



## What is life

We will speak about the seven characteristics of life, the organizational characteristics of all beings, we will discuss the cellular theory and its importance in biology and medicine, we will understand the concept of metabolism, environmental adaptation, hemostasis, growth and development, reproduction and evolution. We will discuss the difference between multicellular and unicellular creatures, homeostasis as a function of stability and equilibrium and receptors in our body.

## The chemical properties of life

We will understand the general concept of the matter, element, trace element and compound, we will list the most common elements in living things and compare and contrast elements and compounds. We will learn about the chemical properties of the matter, given by its atomic structure, and understand the concept of an atom and its sub-particles – protons, electrons, and neutrons. We will learn about atomic number, isotopes and radioactive isotopes. We will learn about different chemical bonds (ionic, covalent), about the formation of a molecule, chemical reaction and its sides – the reactant and product. We will learn about water and its unique properties, about acids, bases and the concept of pH and buffers. We will learn how carbon is the main ingredient of organic molecules, and discuss the differences between organic, and inorganic molecules, hydrocarbon, functional chemical groups, monomers and polymers. We will speak about carbohydrates and their properties, and clarify the terms monosaccharides, disaccharides and polysaccharides. We will learn about lipids, fats and steroids. We will learn about proteins and their building blocks – the amino acids. We will clarify the concept of denaturation. We will discuss some special proteins and their function in biology and medicine – enzymes and immunoglobulins.

## The cell is the most basic unit of life

We will learn about the cell theory, describe how microscopes aid the study of cells, compare and contrast animal cells and plant cells, and learn the differences between prokaryotes and eukaryotes. We will learn about the cell membrane and other biological membranes, describe their structure and function. We will learn about molecules transport into and from the cell, and the way cells eat. We will clarify the terms diffusion and osmosis, equilibrium, selective permeability, passive and active transport, facilitated diffusion, types of environments – isotonic, hypotonic and hypertonic and the concept of vesicular transport. We will learn about cell organelles – nucleus and nuclear envelope, ribosomes, endoplasmic reticulum, Golgi apparatus, vacuoles and lysosomes. We will learn general notions about energy of the cell, chloroplasts, mitochondria and the concept of ATP. We will learn about the cytoskeleton and cell movement – microtubules, microfilaments, flagella and cilia.



## **The energy that drives cells**

We will learn about the ways living creatures obtain food, clarify the terms autotroph, photosynthesis, heterotroph and cellular respiration. We will talk about what is energy, and types of energy – kinetic, potential, thermal, chemical and the concept of calorie. We will learn about ATP and its cycle, breathing and cellular respiration, aerobic and anaerobic respiration, glycolysis and ATP synthesis. We will learn about fermentation and anaerobic respiration as alternative energy pathways.

## **Molecular genetics**

We will learn about the cell cycle and how cells are multiplied, clarify the terms chromatin, chromosomes, sister chromatids, centromere, cell cycle and its phases – interphase, mitotic phase and its sub-phases – prophase, metaphase, anaphase, telophase and cytokinesis. We will learn about DNA, RNA, transcription, translation, codons and genes, the pathway from gene to protein and DNA replication.

## **The genetics of an organism**

We will learn about Mendel and his theory, about mutations and mutagens, and some very interesting diseases correlated to those processes. We will learn about dominance, recessivity and co-dominance. We will learn about medical genetics and forensic genetics.

## **Microbiology is the science of unseen creatures**

We will learn about bacteria and their morphology, special features of bacteria – flagella, cilia, parasitism and gram staining classification. We will learn about molds and yeast, viruses and bacteriophages and how infection is produced. We will learn about biochemistry in microbiology and modes of nutrition, we will learn about the Protista kingdom, the Algae and antibiotics.

## **Anatomy is the architecture of the body**

We will learn about the language of anatomy – anatomical positions, sections, we will learn about the upper limbs, lower limbs, skull, clavicle, scapula, sternum, ribs, vertebral column, humerus, radius and ulna, phalanges, pelvis, femur, tibia and fibula.

## **Histology, the anatomy of tissues**

We will learn about the 4 types of tissues – epithelia, connective tissue, muscle tissue and nervous tissue.



## **The blood system**

We will learn about blood vessels and their structure, about blood pressure and control of blood, capillary bed and gas exchange and the lymphatic system. We will learn about the function of blood and its properties, plasma and plasma proteins, erythrocytes, leukocytes and platelets. We will learn about hemostasis and coagulation.

## **The cardiovascular system**

We will learn about the anatomy, physiology and electrophysiology of the heart, the vessels of the heart, ECG, the heart cycle and some diseases related – angina pectoris, myocardial infarction, cardiomyopathy, and arrhythmias.

## **The respiratory system**

We will learn about the anatomy and physiology of the respiratory system, the external respiration and functional respiration, upper and lower airways, the process of breathing and pulmonary function and alveolar gas exchange.

## **The gastrointestinal system**

We will learn about the anatomy and physiology of the gastrointestinal system and the accessory organs, ingestion, digestion, absorption and elimination and the concept of peristalsis.

## **The endocrine system**

We will learn about endocrine glands, adrenal gland, hypothalamus, pituitary gland, the thyroid gland, the pancreas and the gonads. We will learn about different types of hormones, their function and diseases related to their hypersecretion or absence.

## **The reproductive system**

We will learn about the importance of the reproductive system, the male and female reproductive systems, the menstrual cycle and pregnancy.



## **The urinary system**

We will learn about the kidneys, ureter, urethra, bladder, renal cortex, medulla and pyramids, the nephron and its cellular structure, we will discuss the concepts of filtration, reabsorption and secretion, we will speak about the anti-diuretic hormone, atrial natriuretic peptide and renin-angiotensin - aldosterone system.

## **The nervous system**

We will learn about the sensory function, integrative function and motor function of the nervous system, the central nervous system, the brain and its structure, the cerebrospinal fluid, the spinal cord, the peripheral nervous system and cranial nerves, the sympathetic and parasympathetic nervous systems, the neuron and its function, neurotransmitters, resting and action potentials and drugs related. We will learn the physiology and mechanism of sleep.

## **Skeletal muscle physiology**

We will learn about the function of skeletal muscles, the proteins of the muscle and the way contraction and relaxation are produced.

## **The immune system protects us against evil**

We will learn about the innate immune system and the adaptive immune system, and their cellular compounds and humeral compounds. We will learn about the first and second lines of defense, the inflammatory response and the cells mediating it, proteins of the immune system and the antibody and antigen.

## **The theory of evolution**

### **Ecology**

We will learn about ecosystems, communities, and populations in ecosystem.