

Class-7

LIFE PROCESS

Introduction to Life Processes (Deeper Overview)

Life processes are the ****biochemical and physiological activities**** that sustain life, involving energy transformations, material exchanges, and regulatory mechanisms. At a molecular level, they rely on enzymes, ATP (adenosine triphosphate as energy currency), and cellular organelles. They maintain ****homeostasis**** (internal balance) through feedback loops (e.g., hormone regulation). In Nepal's diverse ecosystems (mountains, rivers, forests), these processes adapt to challenges like altitude or monsoon rains. Disruptions (e.g., pollution) can lead to imbalances, affecting biodiversity. Deep insight: Life processes evolved from simple unicellular organisms to complex multicellular ones, ensuring survival in dynamic environments.

1. Nutrition (Deeper Insights)

- ****Molecular Mechanisms****: Photosynthesis is a redox reaction where chlorophyll absorbs photons, exciting electrons to produce NADPH and ATP via the light-dependent phase. The Calvin cycle (light-independent) fixes CO₂ into glucose using RuBisCO enzyme. In animals, digestion involves hydrolysis (water-splitting) reactions: e.g., proteases break peptide bonds in proteins.
- ****Cellular Level****: Autotrophs use chloroplasts; heterotrophs rely on lysosomes and vacuoles for intracellular digestion (e.g., amoebae engulf food).
- ****Interconnections****: Nutrition provides substrates for respiration (glucose oxidation) and raw materials for transportation (e.g., amino acids for protein synthesis in blood cells).
- ****Real-Life Applications****: In Nepal, terraced farming maximizes photosynthesis for crops like maize, supporting food chains. Parasitic nutrition (e.g., ticks on livestock) disrupts host health.
- ****Health/Environmental Impacts****: Malnutrition causes vitamin deficiencies (e.g., vitamin A blindness in rural Nepal). Over-fertilization pollutes rivers, harming aquatic nutrition. Deep insight: Balanced diets prevent oxidative stress from free radicals produced during metabolism.

2. Respiration (Deeper Insights)

- ****Molecular Mechanisms****: Aerobic respiration involves glycolysis (cytoplasm), Krebs cycle (mitochondria), and electron transport chain (ETC), producing 36-38 ATP via oxidative phosphorylation. Anaerobic respiration uses fermentation (e.g., pyruvate to lactate), regenerating NAD⁺ for glycolysis.
- ****Cellular Level****: Mitochondria are "powerhouses" with cristae for ETC. In plants, respiration occurs in mitochondria of all cells, competing with photosynthesis for substrates.
- ****Interconnections****: Respiration consumes O₂ from transportation and produces CO₂ for plant nutrition. Waste CO₂ is excreted, linking to excretion.
- ****Real-Life Applications****: In Nepal's high altitudes (e.g., Everest base camp), low O₂ pressures enhance anaerobic pathways, causing altitude sickness. Yeast respiration is used in brewing local raksi (alcohol).
- ****Health/Environmental Impacts****: Smoking damages alveoli, reducing surface area for gas exchange, leading to emphysema. Urban pollution (e.g., Kathmandu smog) increases respiratory illnesses. Deep insight: Respiration rates rise with temperature (Q₁₀ effect), explaining why tropical organisms have higher metabolic needs.

3. Transportation (Deeper Insights)

- ****Molecular Mechanisms****: In plants, cohesion (water molecules stick) and adhesion (to xylem walls) create tension. In animals, hemoglobin binds O₂ reversibly via heme groups; blood clotting involves fibrin networks from platelets.
- ****Cellular Level****: Xylem vessels are dead, lignified tubes; phloem has living sieve tubes with companion cells. Animal capillaries have thin walls for diffusion.
- ****Interconnections****: Transportation delivers glucose from nutrition to respiring cells and carries urea from excretion to kidneys.
- ****Real-Life Applications****: In Nepal, irrigation systems mimic xylem to transport water uphill for rice paddies. Blood transfusions save lives in accidents.
- ****Health/Environmental Impacts****: Atherosclerosis (plaque buildup) blocks arteries, causing strokes. Deforestation reduces transpiration, leading to droughts in Nepal's Terai region. Deep insight: Blood pressure regulation involves baroreceptors, maintaining flow against gravity in tall trees or upright humans.

4. Excretion (Deeper Insights)

- ****Molecular Mechanisms****: Kidney filtration uses glomerulus pressure; reabsorption involves active transport (ATP-dependent) for glucose and passive osmosis for water. Urea is produced in liver via ornithine cycle from ammonia.
- ****Cellular Level****: Nephrons have Bowman's capsule for filtration and tubules for reabsorption. Plants excrete via vacuoles and guttation (root pressure pushes water out).
- ****Interconnections****: Excretion removes metabolic wastes from respiration (CO₂) and digestion (undigested matter), preventing feedback inhibition in other processes.

- ****Real-Life Applications****: In Nepal, traditional toilets aid excretion; dialysis treats kidney failure in urban hospitals. Desert plants (e.g., cactus) minimize water loss via excretion.
- ****Health/Environmental Impacts****: Kidney stones form from mineral imbalances; untreated, lead to uremia. Industrial waste (e.g., from factories) contaminates water, causing fish excretion failure. Deep insight: Osmoregulation in freshwater fish involves constant water intake and dilute urine, unlike marine fish.

5. Overall Interconnections and Importance (Deeper Insights)

- ****Systemic Links****: Life processes form a ****metabolic web**** – e.g., photosynthesis (nutrition) fixes CO₂ from respiration, while transportation circulates products. Hormones (e.g., insulin for glucose uptake) regulate them, ensuring homeostasis.
- ****Ecosystem Level****: In Nepal's forests, plant nutrition supports herbivores (respiration), predators (transportation), and decomposers (excretion), maintaining biodiversity. Human activities (e.g., overgrazing) disrupt this.
- ****Evolutionary Adaptations****: Processes evolved for efficiency – e.g., lungs in terrestrial animals vs. gills in aquatic ones. In extreme environments (Nepal's Himalayas), organisms have adaptations like thick blood for low-O₂ respiration.
- ****Health/Environmental Impacts****: Imbalances cause pandemics (e.g., poor immunity from malnutrition weakens defenses). Climate change affects photosynthesis rates, threatening food security. Deep insight: Life processes are energy-efficient; inefficiencies (e.g., in diseased cells) lead to entropy increase, explaining aging.
- ****Nepal-Specific Context****: Rural diets (e.g., millet) support nutrition in harsh terrains; urban pollution challenges respiration. Conservation efforts (e.g., Chitwan National Park) preserve these processes for sustainable living.

****Final Deep Note****: Life processes are not isolated; they are interdependent, governed by laws like thermodynamics (energy conservation). Studying them reveals how organisms adapt, survive, and evolve – crucial for Nepal's biodiversity conservation.

These notes are now at an advanced depth for class 7, covering molecular to ecosystem levels. If you need questions, diagrams, or focus on a specific process, let me know!