Slide 1: Introduction to Life Processes

What is Life?

- Living organisms show characteristics like growth, reproduction, movement, and metabolism.
- Molecular movement is critical and continuous.

Defining Characteristics of Living Beings:

- Growth and movement (visible/invisible)
- Metabolism (invisible molecular movement)
- Cellular organization
- Continuous energy transformation

Why is molecular movement essential? Continuous repair and maintenance of internal structures.

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Slide 2: What Are Life Processes?

Definition: Life processes are the essential processes that maintain life in an organism, even when it is at rest.

Examples of Life Processes:

- Nutrition
- Respiration
- Transportation
- Excretion

Why do these processes need energy? To maintain internal order against environmental breakdown. Energy is derived from food.

Types of Substances Needed: Energy sources (food), Raw materials (carbon, nitrogen compounds)

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Slide 3: Need for Specialized Systems in Multicellular Organisms

Single-celled organisms: No specialized organs; all functions occur at the surface.

Multicellular organisms: Cells are not in direct contact with environment. Require specialized tissues/organs for:

- Food intake
- Gas exchange
- Excretion

Also need a transportation system to carry substances to/from all cells.

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Slide 4: NUTRITION – Introduction

Why is Nutrition Important?

- Provides energy for all life processes.
- Supplies raw materials for growth, repair, and synthesis.

Types of Nutrition:

- **Autotrophic:** Organism prepares its own food (e.g., green plants)
- **Heterotrophic:** Organism depends on others for food (e.g., animals, fungi)

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Slide 5: Autotrophic Nutrition

What is it? A mode of nutrition in which an organism makes its own food from simple inorganic substances using energy.

Key Points:

- Performed by green plants, some bacteria
- Requires: Carbon dioxide, Water, Sunlight, Chlorophyll

Photosynthesis: $CO_2 + H_2O \rightarrow [\text{Sunlight} + \text{Chlorophyll}] \rightarrow \text{Carbohydrates} + O_2$

Stored Food: Excess carbohydrates are stored as starch (in plants) or glycogen (in animals).

Slide 6: Events in Photosynthesis

- Absorption of light energy by chlorophyll
- Conversion of light energy into chemical energy
- Splitting of water into hydrogen and oxygen
- Reduction of CO_2 to carbohydrates using hydrogen

Note: In desert plants, CO_2 is absorbed at night and processed during the day.

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Slide 7: Leaf Structure for Photosynthesis

- **Chloroplasts:** Organelles with chlorophyll, mainly in leaf cells
- **Stomata:** Pores for gas exchange; controlled by guard cells
- **Water Loss:** Stomata close to reduce water loss when CO_2 is not needed

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Slide 8: Activity-Based Understanding

Variegated Leaf Starch Test: Shows chlorophyll is necessary for photosynthesis. Only green parts turn blue-black with iodine.

CO_2 and Photosynthesis: Bell-jar setup with KOH. Only plant with access to CO_2 shows presence of starch.

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Slide 9: Other Raw Materials for Autotrophs

- **Water:** Absorbed from soil by roots
- **Minerals:** Nitrogen, Phosphorus, Iron, Magnesium
- **Nitrogen:** Used for proteins and nucleic acids, absorbed as nitrates/nitrites or from organic compounds

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Slide 10: Heterotrophic Nutrition

Definition: Organisms obtain complex organic substances from other organisms.

Key Characteristics:

- Cannot prepare their own food
- Depend on autotrophs
- Use enzymes to digest complex food

Types:

- Saprophytic (e.g., fungi)
- Holozoic (e.g., humans)
- Parasitic (e.g., lice)

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Slide 11: Heterotrophic Nutrition Examples

- **Saprophytes:** Digest food externally, e.g., fungi
- **Parasites:** Live on/in host, derive nutrition, e.g., lice
- **Holozoic:** Ingest solid food, digest internally, e.g., humans

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Slide 12: Nutrition in Amoeba

Organism Type: Unicellular, holozoic nutrition

- Ingestion – Forms pseudopodia
- Digestion – Enzymes in food vacuole
- Absorption – Nutrients into cytoplasm
- Assimilation – Used for growth/energy
- Egestion – Expels undigested food

Slide 13: Nutrition in Paramoecium

- Unicellular like amoeba
- Has a definite shape
- Uses cilia to sweep food into cell
- Food processed similarly to amoeba

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Slide 14: Human Digestive System – Overview

Type: Holozoic Nutrition

- Mouth
- Oesophagus
- Stomach
- Small Intestine
- Large Intestine
- Anus

Associated Glands: Salivary glands, Liver, Pancreas

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Slide 15: Digestion in the Mouth

- Ingestion and chewing (mechanical)
- Chemical digestion via saliva
- Salivary amylase breaks starch to sugar
- Saliva lubricates food for swallowing

Activity 5.3: Starch breakdown using iodine test

Slide 16: Peristalsis & Oesophagus

Peristalsis: Rhythmic contraction of muscles in the alimentary canal that pushes food forward.

- Starts in oesophagus and continues to rectum
- Mixes food with digestive enzymes at each stage

Slide 17: Digestion in the Stomach

Stomach: Large muscular organ that churns food with digestive juices.

- **Hydrochloric acid (HCl):** Provides acidic pH and kills bacteria
- **Pepsin:** Breaks proteins into peptides

- **Mucus:** Protects stomach lining

Note: Excess acid can cause ulcers.

Slide 18: Digestion in the Small Intestine – Part 1

Structure: Longest part of digestive system; coiled and narrow for absorption.

Length Varies:

- Herbivores: Longer intestines (cellulose digestion)
- Carnivores: Shorter intestines

Digestive Juices:

- **Bile (Liver):** Alkalizes food and emulsifies fats
- **Pancreatic Juice:** Contains trypsin (proteins) and lipase (fats)

Slide 19: Digestion in the Small Intestine – Part 2

Intestinal Juice: Completes digestion.

- Proteins → Amino acids
- Carbohydrates → Glucose
- Fats → Fatty acids + Glycerol

Absorption: Occurs through villi with rich blood supply to transport nutrients.

Slide 20: Large Intestine & Egestion

- **Large Intestine:** Absorbs remaining water from undigested food
- **Egestion:** Undigested food expelled via anus
- **Controlled by:** Anal sphincter

Dental Caries: Bacterial acid damages enamel – prevent with brushing.

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Slide 21: RESPIRATION – Introduction

What is Respiration? The process by which food (mainly glucose) is broken down in cells to release energy (ATP).

- Occurs in all living cells (plants & animals)
- Energy used for growth, repair, transport, etc.

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Slide 22: Types of Respiration

- **Aerobic:** Glucose breakdown in presence of oxygen → CO_2 + H_2O + Energy (high); site: mitochondria
- **Anaerobic:** Glucose breakdown without oxygen → Lactic acid or Alcohol + CO_2 + Energy (low); site: cytoplasm

Initial Step: Glucose → Pyruvate (common to both types)

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Slide 23: Pathways of Pyruvate Breakdown

- **Aerobic Respiration:** Pyruvate → CO_2 + H_2O + Energy (in mitochondria)
- **Fermentation (Yeast):** Pyruvate → Alcohol + CO_2 + Energy
- **Lactic Acid Formation (Muscles):** Pyruvate → Lactic Acid + Energy (during oxygen deficiency)

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Slide 24: ATP – The Energy Currency

What is ATP? Adenosine Triphosphate – stores and supplies energy for all cellular activities.

- Formed from ADP + Pi during respiration
- One ATP releases ~30.5 kJ/mol of energy

- Functions: Muscle contraction, Nerve impulses, Protein synthesis, Active transport

Analogy: ATP is like a battery that powers cellular work.

Slide 25: Respiration in Plants

- Gas exchange occurs mainly through stomata
- **Day:** CO_2 used in photosynthesis; O_2 released
- **Night:** Only respiration; CO_2 released
- Large intercellular spaces help gas diffusion

Slide 26: Respiration in Aquatic vs. Terrestrial Animals

- **Aquatic Animals:** Use dissolved oxygen; breathe faster due to low O_2 availability
- **Terrestrial Animals:** Use atmospheric oxygen via lungs or skin; more efficient due to higher O_2 concentration

Activity Tip: Observe fish gills and mouth movement for coordination.

Slide 27: Human Respiratory System – Overview

- **Nostrils:** Air entry; filtered by hairs
- **Trachea:** Windpipe with cartilage rings
- **Bronchi & Bronchioles:** Branching airways
- **Alveoli:** Site for gas exchange

Oxygen enters blood via alveoli; CO_2 diffuses out for exhalation.

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Slide 28: Mechanism of Breathing

- **Inhalation:** Ribs up & out, diaphragm flattens, chest expands → air in
- **Exhalation:** Ribs down & in, diaphragm dome-shaped, chest contracts → air out

Residual air remains in lungs for continuous gas exchange.

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Slide 29: Role of Haemoglobin & Blood in Gas Transport

- **Haemoglobin:** Red pigment in RBCs; carries oxygen
- **CO_2 Transport:** Dissolved in blood plasma

Importance: Haemoglobin ensures quick O_2 delivery to tissues; diffusion alone is too slow.

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Slide 30: Smoking – A Health Hazard

- Destroys cilia in respiratory tract → germs & dust enter lungs
- May cause lung cancer, strokes, heart attacks
- Tobacco forms: cigarettes, bidis, hookah, gutkha
- Increased risk of oral, lung, and throat cancers

Moral Message: Stay healthy – Say NO to smoking and tobacco.

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Slide 31: TRANSPORT – Introduction

What is Transport in Biology? Movement of substances like food, gases, hormones, and wastes to and from cells.

- Necessary for maintaining life and internal balance (homeostasis)
- Multicellular organisms need specialized transport systems

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Slide 32: Transportation in Human Beings – Overview

Main Components:

- Blood – Circulatory fluid
- Heart – Pumping organ
- Blood vessels – Arteries, veins, capillaries
- Lymph – Helps transport and immunity

Functions: Transport nutrients, gases, hormones, waste; regulate temperature and immunity

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Slide 33: Blood – The Circulating Fluid

- **Plasma:** Fluid part; transports nutrients, hormones, waste
- **RBCs:** Contain haemoglobin; transport oxygen
- **WBCs:** Fight infections
- **Platelets:** Help clot blood during injuries

Slide 34: The Human Heart – Structure & Chambers

- Four chambers: Right/Left atria, Right/Left ventricles
- Right side handles deoxygenated blood → lungs
- Left side handles oxygenated blood → body
- Prevents mixing of oxygenated and deoxygenated blood

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Slide 35: Blood Circulation Pathway in Humans

Double Circulation:

- **Pulmonary:** Right side → lungs → left side (gas exchange)
- **Systemic:** Left side → body → right side (nutrient/waste exchange)

Ensures efficient and continuous blood flow.

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Slide 36: Valves and Heart Function

- Valves ensure one-way flow of blood
- Prevent backflow during contraction
- Ventricles: thicker walls to pump blood farther
- Atria: thinner, act as receiving chambers

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Slide 37: Blood Vessels – Arteries, Veins, Capillaries

- **Arteries:** Carry blood away from heart; thick, elastic walls
- **Veins:** Carry blood to heart; thin walls, valves prevent backflow
- **Capillaries:** Connect arteries and veins; one-cell thick for exchange

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Slide 38: Blood Pressure

- **Definition:** Pressure exerted by blood on vessel walls
- Measured with a sphygmomanometer
- **Systolic:** ~120 mm Hg (during contraction)
- **Diastolic:** ~80 mm Hg (during relaxation)

- High BP = Hypertension (can damage arteries)

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Slide 39: Lymph – The Other Circulatory Fluid

- Colorless fluid escaping capillaries and bathing tissues
- Transports digested fats, vitamins, excess fluid
- Helps in immune response
- Lymph nodes and vessels carry WBCs and antibodies

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Slide 40: Transportation in Plants – Overview

- **Xylem:** Transports water/minerals from roots upward
- **Phloem:** Transports food from leaves to rest of plant
- Xylem: One-way; Phloem: Two-way (source to sink)

Slide 41: Transport of Water – Role of Xylem

- **Root Pressure:** Osmotic pressure pushes water upward
- **Transpiration Pull:** Evaporation from leaves creates suction
- **Capillary Action:** Narrow tubes help water rise
- **Transpiration:** Water vapor loss from leaves

Helps in mineral uptake, cooling, and maintaining turgor pressure

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Slide 42: Transport of Food – Role of Phloem

Translocation: Movement of food products (sugars, amino acids) from leaves to rest of plant

- Requires ATP (active transport)
- Water enters by osmosis → pressure flow
- Moves from source (leaves) to sink (roots, fruits)

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Slide 43: EXCRETION – Introduction

What is Excretion? Removal of harmful metabolic wastes from body

- **Why:** To maintain chemical balance and prevent toxicity
- **Wastes:** CO_2, urea, uric acid, excess salts and water

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Slide 44: Excretion in Humans – Organs Involved

- Kidneys – Filter blood
- Ureters – Carry urine to bladder
- Urinary Bladder – Stores urine
- Urethra – Passage for urine expulsion

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Slide 45: Structure and Function of the Nephron

- **Bowman's Capsule:** Cup-like structure
- **Glomerulus:** Filtration knot of capillaries
- **Tubule:** Reabsorbs water and nutrients

Stages: Filtration → Reabsorption → Secretion → Urine

Slide 46: Regulation of Urine Production

- Depends on water intake, salt concentration, temperature, hormones (ADH)
- Normal adult: 180L filtered, 1–2L urine/day

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Slide 47: Pathway of Urine in the Body

Kidneys → Ureters → Bladder → Urethra

- Bladder is muscular and controlled by nervous system
- Urination is voluntary in normal adults

Slide 48: Artificial Kidney – Dialysis

- Used in kidney failure
- Blood filtered using semi-permeable tubes in dialysing fluid
- No reabsorption like real kidney; only filtration

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Slide 49: Excretion in Plants

- Low metabolic waste
- **Methods:**
- Gaseous: O_2 & CO_2 via stomata
- Water: Transpiration
- Storage: Resins, gums in vacuoles or leaves

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Slide 50: Chapter Recap – Life Processes

- Movement includes molecular activity
- Key Processes: Nutrition, Respiration, Transportation, Excretion
- Energy Currency: ATP
- Human systems: Double circulation, nephron filtration, haemoglobin transport
- Plant systems: Passive transport, waste storage/disposal

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