cells divide to produce new cells, both inwards and outwards.
- ✓ Cell Differentiation:
- ✓ Xylem: Cells differentiate into various types like tracheids, vessel elements, and xylem parenchyma. They lose their protoplasm and develop thick, lignified cell walls to provide structural support and efficient water conduction.
- ✓ Phloem: Cells differentiate into sieve tube elements, companion cells, phloem parenchyma, and fibers. Sieve tube elements lose their nucleus and most organelles but retain cytoplasm and plasmodesmata for nutrient transport. Companion cells retain their nucleus and organelles and support the metabolic activities of sieve tube elements.

(b) Give the structural differences between xylem and phloem sieve tubes.

Feature	Xylem	Phloem Sieve Tubes
Cell Type	Tracheids, vessel elements, xylem parenchyma, xylem fibers	Sieve tube elements, companion cells, phloem parenchyma, phloem fibers
Function	Water and mineral transport	Transport of organic compounds (e.g., sucrose)
Cell Wall	Thick, lignified cell walls	Thin, cellulose cell walls
Protoplasm	Non-living cells (at maturity)	Living cells with cytoplasm but no nucleus
Special Features |	Pits in cell walls for water movement; vessel elements have perforated end walls	Sieve plates with pores for cytoplasmic connections between cells

(c) Survey the mechanisms of translocation in flowering plants.

Translocation in flowering plants refers to the movement of organic compounds (mainly sucrose) from source tissues (e.g., leaves) to sink tissues (e.g., roots, fruits, growing points). The major mechanisms proposed for translocation are:

- ✓ Pressure Flow Hypothesis: This is the most widely accepted model. It suggests that the movement of sugars is driven by a pressure gradient generated by the loading and unloading of sucrose into the phloem sieve tubes.
- ✓ Loading: Sucrose is actively transported into the phloem sieve tubes at the source. This creates a high osmotic pressure, drawing water into the sieve tubes.
- ✓ Unloading: Sucrose is actively transported out of the phloem sieve tubes at the sink. This reduces osmotic pressure, causing water to move out of the sieve tubes.
- ✓ Mass Flow: The resulting pressure difference drives the bulk flow of the solution (sucrose and water) through the sieve tubes from source to sink.
- ✓ Polymer-Sugars Hypothesis: This theory suggests that sugars are converted into larger molecules (e.g., raffinose) for transport and then broken down back into sucrose at the sink.

(d) Discuss the evidences in support of the phloem as the channel of transport of organic materials.

- ✓ **Ringing Experiments:** When a ring of bark is removed from a tree, phloem tissues are severed. This results in the accumulation of sugars above the ring, indicating that phloem is the pathway for sugar transport.
- ✓ **Tracer Studies:** Radioactively labeled sugars have been used to track their movement within plants. These studies have shown that labeled sugars move through the phloem sieve tubes.
- ✓ **Aphid Stylet Experiments**: Aphids feed on plant sap by inserting their stylets into phloem sieve tubes. Collecting sap from aphid stylets has provided direct evidence of the composition of phloem sap, which is rich in sugars.

(e) How is xylem adapted to carry out its functions?

Xylem is remarkably adapted for its function of transporting water and minerals from roots to shoots:

- ✓ **Lignified Cell Walls:** Provide structural support to withstand the negative pressure generated during water transport.
- ✓ **Pits:** Allow lateral movement of water between xylem cells.
- ✓ **Vessel Elements**: In angiosperms, vessel elements form continuous tubes for efficient water transport.
- ✓ **Dead Cells:** The absence of protoplasm reduces resistance to water flow.

6. (a) State the conditions when non-carbohydrate substances are used in respiration.

Non-carbohydrate substances like fats and proteins are used as respiratory substrates under the following conditions:

- ✓ **Carbohydrate shortage:** When the supply of carbohydrates (glucose) is limited or unavailable, the body switches to utilizing fats and proteins as energy sources.
- ✓ **Starvation:** During prolonged periods of food deprivation, the body breaks down stored fats and proteins to generate energy.
- ✓ **Dietary intake:** A diet rich in fats and proteins can also lead to their utilization as respiratory substrates.

(b) Describe briefly how these substances are integrated in the pathway of carbohydrate metabolism.

Non-carbohydrate substances enter the pathway of carbohydrate metabolism at different points:

Fats:

- ✓ Fats are broken down into fatty acids and glycerol.
- ✓ Fatty acids are converted into acetyl-CoA through a process called beta-oxidation.
- ✓ Acetyl-CoA then enters the Krebs cycle, a central pathway of cellular respiration.

Proteins:

- ✓ Proteins are broken down into amino acids.
- ✓ Amino acids can be converted into various intermediates of glycolysis and the Krebs cycle.
- ✓ Some amino acids can also be converted into acetyl-CoA.

(c) Outline the main events occurring during glycolysis in both aerobic and anaerobic respiration.

Glycolysis is the first stage of cellular respiration, and it occurs in the cytoplasm of the cell. The main events of glycolysis are:

- ✓ **Glucose Phosphorylation:** Glucose is phosphorylated to glucose-6-phosphate using ATP.
- ✓ **Isomerization:** Glucose-6-phosphate is converted into fructose-6-phosphate.
- ✓ **Second Phosphorylation:** Fructose-6-phosphate is phosphorylated to fructose-1,6-bisphosphate using ATP.
- ✓ **Cleavage:** Fructose-1,6-bisphosphate is cleaved into two 3-carbon molecules: glyceraldehyde-3-phosphate (G3P).
- ✓ **Oxidation and Phosphorylation:** G3P is oxidized and phosphorylated to form 1,3-bisphosphoglycerate. NADH is produced in this step.

- ✓ **Substrate-Level Phosphorylation:** 1,3-bisphosphoglycerate transfers a phosphate group to ADP, forming ATP and 3-phosphoglycerate.
- ✓ **Rearrangement:** 3-phosphoglycerate is converted to 2-phosphoglycerate.
- ✓ **Dehydration:** 2-phosphoglycerate Isaac converted to phosphoenolpyruvate (PEP).
- ✓ **Substrate-Level Phosphorylation:** PEP transfers a phosphate group to ADP, forming ATP and pyruvate.

In aerobic respiration: pyruvate enters the mitochondria, where it is further oxidized in the Krebs cycle and electron transport chain.

In anaerobic respiration: pyruvate is converted into lactate (in animals) or ethanol (in yeast) through fermentation. This process produces a small amount of ATP but does not require oxygen.

(d) Explain the significance of the Krebs' cycle in respiration.

The Krebs cycle, also known as the citric acid cycle or tricarboxylic acid cycle, is a central metabolic pathway that plays a crucial role in cellular respiration. Its significance lies in:

- ✓ **Generating ATP:** Although the Krebs cycle directly produces only a small amount of ATP through substrate-level phosphorylation, it generates a significant amount of reduced electron carriers, NADH and FADH2.
- ✓ **Producing Intermediates:** The Krebs cycle produces intermediates that are used in various biosynthetic pathways, including the synthesis of amino acids and glucose.
- ✓ **Oxidizing Acetyl-CoA**: The Krebs cycle oxidizes acetyl-CoA, a product of carbohydrate, fat, and protein breakdown, releasing energy in the form of reduced electron carriers.

The reduced electron carriers (NADH and FADH2) from the Krebs cycle enter the electron transport chain, where they donate their electrons. This electron transport chain ultimately drives the synthesis of ATP through oxidative phosphorylation, generating the majority of ATP produced during cellular respiration.

7. (a) Describe the structural components of a gene.

A gene is a segment of DNA that contains the instructions for building a specific protein or RNA molecule. It has the following structural components:

- ✓ **Promoter:** A region of DNA that signals the start of a gene and where RNA polymerase binds to initiate transcription.
- ✓ **Coding Region:** The sequence of DNA that contains the genetic information for the protein or RNA. It is made up of codons (triplets of nucleotides) that specify the amino acid sequence.
- ✓ **Terminator:** A region of DNA that signals the end of the gene and causes RNA polymerase to detach.

- ✓ **Regulatory Sequences:** These are DNA sequences that control the rate of transcription. They can be located upstream (promoter), downstream (terminator), or even within the gene itself.

(b) Describe how DNA determines the nature of protein made in a cell.

DNA determines the nature of a protein through the process of gene expression, which involves transcription and translation:

- ✓ **Transcription:** The DNA sequence of a gene is copied into a messenger RNA (mRNA) molecule. This mRNA carries the genetic information from the DNA to the ribosomes, where protein synthesis occurs.
- ✓ **Translation**: The mRNA sequence is read by ribosomes in the cytoplasm. Each codon on the mRNA specifies a particular amino acid. Transfer RNA (tRNA) molecules bring the corresponding amino acids to the ribosome, where they are linked together by peptide bonds to form a polypeptide chain. The polypeptide chain then folds into a functional protein.

(c) Differentiate between transcription and translation processes.

Feature	Transcription	Translation
Location	Nucleus	Cytoplasm (on ribosomes)
Template	DNA	mRNA
Enzyme	RNA polymerase	Ribosome
Product	mRNA	Polypeptide chain
Process	Copying DNA sequence into mRNA	Decoding mRNA sequence to produce protein

(d) Explain fully the process of translation as it occurs in a cell.

Translation is the process of synthesizing a protein from the information carried by an mRNA molecule. Here's a step-by-step breakdown:

- ✓ **Initiation:** The ribosome binds to the mRNA at the start codon (AUG). The first tRNA carrying the amino acid methionine binds to the start codon.
- ✓ **Elongation:** The ribosome moves along the mRNA, reading each codon. For each codon, the appropriate tRNA carrying the corresponding amino acid binds to the mRNA. A peptide bond is formed between the amino acids, and the tRNA is released. This process continues until the ribosome reaches a stop codon.
- ✓ **Termination:** When the ribosome encounters a stop codon (UAA, UAG, or UGA), protein synthesis is terminated. The polypeptide chain is released from the ribosome, and the ribosome disassembles.

(e) What is the significance of the translation process to living organisms?

Translation is crucial for living organisms as it is the final step in gene expression, ultimately determining the proteins produced by a cell. Proteins are essential for all cellular functions, including:

- ✓ **Enzymatic activity:** Catalyzing biochemical reactions.
- ✓ **Structural support:** Providing structural components for cells and tissues.
- ✓ **Transport:** Facilitating the movement of molecules across cell membranes.
- ✓ **Hormonal signaling:** Regulating physiological processes.
- ✓ **Immune response:** Defending the body against pathogens.

(f) Give an account of the theories put forward to explain DNA replication and draw conclusions about them.

Several theories have been proposed to explain DNA replication:

- ✓ **Conservative Replication:** This model suggests that the original parental DNA double helix remains intact, and a completely new double helix is synthesized.
- ✓ **Semi-Conservative Replication:** This model, which has been experimentally proven, proposes that each daughter DNA molecule contains one original strand from the parent DNA and one newly synthesized strand.
- ✓ **Dispersive Replication:** This model suggests that the parent DNA molecule is fragmented, and the daughter DNA molecules contain a mixture of old and new DNA segments.

Conclusion: The semi-conservative model of DNA replication is widely accepted as it is supported by experimental evidence, such as the Meselson-Stahl experiment.

(g) What evidence supports that DNA is a genetic material?

Several lines of evidence support the role of DNA as the genetic material:

- ✓ Transformation Experiments: Griffith's experiments with Streptococcus pneumoniae demonstrated that genetic material could be transferred from dead pathogenic bacteria to live non-pathogenic bacteria, transforming them into pathogenic strains.
- ✓ Avery-MacLeod-McCarty Experiment: This experiment showed that DNA, not protein or RNA, was the transforming principle in Griffith's experiment.
- ✓ Hershey-Chase Experiment: This experiment used bacteriophages (viruses that infect bacteria) to demonstrate that DNA, not protein, is the genetic material that is injected into the host cell during infection.

12(a) (i)Describe Fluid-Mosaic Model of Cell Membrane Structure:

- ✓ The cell membrane is composed of a phospholipid bilayer, with hydrophilic heads facing outwards and hydrophobic tails inwards.
- ✓ Proteins are embedded within this bilayer, acting as channels, transporters, receptors, and enzymes.
- ✓ Cholesterol molecules add rigidity and fluidity to the membrane.
- ✓ Carbohydrates are attached to proteins and lipids, forming glycoproteins and glycolipids, which play a role in cell recognition and adhesion.

(ii) Describe Functions of Cell and Organelle Membranes:

Cell Membrane:

- ✓ Encloses the cell: Separates the internal environment from the external environment.
- ✓ Selectively permeable: Controls the movement of substances in and out of the cell.
- ✓ Cell signaling: Receives and transmits signals from the environment.
- ✓ Cell adhesion: Allows cells to attach to each other and to the extracellular matrix.

Organelle Membranes:

- ✓ Mitochondria: Inner membrane folds to increase surface area for ATP production.
- ✓ Chloroplasts: Thylakoid membranes contain chlorophyll for photosynthesis.
- ✓ Endoplasmic Reticulum: Rough ER is studded with ribosomes for protein synthesis, while smooth ER synthesizes lipids and detoxifies substances.
- ✓ Golgi Apparatus: Modifies, sorts, and packages proteins and lipids.
- ✓ Lysosomes: Membrane-bound vesicles containing digestive enzymes.