

BIOLOGY GRADE NINE AND TEN

UNIT ONE BIOLOGY AND TECHNOLOGY

- Biology is the study of life and living organisms.

Biologists use scientific methods to study nature and living things. This method consists of a number of steps. These are observation, problem identification, background research, hypothesis construction, experimentation, analysis, conclusion and report the result.

- Scientific research is based on the ideas of scientists. They design experiments to test these ideas or hypothesis. Results of these experiments are published in peer-reviewed journals, which are read by scientists around the world.

- Ethiopia has some renowned biologists whose work is known both in Ethiopia and internationally. They include Dr Aklilu Lemma, Professor Tilahun Yilma, Professor Yalemtehay Mekonnen, Dr Melaku Worede, Dr Legesse Woldeyes, Professor Gebissa Ejeta, Dr Berhane Asfaw, Professor Legesse Negash, Professor Mogessie Ashenafi, Professor Ensermu Kelbessa and many others.

- Most biological research is linked to a research institution that has the facilities which are needed. There are a number of well-known Ethiopian biological research institutions.

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UNIT 2 CELL BIOLOGY

- Light microscopes and electron microscope are widely used by biologists.
- Microscopes magnify both living and dead tissue so you can observe the features of the cells and tissue.
- Magnification involves increasing the size of an object. To work out the magnification of a microscope you multiply the magnification of the objective lens by the magnification of the eyepiece lens.
- Resolution is the ability to distinguish between two separate points.
- The resolving power of a microscope is dependent on the wavelength used, so the resolving power of an electron microscope is around 1000 times greater than the resolving power of a light microscope.

- Using a light microscope takes skill and practice.
- Dead specimens are fixed, stained and sliced before mounting on slides to be observed under the microscope. Living specimens are mounted on slides and stains may be added.
- Stains are used to make parts of cells (e.g. the nucleus) or types of cells show up better under the microscope.
- Tissue has to be prepared carefully before it can be used in the electron microscope. Only dead tissue can be used in the electron microscope
- Cells are the structural and functional units of living things.
- Cells are the smallest units of life capable of independent existence.
- The discovery of cells is due to the development of reliable microscopes that could magnify sufficiently to show the cellular structure.
- Robert Hooke introduced the term **cell**.
- Botanist Matthias Schleiden and zoologist Theodor Schwann and Rudolf Virchow completed the first accepted version of the cell theory:
 - a. all organisms are made up of one or more cells
 - b. all cells come from pre-existing cells
 - c. the cell is the unit of structure, physiology and organization in living things.
 - d. the cell retains a dual existence as a distinct entity and a building block in the construction of organisms
- There are seven life processes that are common to all living organisms: nutrition, respiration, excretion, growth, irritability (response to stimuli), movement and reproduction.
- Unspecialized animal cells all have the following structures and organelles: a cell membrane, cytoplasm, nucleus, mitochondria, endoplasmic reticulum and ribosomes. Each of these has a characteristic structure and carries out clear functions in the working of the cell.
- Unspecialized plant cells all have the same basic structures and organelles as an animal cell. In addition, they have a cellulose cell wall, and have a permanent vacuole. In the green parts of a plant all the cells contain chloroplasts, which in turn contain chlorophyll. Each of these has a characteristic structure and carries out clear functions in the working of the cell.
- In multicellular organisms like human beings the cells of the embryo differentiate to form specialized cells, which carry out particular functions in the body.
- Cells specialized to carry out a particular function are grouped together to form a tissue, tissues group together to form an organ, several different organs working together form an organ system and organ systems working together make up the body of a complex multicellular organism.

- There are many different specialized cells in the human body. They include epithelial cells, sperm cells, egg cells, nerve cells and muscle cells. A close look at their specialization shows how they are adapted to their functions.

Structure	Description	Function
Cell wall	Outer layer of cellulose or chitin; or absent	Protection; support
Cytoskeleton	Network of protein filaments	Structural support; cell movement
Flagella (cilia)	Cellular extensions with 9 + 2 arrangement of pairs of Microtubules	Motility or moving fluids over surfaces
Plasma membrane	Lipid bilayer with embedded proteins	Regulates what passes into and out of cell; cell-to-cell recognition
Endoplasmic reticulum	Network of internal membranes	Forms compartments and vesicles; participates in protein and lipid synthesis
Nucleus	Structure (usually spherical) surrounded by double membrane that contains chromosomes	Control center of cell; directs protein synthesis and cell reproduction
Lysosomes	Vesicles derived from Golgi apparatus that contain hydrolytic digestive enzymes	Digest worn-out organelles and cell debris; play role in cell death
Microbodies	Vesicles formed from incorporation of lipids and proteins containing oxidative and other enzymes	Isolate particular chemical activities from rest of cell
Mitochondria	Bacteria-like elements with double membrane	“Power plants” of the cell; sites of oxidative metabolism
Chloroplasts	Bacteria-like elements with membranes containing chlorophyll, a photosynthetic pigment	Sites of photosynthesis
Chromosomes	Long threads of DNA that form a complex with Protein	Contain hereditary information
Nucleolus	Site of genes for rRNA synthesis	Assembles ribosomes
Ribosomes	Small, complex assemblies of protein and RNA, often	Sites of protein synthesis

- Diffusion is the net (overall) movement of particles from an area of high concentration to an area of lower concentration.
- Diffusion takes place because of the random movements of the particles of a gas or of a substance in solution in water.
- Diffusion is important in many processes taking place in animals and plants. Examples include gaseous exchange in the lungs, the absorption of digested food

from the gut and the entry of carbon dioxide into the leaves of plants.

- Osmosis is a special type of diffusion where only water moves across a selectively permeable membrane, from an area of high concentration of water to an area of lower concentration of water.
- Cell membranes are selectively permeable so osmosis occurs frequently in plant and animal cells.
- Osmosis can be very useful to plants and animals, but it can cause many difficulties.
- Both osmosis and diffusion can be demonstrated experimentally in the laboratory.
- When plant cells lose water by osmosis they become flaccid. when plant cells absorb water by osmosis they become turgid.
- In active transport substances are moved against a concentration gradient or across a selectively permeable membrane.
- Active transport uses energy produced by cellular respiration.
- Cells which carry out a lot of active transport often have many mitochondria to provide the energy they need.
- Active transport is very important in cells and whole organisms, for example in the movement of mineral ions into plant roots and in the movement of excess salt out of the body via the salt glands in some marine creatures.

UNIT THREE HUMAN BIOLOGY AND HEALTH

- A balanced diet contains carbohydrates, proteins, lipids, minerals, vitamins and water in the right proportions to keep our body functioning effectively. Fibre is also important.
- Carbohydrates are the main energy supply for the body. Carbohydrates are found as simple sugars, double sugars and complex sugars.
- Iodine is used to test for the presence of starch and Benedict's solution for the presence of simple Reducing sugars.
- Proteins are needed for building new cells and repairing old ones. They are made up of small units called amino acids.
- The Biuret test using 5% sodium hydroxide solution and 1% copper sulphate solution is used to show

the presence of protein in the food.

- Lipids are fats and oils. They provide energy for the body. They are made up of fatty acids and glycerol.
- The translucent smear test and the ethanol test identify lipids in foods.
- Iron is needed in the body for the production of haemoglobin to carry oxygen in the red blood cells.
Lack of iron in our diet causes anaemia.
- Calcium is needed for healthy bones and teeth. Lack of calcium in our diet can cause rickets.
- Vitamins are needed in small amounts for our cells to work properly. Vitamins A, B1, C and D are all vital for health.
- Malnutrition is when our diet is unbalanced. This can result from too little food, when we are at risk of deficiency diseases, and also too much food, which can give rise to obesity.
- The breakdown of large food molecules into smaller soluble molecules through hydrolysis reactions is catalysed by enzymes.
- Enzymes are proteins that catalyse specific reactions.
- Each enzyme has an active site that fits the reactants of the reaction it catalyses.
- Enzymes are affected by temperature. Up to their optimum temperature, raising the temperature increases the rate of reaction. Once the temperature goes above the optimum, the protein structure of the enzyme is denatured, the shape of the active site is destroyed and the rate of the reaction decreases rapidly.
- Enzymes work best at specific pH levels – pH affects the structure of the active site.
 - Different areas of the gut have different pHs to suit the enzymes involved.
 - The process of eating your food involves ingestion, digestion, absorption, assimilation and egestion.
 - The human digestive system is a muscular tube running through the body with specialised areas adapted to carry out different parts of the digestive process.
 - Peristalsis is a wave of muscular contraction pushing food along the gut.
 - The liver makes bile, which emulsifies fats, increasing the surface area for enzyme action.
 - The ileum has a very large surface area due to the presence of villi and microvilli. This enables the digested food products to be absorbed into the blood and lymph systems.
 - Water is removed from the remaining undigested food in the large intestine and the remaining

material is egested from the body as the faeces.

- Food must be handled and stored carefully to avoid the transmission of diseases.
- The breathing system takes air into and out of the body to supply oxygen and remove carbon dioxide.
- The respiratory system is made up of the mouth and nose, larynx, trachea, bronchi, bronchioles and alveoli. The lungs are surrounded by the pleural membranes and enclosed in the thorax.
- The movement of air is brought about by the intercostal muscles moving the ribs and the diaphragm.
- Breathing movements because changes in the volume and pressure of the chest that brings about ventilation of the lungs.
- In the lungs oxygen from the air diffuses into the bloodstream at the same time as carbon dioxide from the blood diffuses out of the bloodstream into the air. This is known as gas exchange.
- The alveoli provide a very large, moist surface area, richly supplied with blood capillaries to allow the most efficient possible gas exchange.
- The rate of breathing is affected by a number of factors including exercise, anxiety, drugs, environmental factors, altitude, body weight and smoking.
- Nicotine is the addictive drug found in tobacco.
- Tobacco smoke also contains carbon monoxide, which reduces the oxygen carrying capacity of the blood.
- In pregnant women carbon monoxide deprives the foetus of oxygen and can lead to low birth weight babies and stillbirths.
- Tobacco smoke contains tar and other chemicals, which contribute to lung cancer, bronchitis, emphysema and disease of the heart and blood vessels
- Aerobic respiration is the breakdown of glucose with oxygen to provide energy for the cells.
- Carbon dioxide and water are the waste products.
- ATP is the molecule that supplies energy to all of the reactions in the cell.
- Anaerobic respiration is respiration without oxygen.
- In humans, glucose is broken down to form lactic acid and a small amount of energy.
- If muscles work hard for a long time they become fatigued and don't contract properly.
- If they don't get enough oxygen they will respire anaerobically.
- After exercise, oxygen is still needed to break down the lactic acid that has built up. This oxygen is known as an oxygen debt

- The body transport system consists of the blood vessels (the pipes), the heart (the pump) and the blood (the medium).
- Human beings have a double circulation – the pulmonary circulation to the lungs and the systemic circulation to the body.
- The three main types of blood vessels are the arteries, veins and capillaries and they are each adapted for a different function.
- The heart is mainly made of muscle.
- It pumps blood around the body in response to the needs of the tissues.
- Blood enters the atria of the heart, which contract to force blood into the ventricles.
- When the ventricles contract blood leaves the heart to go to the lungs (from the right) and around the body (from the left).
- Valves control the flow of blood in the heart.
- The blood has four main components:
 2. Plasma, which transports dissolved food molecules, carbon dioxide and urea.
 3. Red blood cells, which transport oxygen.
 4. White blood cells, which defend against attack by microbes.
 5. Platelets, which help clot the blood.

Oxygen is carried by haemoglobin, which becomes oxyhaemoglobin in a reversible reaction.

- Tissue fluid is forced out of the blood in the capillaries and bathes the cells of the body. Exchange of substances by diffusion between the blood and the cells takes place through the tissue fluid.
- When the tissue fluid passes into the lymph system it becomes lymph. Lymph eventually returns to the blood enriched with antibodies.
- There are four main blood groups: A, B, AB and O. They are not all compatible and they must be matched carefully before a blood transfusion.
- Anaemia and hypertension are two diseases of the circulatory system which are particularly common in Ethiopia

UNIT 5 CLASSIFICATION

- Scientists classify organisms to make the living world easier to understand.
- Living organisms are classified into categories to avoid confusion created by different languages.
- A species is a group of living organisms that are able to breed successfully with one another and produce

fertile offspring.

- Taxonomy involves dividing living organisms into smaller and smaller groups based on features they have in common.
- The binomial system of nomenclature was developed by Carl Linnaeus.
- Living organisms can be classified using simple keys
- The five-kingdom classification of the living world.
- The characteristic features of the kingdom Monera and examples of typical monerans.
- The characteristic features of the kingdom Protista and examples of typical protista.
- The characteristic features of the kingdom Fungi and examples of typical fungi.
- The characteristic features of the main divisions of the kingdom Plantae – Bryophyta, Pteridophyta, Gymnospermae and Angiospermae with typical examples of each.
- That the Angiospermae are divided into monocots and dicots and how to recognize each type of plant.
- The characteristic features of each phylum of the kingdom Animalia – Porifera, Coelenterata, Platyhelminthes, Nematelminthes, Annelida, Mollusca, Echinodermata, Arthropoda and Chordata with typical examples of each phylum.

The characteristic features of the main classes of the phylum Chordata – fish, amphibian, reptiles, birds and mammals with typical examples of each

UNIT 6 ECOLOGY

- ✓ An ecosystem is a life-supporting environment which includes all the living organisms, the nutrients which cycle through the system and the physical and chemical environment in which the organisms are living.
- ✓ The abiotic components of an ecosystem are the non-living components of the environment. They include the amount of sunlight, the amount of rainfall, temperature, the type of soil and rocks, the drainage of the soil and the pH (acidity), the levels of oxygen dissolved in the water, the current and the levels of wind.
- ☐ The biotic components (factors) of an ecosystem are the living organisms within an ecosystem which affect the ability of an organism to survive there. They include disease, predator numbers, food availability and competition for things such as mates, territory, food, light, etc
- ☐ Radiation from the sun is the source of energy for all communities of living organisms. It is captured by green plants in photosynthesis. Green plants are known as phototrophs.
- ☐ Heterotrophs get their energy by feeding off other organisms and chemotrophs get their energy from chemical reactions which are not related to photosynthesis.
- ☐ Food chains and food webs show the feeding relationships between animals and plants.
- ☐ The idea of food chains and food webs was developed by Charles Elton in the 1920s from his observations on Bear Island.
- ☐ The mass of living material (the biomass) at each stage of a food chain is less than it was at the previous stage

because some material is always lost in waste materials and much is used for respiration to supply energy for movement and maintaining the body temperature.

- ☐ The biomass at each stage of a food chain can be drawn to scale and shown as a pyramid of biomass.
- Measuring the flow of energy through a system takes place over time. It can be shown in an energy pyramid
- ☐ Living organisms remove materials from the environment as they grow and return them when they die through the action of the decomposers.
- ☐ Dead materials decay because they are broken down by micro-organisms.
- ☐ The carbon cycle describes the way carbon is cycled through the environment including plants and animals and carbon sinks.
- ☐ The nitrogen cycle describes the way nitrogen is cycled through the environment, including plants and animals and showing how nitrates are returned to the soil.
- ☐ Living organisms have features (known as adaptations) which make it possible for them to survive in their particular habitat.
- ☐ Plants have many adaptations including thick waxy cuticles, water storage tissue, stomata in pits, etc. to help them survive in different conditions.
- ☐ Animals have many different adaptations to help them survive in different conditions from very hot, dry deserts to very cold and hostile countries.
- That it is very important to plant and grow trees in Ethiopia to replace the many forests that have been lost.
- That trees are important for many reasons including taking carbon dioxide out of the atmosphere, holding the soil together and providing us with food and many other products.
- How to plant and grow trees in your community, including how to plan the best place to plant the tree

G-10 UNIT ONE BIOTECHNOLOGY

Biotechnology is the use of micro-organisms to make things that people want, often involving industrial production.

Biotechnology has been used for thousands of years to make bread, alcoholic drinks and fermented food products such as yoghurt and cheese.

Yeast is a single-celled organism that can respire aerobically, producing carbon dioxide and water; this reaction is used in bread making to make the dough rise.

Yeast can also respire anaerobically, producing ethanol and carbon dioxide in a process known as fermentation – the fermentation reaction of yeast is used to produce ethanol in the production of beer and wine.

Bacteria are used in making both yoghurt and cheese. In the production of both, a starter culture of bacteria acts on warm milk. Lactose is converted to lactic acid in a lactic fermentation reaction. This changes the texture and taste of the milk to make yoghurt.

In cheese making, a different starter culture is added to warm milk, giving a lactic fermentation which results in solid curds and liquid whey. The curds are often mixed with other bacteria or molds before they are left to ripen.

Modern biotechnology often involves genetic engineering and large-scale fermenters.

In genetic engineering, desirable genes from one organism can be 'cut out' using enzymes and transferred to the cells of bacteria, animals and plants.

Micro-organisms can be grown on a large scale in vessels known as fermenters, to make useful products such as antibiotics. Industrial fermenters have a range of features to make sure fermentation takes place in the best possible conditions.

Modern biotechnology has many applications. In agriculture biotechnology is used to develop better crops and livestock, and to develop plants that contain their own pesticide.

In food it is used in many ways: including to break down starch to form useful sugar syrups; to improve the production of beers and other fermented products; and to develop new foodstuffs.

In medicine biotechnology is used to make drugs and medicines.

Biotechnology is important in producing new forms of fuel to provide us with energy.

Biogas – mainly methane – can be produced by anaerobic fermentation of a wide range of plant products and waste materials that contain carbohydrates.

Ethanol-based fuels can be produced by the anaerobic fermentation of sugar cane juices and from glucose derived from maize starch by the action of the enzyme carbohydrase.

UNIT TWO GENETICS

A chromosome is a structure, in the nucleus of a cell, consisting of genes. Chromosomes are made up of the genetic material DNA in a DNA–protein complex.

Chromosomes contain genes that carry genetic information about an individual, which is passed on from one generation to another.

DNA is the genetic material contained in the nucleus. It is a long molecule made up of two strands twisted together to make a double helix. The DNA molecule is made up of many smaller units called nucleotides that are joined together.

Each nucleotide is composed of a sugar, phosphate and one of the four bases (adenine, thymine, guanine and cytosine).

A gene is a unit of hereditary material located on the chromosomes. In the body's cells, chromosomes are found in homologous pairs.

Humans have 46 chromosomes arranged in 23 pairs.

22 pairs of chromosomes carry information about the body generally. The final pair is the sex chromosomes, which determine whether you are female (XX) or male (XY).

Mitosis is division of the somatic cells to make identical daughter cells.

The stages of mitosis are interphase, prophase, metaphase, anaphase and telophase.

Body cells divide by mitosis to produce more identical cells for growth, repair, replacement and, in some cases, asexual reproduction.

Cells divide in a regular pattern known as the cell cycle.

Body cells have two sets of chromosomes; gametes have only one set.

Meiosis is the division of the sex cells resulting in daughter cells with half the original number of chromosomes.

The process of meiosis introduces variety because no two gametes are ever the same. Meiosis is divided into two divisions. The first meiotic division is very similar to mitosis.

The second is again similar, but there is no more replication of chromosomes, so the number of chromosomes in the final cells is halved.

Meiosis takes place in the ovaries of girls and women. It is called oogenesis, and forms the ova. The first stage takes place before birth. The second stage occurs as the eggs ripen during the menstrual cycle and is completed after fertilization of the egg.

Meiosis takes place in the testes after puberty. Spermatogenesis produces sperm. Mitosis and meiosis show both similarities and differences.

- Farm animals and plants are the result of selective breeding.
- In selective breeding, only the animals or plants with the characteristic we want are allowed to breed. In time, every member of the breed shows that characteristic.
- Another way of getting desirable characteristics is to cross-breed between two different breeds. This gives us a combination of traits from the two different breeds – the best of both can be used to develop a new breed.
- The many different breeds of Ethiopian cattle are the result of selective breeding and cross-breeding over many years. They, and all our breeds of other animals and plants, represent an important genetic heritage for our country.
- Breeding animals and plants to develop the best possible characteristics is very important for society, to enable us to make the best possible use of our resources, to feed our population, to maintain our genetic diversity and to provide new and useful genes for the international community.

UNIT THREE HUMAN BIOLOGY AND HEALTH

- Living organisms need systems of co-ordination and control.
- Many multicellular organisms including human beings have both nervous and hormonal co-ordination and control systems.
- The nervous system is the most rapid.
- Nervous control involves: Stimulus → Receptor → Co-ordinator → Effector → Response

- A nerve cell or neuron consists of a cell body, dendrites and an axon.
- Sensory neurons carry information from the sense organs to the central nervous system (CNS).
- Motor neurons carry instructions from the CNS to the effector organs (muscles and glands).
- The central nervous system is the brain and spinal cord. Information is assimilated and co-ordinated in the CNS.
- Neurons carry electrical impulses known as the action potential.
- In any pathway the junctions between neurons are called synapses. When an impulse arrives in one neuron chemicals are released in the synapse to trigger an impulse in the next neuron.
- A nerve contains many neurons. There are sensory nerves, motor nerves and mixed nerves.
- The spinal cord carries information from all over the body to and from the brain.
- Mental illnesses describe a wide variety of disorders and diseases that involve thought processes, emotional disturbances and/or behavior that are considered abnormal.
- Cranial nerves come from the brain, while spinal nerves are from the spinal cord.
- Reflex actions avoid danger and run mundane bodily functions – they avoid conscious thought.
- Reflex actions involve:
- Stimulus → Receptor → Co-ordinator → Effector → Response but the co-ordinator is the relay neuron in the spinal cord and there is no conscious thought involved.
- The knee jerk reflex is a common example of a reflex. It is used by doctors to test reflexes and in ordinary life to prevent stumbling.
- Drug abuse is when you use a substance to the point of excess and/or dependence.
- When you take an excess of a drug you risk serious side effects and even death.
- Drug dependence is when you use a drug again and again and become addicted.
- Drugs change the chemical processes in your body so you can become addicted to them (dependent on them). This means you cannot manage or function properly without the drug. This may be psychological – the Need to keep using it becomes a craving or compulsion – or a physical dependence where your body no longer works properly without the drug.
- Alcohol, tobacco, khat and cannabis are the most widely used substances in Ethiopia. Other drugs which can be misused include prescription sedatives, cocaine, LSD, ecstasy and heroin.
- Drug abuse and dependence can hurt the individual user, their family and the entire community.

Hormones Produced by the Major Hormone-Producing (i.e., Endocrine) Glands and Their Primary Functions

Endocrine Gland	Hormone	Primary Hormone Function
Hypothalamus	Corticotropin-releasing hormone (CRH)	Stimulates the pituitary to release adrenocorticotrophic hormone (ACTH)
	Gonadotropin-releasing hormone (GnRH)	Stimulates the pituitary to release luteinizing hormone (LH) and follicle-stimulating hormone (FSH)
	Thyrotropin-releasing hormone (TRH)	Stimulates the pituitary to release thyroid-stimulating hormone (TSH)
	Growth hormone-releasing hormone (GHRH)	Stimulates the release of growth hormone (GH) from the pituitary
	Somatostatin	Inhibits the release of GH from the pituitary
	Dopamine	Inhibits the release of prolactin from the pituitary
Anterior pituitary gland	ACTH	Stimulates the release of hormones from the adrenal cortex
	LH	In women, stimulates the production of sex hormones (i.e., estrogens) in the ovaries as well as during ovulation; in men, stimulates testosterone production in the testes
	FSH	In women, stimulates follicle development; in men, stimulates sperm production
	TSH	Stimulates the release of thyroid hormone
	GH	Promotes the body's growth and development
	Prolactin	Controls milk production (i.e., lactation)
Posterior pituitary gland ¹	Vasopressin	Helps control the body's water and electrolyte levels
	Oxytocin	Promotes uterine contraction during labor and activates milk ejection in nursing women
Adrenal cortex	Cortisol	Helps control carbohydrate, protein, and lipid metabolism; protects against stress
	Aldosterone	Helps control the body's water and electrolyte regulation
Testes	Testosterone	Stimulates development of the male reproductive organs, sperm production, and protein anabolism
Ovaries	Estrogen (produced by the follicle)	Stimulates development of the female reproductive organs
	Progesterone (produced by the corpus luteum)	Prepares uterus for pregnancy and mammary glands for lactation
Thyroid gland	Thyroid hormone (i.e., thyroxine [T ₄] and triiodothyronine [T ₃])	Controls metabolic processes in all cells
	Calcitonin	Helps control calcium metabolism (i.e., lowers calcium levels in the blood)
Parathyroid gland	Parathyroid hormone (PTH)	Helps control calcium metabolism (i.e., increases calcium levels in the blood)
Pancreas	Insulin	Helps control carbohydrate metabolism (i.e., lowers blood sugar levels)
	Glucagon	Helps control carbohydrate metabolism (i.e., increases blood sugar levels)

Chemical co-ordination and control of the body is brought about by hormones secreted by special endocrine glands.

The hormones are secreted directly into the blood and are carried around the body in the blood.

They may affect a single target organ or a range of organs and tissues. They have their effect through special receptor molecules on the cell membranes of the target organs and tissues.

Hormonal control may be rapid but is often relatively slow and long term.

Important endocrine organs include the pituitary gland, the thyroid gland, the Adrenal glands, the pancreas, the ovaries and the testes.

Insulin produced by the pancreas controls the blood sugar levels. If the insulin metabolism goes wrong you have diabetes.

Hormones from the pituitary and the ovary control the menstrual cycle

- There are a number of different birth control methods which can be used to control the size and the spacing of a family. They include natural methods, physical or barrier methods such as condoms, chemical methods such as the contraceptive pill or implants and surgical methods such as sterilization.
- HIV is the virus that causes AIDS. It is spread through blood, semen, vaginal secretions and breast milk. The most common way in which it is transmitted is by unprotected sex. Patients often do not have any symptoms to begin with but deteriorate and eventually show many signs and symptoms of a weakened immune system.
- Treatment options include use of antiretroviral drugs, healthy lifestyle practices and strong support systems.
- Female genital mutilation is a traditional practice which people are now realizing causes much harm. It increases the spread of HIV/AIDS and means many girls and women suffer and die in childbirth unnecessarily.

UNIT FOUR FOOD MAKING IN GREEN PLANTS

- The internal structures of leaves are adapted for photosynthesis to take place.
- Leaves have a number of different tissues including the waxy cuticle, the epidermis, the palisade mesophyll, the spongy mesophyll, the vascular bundles, the stomata and guard cells.
- The different tissues of the plant leaf have different functions, e.g. waxy cuticle prevents water loss, palisade mesophyll allows maximum photosynthesis, and stomata allow the diffusion of gases into and out of the leaf.
- You can use the light microscope to study the internal structures of leaves.
Water is transported from the roots to the rest of the plant in the xylem in a passive process which does not use energy.

Water is taken up by the roots of the plants through osmosis. Water moves through the cells of the root to the xylem by osmosis.

Once in the xylem, adhesive forces between the water and the walls of the xylem support the whole column of water, and as molecules evaporate away from the surface of the leaf, the following molecules are pulled upwards by cohesive forces between the water molecules.

The main pull which moves water up from the roots to the leaves is the almost constant evaporation of water from the leaves. In the leaves water moves out of the xylem into the cells and across the leaf. When it reaches a mesophyll cell which is surrounded by air, water evaporates from the surface into the air and diffuses out through the stomata along a concentration gradient.

The movement of water through the plant is known as transpiration. It is affected by a number of factors including light levels, temperature and wind.

- Conservation is the protection and preservation of our natural environment.
- An important aspect of conservation is to preserve biodiversity.
- Biodiversity can be defined in several ways – the most useful is as the wealth of species in a given place.
- Biodiversity is important because it maintains the balance in an ecosystem, produces genetic variety, makes places look good with a mixture of different species rather than a monoculture and helps reduce the spread of disease.
- Vegetation has many different uses from food and clothing to building materials and medicines.
- Human activity can have many different impacts on natural vegetation. Human activity often reduces natural vegetation by deforestation, burning, farming etc.
- There are many endemic vegetation species in Ethiopia which include teff (*Eragrostis tef*), many *Euphorbia* spps, noug or niger seed (*Guizotia abyssinica*), enset (*Ensete ventricosum*), *Ficus vasta* Forssk, zigba, juniper (tid), kererro and sembo trees.
- There are a number of different methods of conservation of vegetation which include protecting natural habitats and replanting endemic species.
- Ethiopian vegetation has been affected by human activities through history for a very long time. Some of this activity has been positive, but often we have damaged and destroyed our woodlands and forests.
- ✓ The wildlife in Ethiopia has many uses from food to encouraging tourism, and from maintaining genetic diversity to providing the original species for our domestic animals.
- ✓ Human beings have had a major impact on wildlife and their status in Ethiopia. For many years people

have threatened the wild life, hunting animals and often destroying their habitat, e.g. in deforestation. However, increasingly people are protecting and conserving wildlife.

✓ There are many endemic wildlife species of Ethiopia including *Gelada Baboon*, the *Walia ibex*, *Menelik's Bushbuck*, the *Mountain Nyala*, *Swayne's Hartebeest*, the *Ethiopian wolf*, the *heavy-headed, thick-billed raven*, the *wattled ibis*, the *black-winged lovebird*, the *white-collared pigeon* and the *Prince Ruspoli's Turaco*.

✓ There are a number of methods of conservation of wildlife including restoring lost habitat, e.g. replanting forests. Setting up National Parks or reserves where the habitat is protected and the animals are also protected from hunting and poaching is an effective way of conserving threatened species and wildlife biodiversity.

Ethiopia has many National Parks which are important in the conservation of our endemic wildlife species and others. They include Abijatta-Shalla Lakes National Park, Awash National Park, Bale Mountain National Park, Gambala National Park, Rift Valley Lakes National Park, Mago National Park, Omo National Park, Nechisar National Park, Simien Mountains National Park and Yangudi Rassa National Park.

- Air pollution is caused in a number of ways including by smoke, by carbon dioxide and carbon monoxide from the burning of fossil fuels, by sulphur dioxide and nitrogen oxides causing acid rain and by benzene, lead and soot in homes and offices from paraffin lamps.
- Air pollution has a number of effects on both the environment and on individuals. These include global dimming, global warming, acid rain as well as problems such as asthma, lung infections and cancer for individuals.
- Global warming is an increase in the temperature at the surface of the earth as a result of an increased greenhouse effect.
- Global warming is caused by an increase in the levels of greenhouse gases such as carbon dioxide and methane in the atmosphere. As a result more heat is trapped by the atmosphere and the temperature at the surface of the earth increases.
- Methods of preventing global warming include reducing the use of fossil fuels and managing the farming of cattle and rice. Stopping deforestation and replanting trees can also help by using up some of the carbon dioxide.
- Ozone depletion caused by the use of CFCs has caused an increase in harmful ultraviolet light reaching the surface of the earth. As the use of CFCs has been controlled, the ozone hole in the atmosphere is getting smaller as the damage is repaired.

