DREYFOUS

Subject Guide

BIOLOGY

DREYFOUS

TABLE OF CONTENTS

Course Description

The Dreyfous Secondary Level Science series offers courses in which students are able to appreciate science as part of their daily lives and not simply as a school subject that is unrelated to them or their environment. The usefulness and application of scientific concepts become evident throughout these lessons. The series features an interdisciplinary approach based on projects and research that demonstrates how the subjects are integrated and work together in real life. This series seeks to develop evaluative, research, and problem-solving skills by adopting the 4Cs of 21st-century education: Creativity, Collaboration, Critical Thinking, and Communication.

Each course in the series provides for the development of a group project, which will be worked on as the lessons advance and will connect the topics studied to the real world. Special sections will also be introduced to help students appreciate the integration and usefulness of science in the real world. Each lesson includes supplementary documents that will be helpful to both the teacher and the students to work on the unit lessons. These documents consist of a descriptive log, vocabulary, worksheets containing concept and application exercises along with their answer keys, laboratories, and study guide. Finally, suggested links to online resources are included in order to expand the content and provide fun facts related to the topics being studied.

Course Framework

The Biology course comprises ten units carefully structured into different lessons. The number of lessons per unit varies depending on the scope and depth with which the different topics are discussed and developed. Each lesson contains an interactive presentation that outlines and explains the content of the topic to be studied. Each presentation includes concept definitions, specific examples, explanations, and multiple examples and applications of concepts, as well as daily life skills.

Each unit begins with a section titled *Research and Solve*, which acts as the unit's opening. This section can be found in the first lesson of each unit. It introduces everyday situations or issues related to the main topic of the unit under study. In addition to introducing the topic at hand, this section is intended to guide students through the process of creating their group project. For this project, students will compile everyday problems with their solutions, using their

creativity to present them at the end of the course. The teacher may use different teaching strategies to guide students in the development of this project.

This is followed by an introductory activity titled *Let's Explore!* It consists of a short activity aimed primarily at exploring the students' prior knowledge of the lesson's topic. This may consist of a written exercise or a short activity. This activity is followed by the lesson content, presented in the form of text, diagrams, examples, animations, interactive activities, and videos, among others. Following the content is the *BioLab*, which supplements the conceptualization process.

Finally, the lesson closes with one of the following special sections:

Why Does This Happen? – Articles or videos that show the scientific explanation for everyday biological phenomena.

Techno-Biology – Shows a video or text article about commonly used technological applications of the topic studied in the lesson.

Science Connections – Shows videos or texts that demonstrate how the topic studied in the lesson is integrated with other sciences.

Lessons also include two worksheets: *I Understand!* and *Applying What I Know*. These worksheets reinforce the concepts studied in each lesson. The activities are varied and flexible, with the purpose of addressing the particular needs and interests of each student. Practice activities are designed to make students aware of the strengths and weaknesses in their knowledge of the content, so they can gradually take control of their own learning process. The teacher, as an integral and essential part of this process, will be responsible for stimulating, mentoring, guiding, and periodically evaluating each student's learning progress. Lessons also include a *study guide*, which presents the main ideas and the vocabulary studied, along with its definitions.

Lessons

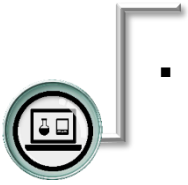
Each unit is made up of different lessons, divided into topics, macro concepts, and skills. In turn, each lesson consists of five key elements: course presentation or content, digital format (PDF) documents, internet links, special sections, and a descriptive log.

- **Descriptive Log.** This is the detailed lesson plan. It includes the lesson's specific objectives, standards, and expectations, teaching strategies and resources, keywords, internet links, and references, among others. The teacher will have sole access to the lesson descriptive logs.
- **Presentation (*Lesson Content*).** Each presentation contains detailed explanations of the lesson's concepts and skills, as established by the objectives. In addition, it contains the following elements, which systematically contribute to the development of the intended learning outcomes for students:

- **Activity.** It includes a series of carefully selected activities to allow the student to practice the skills and concepts discussed. The Activity is designed to periodically assess the learning progress of students before moving on to other topics and skills.

- **Demonstration / Steps.** It features formal demonstrations of the processes to be followed in an activity or in solving a problem.

- **Animation.** It gives access to explanations, procedures, or graphics that provide a visual portrayal of the concepts and skills discussed in the section. It helps address the students' conceptual understanding and development.



- **Tabs.** These can be found on the right or left side of the presentation. Tabs can be expanded to show flowcharts, biographies, notes, photos, explanations, suggestions, reminders, or necessary background knowledge.

- **Photograph or image.** A particular explanation is connected to a photo or image, which will be likely accessed by internet.

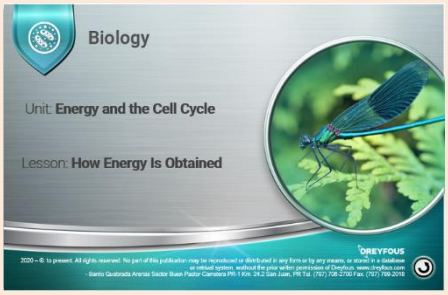
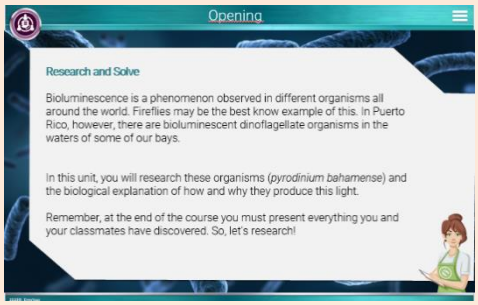
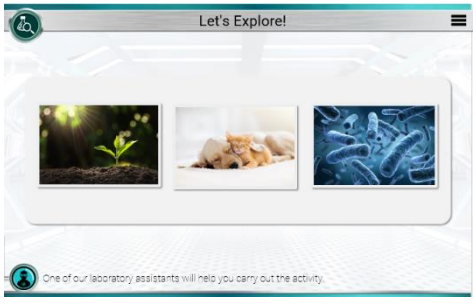
- **Video.** Access to a short video related to the topic.

- **Internet.** A direct link to a site or internet portal closely related to the topic.

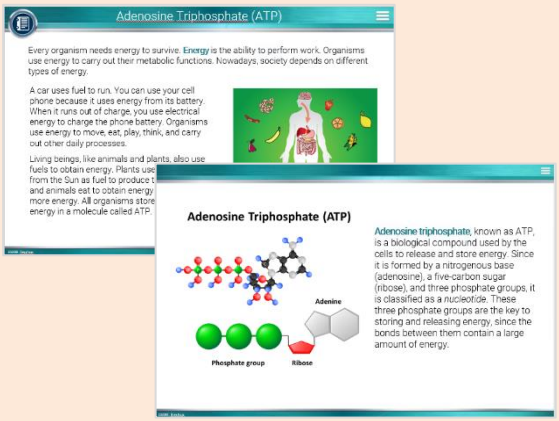
Each of the sections included in the presentation is connected to a particular identifying icon, as shown in the explanation provided. Clicking on the icon will take the presentation immediately to the specific section it represents.

- **PDF documents.** These documents include a copy of the practice exercises, laboratories, and lesson activities. The documents may be printed out for students to work on.
- **Internet links.** These links provide a direct connection to the internet and may be accessed directly from the presentation. They include additional explanations, examples, applications, or demonstrations that facilitate the students' conceptual development in the skills and topics discussed.

Course Framework: Curricular Components

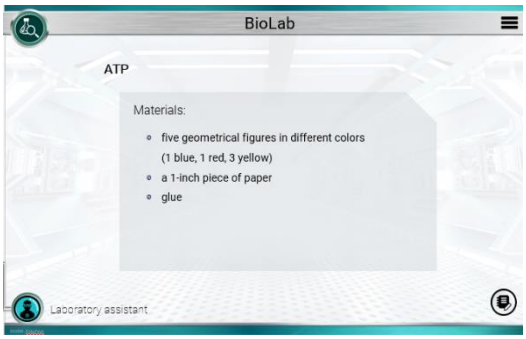
Lesson Content	
Cover  	This is the introduction for the course and the lesson. It identifies the course, unit, and lesson. It contains: ○ Course title ○ Unit and lesson title ○ Image ○ Credits
Directory  	It displays the lesson sections. Each button has a hyperlink to the section it represents. From the second lesson onwards, there is no *Opening* section.
Unit Opening  	This section may only be found in the first lesson of each unit.
Let's Explore!  	This section is included in every lesson.

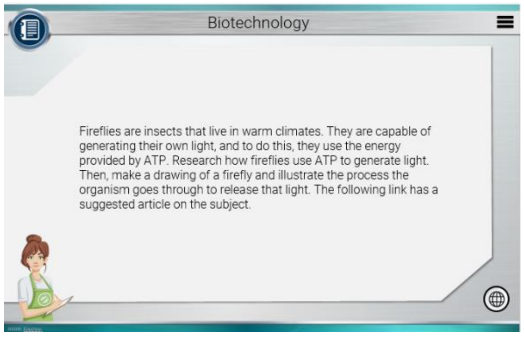
Topics (content)



Development of the content, along with definitions, explanations, examples, and demonstrations.

Special sections

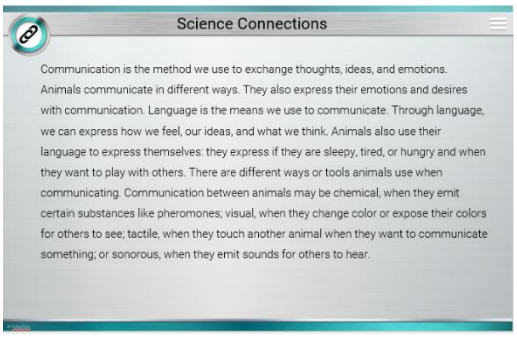


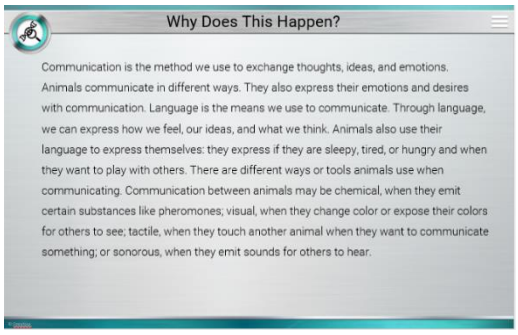


These sections expand on the students' learning experiences.

BioLab. This laboratory activity is included to supplement the conceptualization process.

Techno-Biology. Application of common technologies related to the lesson’s topic.

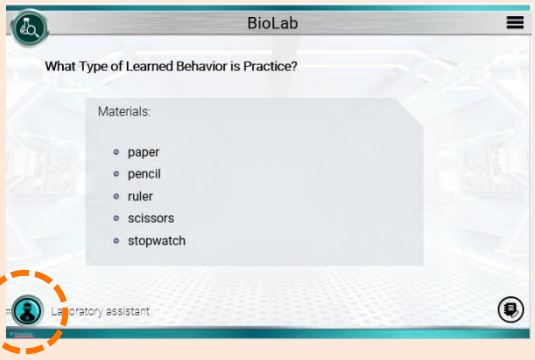


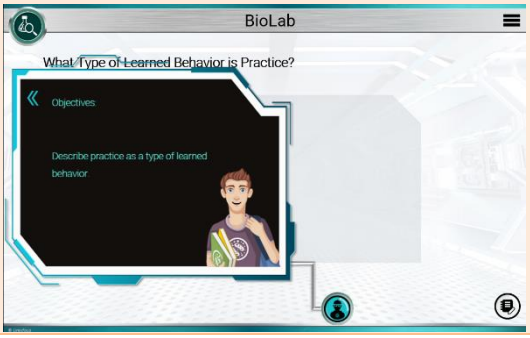


Science Connections. It includes videos or text articles that show how the topic studied in the lesson is integrated with other sciences.

Why Does This Happen? This section includes articles or videos that show the scientific explanation for everyday biological phenomena.

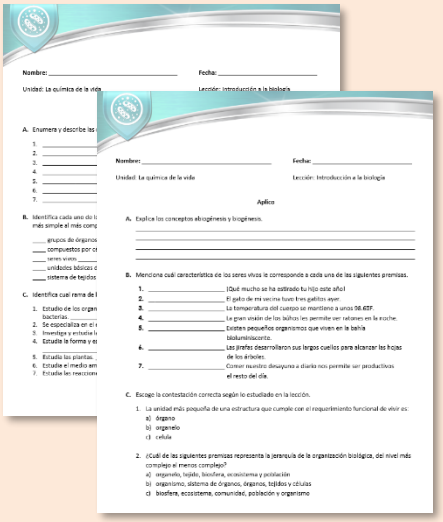
Laboratory Assistant



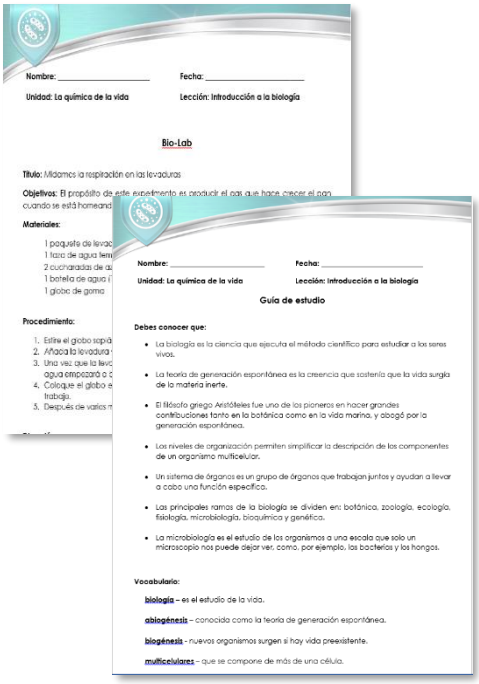


When students click on the Laboratory Assistant tab located in the lower right or left corner of some of the *Lesson Content* templates, they will be able to see important notes to complete the laboratory activities.

Button Directory			
Navigation			
	Close		Credits
	Slide left		Back
General			
	Information		Video
	Laboratory Assistant		Review
	Reason		Image
	Group Project		Steps
	Question		Web
	Concept Map		Calculator
	Map		Music
	Objectives		Observe

	Hide image		Reading
	Zoom in on image		
Special sections			
	BioLab		Why Does This Happen?
	Techno-Biology		Science Connections
Worksheets			
Objective activities 		These activities are featured in every lesson, including the answer key for the teacher. ○ I Understand! ○ Applying What I Know	

Other documents



Nombre: _____ Fecha: _____

Unidad: La química de la vida Lección: Introducción a la biología

Bio-Lab

Título: Midamos la respiración en las levaduras

Objetivos: El propósito de este experimento es producir el gas que hace crecer el pan cuando se está horneand

Materiales:

1 paquete de levad
1 taza de agua tem
2 cucharadas de az
1 botella de agua (
1 globo de goma

Procedimiento:

1. Estire el globo sopl
2. Añada la levadura
3. Una vez que la levad agua empezará a c
4. Coloque el globo e trabaja.
5. Después de varios m

Nombre: _____ Fecha: _____

Unidad: La química de la vida Lección: Introducción a la biología

Guía de estudio

Debes conocer que:

- La biología es la ciencia que ejecuta el método científico para estudiar a los seres vivos.
- La teoría de generación espontánea es la creencia que sostenía que la vida surgía de la materia inerte.
- El filósofo griego Aristóteles fue uno de los pioneros en hacer grandes contribuciones tanto en la botánica como en la vida marina, y abogó por la generación espontánea.
- Los niveles de organización permiten simplificar la descripción de los componentes de un organismo multicelular.
- Un sistema de órganos es un grupo de órganos que trabajan juntos y ayudan a llevar a cabo una función específica.
- Las principales ramas de la biología se dividen en: botánica, zoología, ecología, fisiología, microbiología, bioquímica y genética.
- La microbiología es el estudio de los organismos a una escala que solo un microscopio nos puede dejar ver, como, por ejemplo, las bacterias y los hongos.

Vocabulario:

biología – es el estudio de la vida.

abiogénesis – conocida como la teoría de generación espontánea.

biogénesis - nuevos organismos surgen si hay vida preexistente.

multicelulares – que se compone de más de una célula.

These are included in every lesson.

- BioLab
- Study Guide

Unit Breakdown

Below we have included a breakdown of each unit into lessons, outlining the titles of each unit, as well as the titles, codes, objectives, topics, and concepts of each lesson.

Unit 0. Introduction

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 0. Guide for the Development of Scientific Research

Code: C430G0SU00L00

Appendix

- Guide for the Development of Scientific Research

Concepts

- Science fair
- Scientific research

Lesson 1. Scientific Knowledge

Code: C430G0S00L01

Objectives

By the end of this lesson, students will:

- identify information as either a scientific or a non-scientific fact;
- distinguish between science and pseudoscience.

Topics

- Common knowledge or scientific knowledge
- Science vs. pseudoscience

Concepts

- common knowledge
- empirical knowledge
- observation
- pseudoscience
- reliability
- science
- scientific knowledge
- scientific method

Lesson 2. The Scientific Method

Code: C430G0S00L02

Objectives

By the end of this lesson, students will:

- describe the history and origin of the scientific method;
- explain the role of Galileo in the development of modern science;
- describe the characteristics of the scientific method;
- explain the steps of the scientific method;
- conduct a simple investigation following the scientific method.

Topics

- Introduction
- History and Origins
- Definition and Characteristics

Concepts

- experimental method
- logical method
- scientific method

Lesson 3. Scientific Research

Code: C430G0SU00L03

Objectives

By the end of this lesson, students will:

- identify the most recent technological advances in the field of science;
- describe how recent technological advances have benefited scientific research;
- identify and describe examples of scientific fraud;
- distinguish reliable sources of information from unreliable ones;
- identify the different classifications into which scientific research can be grouped;
- identify the main characteristics of scientific research.

Topics

- Introduction
- Research and science
- Types of research
- Technology and mathematics
- Validity and reliability
- Scientific fraud

Concepts

- objectivity
- reliability
- research
- scientific fraud
- scientific knowledge
- validity

Lesson 4. Developing Scientific Research

Code: C430G0SU00L04

Objectives

By the end of this lesson, students will:

- identify the dependent, independent, and control variables in different research scenarios;
- identify the different steps in a scientific research;
- develop the first step of a possible scientific research.

Topics

- Stage 1: The beginning
- Stage 2: Research
- Stage 3: Finding meaning
- Stage 4: Publication

Concepts

- APA format
- challenging the hypothesis
- conclusions
- control variable
- data analysis
- dependent variable
- experiment design
- independent variable
- rationale
- theoretical framework
- variables

Lesson 5. Practice Sheets

Code: C430G0SU00L05

Objectives

By the end of this lesson, students will:

- correctly draft a research question and hypothesis for a scientific research project;
- use questions to analyze the data represented through tables or graphs;
- reach and draft conclusions based on data analysis;
- create and draft an original experimental design for a potential formal research project.

Topics

- Research draft
- Question and hypothesis
- Hypothesis: If..., then...
- Data analysis
- Experiment

Lesson 6. Mathematics: The Language of Science

Code: C430G0SU00L06

Objectives

By the end of this lesson, students will:

- explain the importance of the International System of Units;
- mention and describe the units of the International System of Units;
- convert measurements to scientific notation;
- distinguish between accuracy and precision in measurements;
- use significant figures in measurements and calculations;
- determine the correct units to use for certain measurements.

Topics

- The International System of Units
- Prefixes of the International System of Units
- Scientific Notation
- Measurements in the experiment

Concepts

- accuracy
- ampere
- candela
- international measurement system
- kelvin
- kilogram
- meter
- mole
- precision
- prefix
- scientific notation
- significant figures

Lesson 7. Getting to Know the Science Laboratory

Code: C430G0SU00L07

Objectives

By the end of this lesson, students will:

- identify safety symbols in the laboratory and determine what they mean;
- identify the most common laboratory equipment and its uses;
- prevent accidents in the laboratory.

Topics

- Safety in the Laboratory
- Laboratory equipment and its uses

Concepts

- carcinogenic
- contamination
- corrosive
- irritating
- meniscus
- MSDS
- pollution
- radiation
- safety
- toxic

Unit 1. The Chemistry of Life

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Introduction to Biology

Code: C430G0SU01L01

Objectives

By the end of this lesson, students will:

- describe what biology is;
- identify the benefits of the study of biology;
- describe the levels of organization of matter;
- explain the characteristics of living things and distinguish between living and nonliving things.

Topics

- Characteristics of living beings
- The organization of life
- Biology and its branches

Concepts

- anatomy
- asexual reproduction
- biology
- biotechnology
- botany
- cell
- cell biology
- developmental biology
- DNA (deoxyribonucleic acid)
- ecology
- evolutionary biology
- genetics
- homeostasis
- levels of organization
- marine biology
- metabolism
- microbiology
- molecular biology
- organism
- organ
- organ system
- physiology
- sexual reproduction
- stimulus
- tissue
- zoology biology
- living beings

Lesson 2. Principles of Chemistry

Code: C430G0SU01L02

Objectives

By the end of this lesson, students will:

- create a model of an atom and identify the particles that make it up;
- describe the structure of an atom;
- define atomic number;

- compare and contrast ionic and covalent bonds;
- relate energetic changes with cellular chemical reactions;
- explain what metabolism is;
- establish the difference between an anabolic and a catabolic reaction;
- explain the effect of a catalyst on the reaction rate;
- explain the formation of an enzyme-substrate complex;
- discuss the importance of enzymes for the functioning of organisms.

Topics

- Atoms, elements, and compounds
- Chemical reactions

Concepts

- activation energy
- anabolic reaction
- atomic number
- atom
- bond
- catabolic reaction
- catalyst
- chemical element
- chemical reaction
- chemistry
- enzyme
- ionic bond
- metabolism
- molecule

Lesson 3. Water and Solutions

Code: C430G0SU01L03

Objectives

By the end of this lesson, students will:

- describe the similarities and differences between mixtures and solutions;
- classify different substances as either mixtures or solutions;
- distinguish between solute and solvent;
- explain the difference between acids and bases;
- evaluate how the structure of water makes it a good solvent;
- describe the importance of water in the functioning of living things;
- describe the characteristics of water;
- explain the concept of pH;
- explain what a buffer solution is;
- explain the cellular mechanisms for synthesizing and degrading molecules.

Topics

- Solutions and suspensions
- Acids and bases

Concepts

- acid
- base
- buffer solution
- cohesion
- heterogeneous mixture
- homogeneous mixture
- mixture
- pH scale
- solute
- solution
- solvent
- suspensions

Lesson 4. Organic Molecules

Code: C430G0SU01L04

Objectives

By the end of this lesson, students will:

- describe the role of carbon in living things;
- compare the functions of each group of macromolecules and explain the importance each of these substances for living things;
- explain how the spatial distribution of atoms in macromolecules determines some of their functions in living organisms;
- explain how carbon, hydrogen, and oxygen in sugar molecules can combine with other elements to form amino acids and other carbon molecules;
- describe the structure of nucleic acids.

Topics

- Carbon
- Macromolecules

Concepts

- amino acid
- carbohydrate
- carbon
- deoxyribonucleic acid (DNA)
- lipid
- macromolecule
- monomer
- monosaccharide
- nucleic acid
- nucleotide
- organic chemistry
- polymer
- protein
- ribonucleic acid (RNA)

Unit 2. The Base of Life

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Cell Theory

Code: C430G0SU02L01

Objectives

By the end of this lesson, students will:

- identify the technological advances that allowed for the discovery and study of the cell, as well as those that allow for new cell discoveries;
- explain the principles of the cell theory;
- distinguish between prokaryotic and eukaryotic cells;
- build models to compare and contrast organelles and their functions in both eukaryotic and prokaryotic cells.

Topics

- Discovery of the cell
- Types of cells

Concepts

- animal cell
- cell theory
- cell
- eukaryotic cell
- microscope
- multicellular organism
- nucleus
- plant cell
- prokaryotic cell
- unicellular organism

Lesson 2. Organelles

Code: C430G0SU02L02

Objectives

By the end of this lesson, students will:

- relate the structure and function of cell organelles;
- identify and discover the differences and similarities between animal and plant cells;
- build models to compare and contrast the organelles in eukaryotic and prokaryotic cells and their functions.

Topics

- Cellular Organization
- The organelle and its functions

Concepts

- animal cell
- cell membrane
- cell wall
- chloroplast
- cytoplasm
- cytoskeleton
- endoplasmic reticulum
- Golgi apparatus
- lysosome
- mitochondria
- nucleus
- organelle
- plant cell
- ribosome
- vacuole

Lesson 3. The Cell Membrane

Code: C430G0SU02L03

Objectives

By the end of this lesson, students will:

- create a visual representation to describe the way the cell membrane works and explain the how the processes of diffusion, osmosis, active transport, and passive transport occur, as well as their importance for the cell;
- describe the function of cellular transport;
- describe the structure of the cell membrane;
- predict the effects of hypotonic, hypertonic, and isotonic solutions on cells;
- identify everyday examples of these effects;
- explain what a concentration gradient is.

Topics

- Membrane Structure and Function
- Cellular Transport

Concepts

- active transport
- cell membrane
- cellular transport
- concentration gradient
- diffusion
- endocytosis
- exocytosis
- facilitated diffusion
- hypertonic solution
- hypotonic solution
- isotonic solution
- passive transport
- phospholipid
- osmosis

Unit 3. Energy and the Cell Cycle

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. How Energy is obtained

Code: C430G0SU03L01

Objectives

By the end of this lesson, students will:

- describe the function of ATP in cells and its importance for organisms;
- create a model to explain and describe how energy is stored and released from the ATP molecule.

Topics

- Adenosine triphosphate (ATP)

Concepts

- adenosine diphosphate
- adenosine triphosphate
- Calvin cycle
- energy
- fermentation
- glycolysis
- Krebs cycle
- NADP+

Lesson 2. Transforming Energy

Code: C430G0SU03L02

Objectives

By the end of this lesson, students will:

- describe the process of photosynthesis;
- describe the process of cellular respiration;
- distinguish between autotrophs and heterotrophs;
- illustrate and explain how photosynthesis and respiration transform energy in cells;
- describe photosynthetic structures and pigments;
- describe the electron transporters NADP and NADPH;
- explain the Calvin cycle;
- explain the Krebs cycle;
- distinguish between an aerobic reaction and an anaerobic reaction;
- explain glycolysis;
- describe the processes of alcoholic fermentation and lactic fermentation;
- explain dependent and independent light reactions;

- illustrate, using concept maps or flowcharts, the relationships between the processes that occur in a cell's mitochondria during cellular respiration;
- design a model to explain that cellular respiration is a chemical process through which the bonds in food and oxygen molecules break down and form new bonds, resulting in a net energy transfer;
- use models to illustrate how photosynthesis and respiration transform luminous energy into stored chemical energy.

Topics

- Photosynthesis
- Cellular respiration
- Fermentation

Concepts

- aerobic
- alcoholic fermentation
- anaerobic
- autotroph
- Calvin cycle
- cellular respiration
- chlorophyll
- chloroplast
- energy transport chain
- fermentation
- glycolysis
- heterotrophs
- Krebs cycle
- lactic acid fermentation
- light-dependent reactions
- light-independent reactions
- photosynthesis
- photosystems
- pigments
- stoma
- thylakoids

Lesson 3. Mitosis (Cell Cycle)

Code: C430G0SU03L03

Objectives

By the end of this lesson, students will:

- explain the reasons for cell size;
- describe asexual reproduction;
- describe sexual reproduction;
- identify the primary stages of the cell cycle, including cytokinesis;
- describe the function of the structures: centrioles, chromosomes, and centromeres;
- depict and describe the phases of mitosis.

Topics

- Cellular Growth
- Interphase
- Cytokinesis

Concepts

- anaphase
- asexual reproduction
- cell cycle
- centrioles
- centromere
- chromatid
- chromatin
- chromosomes
- cytokinesis
- DNA replication
- G1
- G2
- Interphase
- metaphase
- mitosis
- prophase
- sexual reproduction
- telophase

Lesson 4. Regulation of the Cell Cycle

Code: C430G0SU03L04

Objectives

By the end of this lesson, students will:

- describe the function of cyclin;
- explain the function of internal and external regulators;
- explain the function of growth factors;
- describe the process of apoptosis;
- define the concept of cancer;
- analyze the effect of a mutation in the P53 protein (gene);
- explain the process of protein synthesis, especially in the production of enzymes that regulate all of the processes that cells carry out;
- explain why cancer is so common;
- analyze and describe how a cancer diagnosis can change a person's life, considering financial, social, family, and emotional factors, among others; as well as possible ways to cope with these changes;
- analyze the research conducted to find a cure for cancer in terms of cost, benefits, safety, reliability, and aesthetic considerations, as well as possible social, cultural, and environmental impacts.

Topics

- Enzymes that Control Cell Division
- Cancer

Concepts

- apoptosis
- cancer
- carcinogen
- cyclins
- external regulators
- growth factor
- internal regulators
- metastasis
- necrosis
- stem cells
- tumor

Unit 4. Genetics

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Meiosis

Code: C430G0SU04L01

Objectives

By the end of this lesson, students will:

- describe the relationship between chromosomes, genes, and locus;
- compare and contrast the processes of mitosis and meiosis;
- describe the process of meiosis; prophase I and II, metaphase I and II, anaphase I and II, and telophase I and II;
- distinguish between haploid and diploid cells;
- explain female and male gametogenesis;
- explain the importance of meiosis for the survival and variation of species.

Topics

- Genes and chromosomes
- Stages of meiosis

Concepts

- cellular differentiation
- chromosomes
- crossover
- diploid
- genes
- haploid
- homologous chromosomes
- locus
- meiosis
- r differentiation
- tetrad
- zygote

Lesson 2. Mendelian Genetics

Code: C430G0SU04L02

Objectives

By the end of this lesson, students will:

- analyze and explain the significance of Gregor Mendel's work for science and humanity;
- describe the relationship between chromosomes, genes, and the laws of inheritance;
- predict the potential offspring of a first and second filial generation cross by using Punnett squares;
- relate Mendel's laws of inheritance to the process of meiosis.

Topics

- The father of genetics
- Mendel's crosses
- Probability of Crosses

Concepts

- alleles
- dihybrid cross
- dominant allele
- fertilization
- gametes
- genes
- genetics
- genotype
- heredity
- heterozygous
- homozygous
- hybrid
- law of dominance
- law of independent assortment
- law of segregation
- monohybrid cross
- phenotype
- Punnett square
- recessive allele
- trait

Lesson 3. Non-Mendelian Genetics

Code: C430G0SU04L03

Objectives

By the end of this lesson, students will:

- describe complete dominance, incomplete dominance, and codominance;
- identify and describe some variations of the Mendelian laws of heredity;
- explain what multiple alleles are;
- relate the variations of Mendelian laws of heredity to daily life;
- describe how the environment influences the phenotypes of organisms;
- describe the concept of genome;
- describe dominant and recessive alleles;
- describe what a karyotype is;
- distinguish between a sex and a somatic chromosome;
- describe the hereditary patterns those human traits follow;
- analyze the heredity of determined human traits using a family tree;
- explain and give examples of genes linked to biological sex;
- explain what a Barr body is.

Topics

- Incomplete dominance and codominance
- Environmental Influence

Concepts

- codominance
- ecdysteroids
- incomplete dominance
- multiple alleles
- non-Mendelian inheritance
- polygenic traits
- polyphenism

Lesson 4. Human Genetics

Code: C430G0SU04L04

Objectives

By the end of this lesson, students will:

- describe the hereditary patterns that human traits follow;
- analyze the heredity of certain human traits using a family tree;
- explain what a karyotype is;
- distinguish between autosomes and sex chromosomes;
- explain and give examples of sex-linked genes;
- explain what a Barr body is.

Topics

- Human Chromosomes
- Transmission of Human Inheritance

Concepts

- autosomes
- cytogenetics
- family tree
- genome
- karyotype
- sex chromosomes
- sex-linked gene

Unit 5. Molecular Genetics

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. DNA Replication

Code: C430G0SU05L01

Objectives

By the end of this lesson, students will:

- describe the structure and function of DNA;
- explain the mechanisms for DNA replication;
- describe the nitrogen bases;
- explain the experiments that led to the discovery of the structure of DNA;
- describe the function of the DNA polymerase enzyme;
- define the concept of telomere;
- create a DNA model that illustrates the replication process.

Topics

- DNA, Inheritance Molecule
- Structure and Function of DNA
- DNA Replication

Concepts

- base pairing
- DNA
- DNA polymerase
- DNA replication
- double helix model
- nitrogen bases
- RNA
- semi-conservative replication
- telomeres

Lesson 2. Translation and Transcription

Code: C430G0SU05L02

Objectives

By the end of this lesson, students will:

- describe the structure and function of RNA;
- describe the types of RNA;
- describe the process of transcription;
- explain the role of RNA polymerase in transcription;
- explain what a promoter is;
- explain what exons and introns are;
- explain the formation and function of a codon;
- explain the formation and function of an anticodon;
- create a RNA model that illustrates its replication;
- create a DNA model that illustrates its replication.

Topics

- The Structure and Function of RNA
- Transcription
- Translation and the Genetic Code

Concepts

- anticodon
- codon
- exons
- gene expression
- genetic code
- introns
- mRNA
- RNA
- RNA polymerase
- rRNA
- transcription
- translation
- tRNA

Lesson 3. Mutations

Code: C430G0SU05L03

Objectives

By the end of this lesson, students will:

- describe the different types of mutations: genetic or point, substitution;
- contrast the different types of mutations that occur at a cellular level;
- compare the effects of the different types of mutations on cells and organisms;
- describe DNA repair mechanisms;
- describe some genetic disorders in humans, the methods to detect them and treat them, as well as their risks and benefits.

Topics

- Types of Mutations
- Genetic Disorders

Concepts

- chromosomal mutation
- cystic fibrosis
- deletion mutation
- duplication
- frameshift mutation
- genetic mutation
- gene regulation
- Huntington's disease
- insertion mutation
- inversion
- mutagens
- mutations
- nondisjunction
- point mutation
- polyploidy
- sickle cell anemia
- substitution mutation
- translocation

Lesson 4. Biotechnology

Code: C430G0SU05L04

Objectives

By the end of this lesson, students will:

- explain what biotechnology is;
- describe the areas of biotechnology;
- describe the benefits of selective breeding;
- describe the difference between endogamy and hybridization;
- describe the information collected in the Human Genome Project;
- describe the use and function of restriction enzymes;
- analyze and explain the use of biotechnological tools like the use and creation of recombinant plasmids, PCR, electrophoresis, and others;
- analyze the benefits of gene therapy;
- relate forensic sciences with biotechnology;
- describe how advances in genetics have been integrated into the development of new technology for human benefit, using criteria like cost, benefit, safety, reliability and aesthetic considerations, as well as possible social, cultural and environmental impacts;
- argue for or against the use of genetic advancements in the development of new technologies from ethical, economic and social standpoints.

Topics

- Selective Breeding and the Beginning of Biotechnology
- Study of DNA and Restriction Enzymes
- Modern Biotechnology
- Genetic Manipulation Techniques and Gene Therapy
- The Human Genome
  The Ethical Aspect of Genetic Modification

Concepts

- bioinformatics
- biotechnology
- cloning
- DNA test
- endogamy
- forensic science
- gel electrophoresis
- gene therapy
- genomics
- hybridization
- selective breeding
- restriction enzymes

Unit 6. Evolution

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. The Origin of Life

Code: C430G0SU06L01

Objectives

By the end of this lesson, students will:

- explain what uniformitarianism is;
- describe the main events of planet Earth's formation and transformation;
- explain the Miller-Urey experiments;
- compare and contrast the characteristics of early Earth with those of present-day Earth;
- analyze the evidence that has led to theories about our planet's formation;
- analyze the conditions that propelled life on Earth;
- analyze the origin of protocells;
- explain the evidence that suggests that RNA is the first molecule of heredity;
- describe the endosymbiotic theory;
- analyze the evidence that has led to theories about eukaryotic cell evolution in the first organisms and argue for or against them.

Topics

- Earth's history
- The first organisms

Concepts

- Big Bang theory
- Biogenesis
- endosymbiotic theory
- protocells
- uniformitarianism

Lesson 2. The Theory of Evolution

Code: C430G0SU06L02

Objectives

By the end of this lesson, students will:

- define the term evolution;
- compare the terms adaptation and fitness;
- explain what natural selection is;
- describe the different mechanisms of evolution,
- use the Hardy-Weinberg principle to evidence evolutionary processes;
- describe how speciation occurs;
- explain what coevolution is.

Topics

- The idea of evolution is born
- Mechanisms and patterns of evolution

Concepts

- adaptation
- behavioral isolation
- bottleneck effect
- coevolution
- evolution
- fitness
- fossil
- genetic drift
- geographic isolation
- gradualism
- natural selection
- reproductive isolation
- speciation
- temporal isolation

Lesson 3. Evidence of Evolution

Code: C430G0SU06L03

Objectives

By the end of this lesson, students will:

- analyze the term common ancestor;
- describe the geological eras;
- differentiate between homologous and analogous structures;
- describe the molecular evidence of highly preserved genes;
- describe, analyze, and evaluate the different types of evidence that support the theory of evolution.

Topics

- Common Ancestry
- Fossil Evidence
- Morphologic Evidence
- Embryonic Evidence
- Molecular Evidence

Concepts

- analogous structure
- biogeography
- cladogram
- common ancestor
- cytochrome
- eon
- era
- extinct
- fossil
- fossil record
- geological time
- homologous structure
- Hox genes
- period
- vestigial structure

Lesson 4. Factors Influencing Evolution

Code: C430G0SU06L04

Objectives

By the end of this lesson, students will:

- analyze the conclusions of the Peter and Rosemary Grant experiments on finch populations;
- describe the types of natural selection;
- argue how the environment and geology influence the evolution of species;
- identify the types of natural selection based on analysis of genotype or phenotype distribution.

Topics

- Factors that Affect Evolution

Concepts

- genetic drift
- migration
- mutation
- natural selection

Lesson 5. Our Ancestors

Code: C430G0SU06L05

Objectives

By the end of this lesson, students will:

- compare and contrast the main groups of primates;
- create a model that represents the evolution of primates;
- trace and discover the evolution of hominids from *Proconsul* to *Homo*;
- compare and contrast the species of the genus *Homo*.

Topics

- Primates
- The *Homo* appears

Concepts

- hominids
- hominins
- hominoids
- homo sapiens sapiens
- omnivores
- opposable thumbs
- primates

Unit 7. Taxonomy: Plants, Algae, and Microorganisms

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Classification of Living Things

Code: C430G0SU07L01

Objectives

By the end of this lesson, students will:

- explain the use or purpose of taxonomy;
- describe the rules of binomial nomenclature and provide examples;
- create a diagram that describes the types of evidence used in taxonomy to determine the relationship between species;
- describe the methods used to identify organisms;
- differentiate the six kingdoms;
- classify a given set of organisms, from domain to species.

Topics

- Classifications and nomenclatures
- Methods to Classify Organisms
- Problems with Classification

Concepts

- binary nomenclature
- clade
- cladogram
- class
- dichotomous key
- extremophile
- family
- genus
- kingdom
- order
- phylogeny
- scientific name
- species
- systematics
- taxon
- taxonomy

Lesson 2. Microorganisms

Code: C430G0SU07L02

Objectives

By the end of this lesson, students will:

- describe and create diagrams of bacteria, archaebacteria, protists and fungi;
- compare and contrast the structures of bacteria, archaebacteria, protists and fungi;
- classify bacteria according to their shapes;
- explain the process of binary fission;
- explain why protists are such a diverse group;
- explain the function of endospores;
- analyze what a plasmid is;

- discuss the use or benefits of bacteria and fungi for human beings;
- describe the main structures of fungi;
- describe the sexual and asexual reproduction of fungi;
- describe the four taxonomic phyla of fungi;
- explain the viral replication cycles;
- identify the four structural shapes of viruses;
- explain why viruses are not considered living things and argue for or against this reason.

Topics

- Bacteria and Archaebacteria
- Protists
- Fungi
- Viruses

Concepts

- ascus
- bacillus
- bacteria
- bacteriophages
- fission
- capsid
- chitin
- coccus
- conjugation
- coronavirus
- endospore
- fruiting body
- hypha
- lichen
- lysogenic infection
- lytic infection
- mycelium
- mycorrhiza
- pandemic
- plasmid
- prokaryote
- prophage
- retrovirus
- spirillum
- virus

Lesson 3. Plants

Code: C430G0SU07L03

Objectives

By the end of this lesson, students will:

- describe what botany is and its branches;
- describe the characteristics of plants;
- argue the reason why there is a branch of biology devoted solely to the study of plants;
- discuss the adaptations that allowed plants to live on Earth;
- explain and give examples of the importance of plants in the lives of other organisms, especially for humans.

Topics

- Botany
- What is a plant?
- The importance of plants

Concepts

- applied botany
- botanists
- botany
- paleobotany
- phytochemistry
- phytogeography
- phytography
- phytopathology
- plant histology
- plants
- pure botany

Lesson 4. The Evolution and Classification of Plants and Algae

Code: C430G0SU07L04

Objectives

By the end of this lesson, students will:

- identify the characteristics that plants are classified by;
- differentiate between cryptogam (sporophyte) and phanerogam (spermatophyte) plants;
- describe diatoms;
- classify algae according to photosynthetic pigment;
- describe green algae;
- classify different plants according to their characteristics;
- analyze the importance of bryophytes;
- describe vascular and non-vascular plants;
- differentiate between gymnosperms and angiosperms;
- classify angiosperms according to their stems.

Topics

- The Evolution of Plants
- Types of Plants and their Classification
- Algae and Their Classification

Concepts

- algae
- angiosperm
- bryophyte
- chlorophyll
- cotyledon
- fruit
- gymnosperm
- phloem
- pollen
- pollination
- seed
- tracheid
- tracheophyte
- vascular tissue
- xylem

Lesson 5. Structure and Function of Plants and Algae

Code: C430G0SU07L05

Objectives

By the end of this lesson, students will:

- describe the roles of leaves, roots, and stems in plant nutrition, growth, and reproduction;
- differentiate the morphology of plants and algae;
- identify the general structures of algae and plants;
- describe the reproductive cycle of algae;
- identify the advantages and disadvantages of plant reproduction.

Topics

- Structure and Nutrition
- Growth and Reproduction

Concepts

- abscisic acid
- anther
- antheridium
- archegonium
- auxin
- bark
- carpel
- collenchyma
- cytokinin
- dermal tissue
- embryo sac
- endodermis
- endosperm
- epidermis
- ethylene
- fundamental tissue
- gametophyte
- geotropism
- gibberellin
- hormones
- knot
- leaves
- limbus
- medulla
- meristem
- mesophyll
- ovule
- parenchyma
- petiole
- photoperiodism
- phototropism
- pistil
- plant reproduction
- pollen
- pollination
- root cortex
- root hairs
- roots
- sclerenchyma
- sporangium
- sporophyte
- stamen
- stem
- stigma
- stoma
- target cell
- thigmotropism
- transpiration
- tropism
- vascular cambium
- vascular tissue

Unit 8. Taxonomy: Animals

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Introduction to the Animal Kingdom

Code: C430G0SU08L01

Objectives

By the end of this lesson, students will:

- argue the benefits of the study of zoology;
- describe the areas of zoology;
- describe vertebrates and invertebrates;
- describe the Chordata phylum;
- explain the relationship between body symmetry and phylogeny in animals;
- describe the germ layers: endoderm, mesoderm, and ectoderm;
- describe how the evolution of nerve and muscle tissue is related to one of the main characteristics of animals;
- identify the animals from a series of organisms and justify the answer.

Topics

- Zoology
- Animal characteristics, shapes, and functions
- Animal Taxonomy

Concepts

- animal
- bilateral symmetry
- cephalization
- chordate
- coelom
- ectoderm
- endoderm
- endoskeleton
- exoskeleton
- invertebrate
- mesoderm
- notochord
- pharyngeal pouches
- pseudocoelom
- radial symmetry
- symmetry
- vertebrate
- zoologist
- zoology

Lesson 2. Invertebrate Animals

Code: C430G0SU08L02

Objectives

By the end of this lesson, students will:

- compare the reproductive adaptations of sponges, coelenterates and worms;
- describe the Porifera, Cnidiraria and Platyhelminthes phyla;
- describe the flatworm classes Turbellaria, Trematoda and Cestoda;

- describe the Nematoda phylum;
- describe the Annelida phylum;
- describe the Polychaela, Aelosomata and Clitellata classes;
- describe the Bachiobdella and Hirundinea subclasses;
- describe the Mollusca phylum;
- provide examples of the taxonomic classes of mollusks;
- explain the ecological importance of roundworms and how they can affect humans;
- describe the characteristics of echinoderms;
- provide examples of classes of echinoderms;
- describe and identify the characteristics of mollusks and echinoderms using a diagram, and mention examples;
- describe the importance of mollusks and echinoderms for humans;
- describe the characteristics that distinguish the different classes of arthropods, as well as their economic importance;
- create models of specimens from the different classes of invertebrates that show their main characteristics.

Topics

- Origin of Invertebrates
- Sponges and Cnidarians
- Flatworms and Roundworms
- Segmented Worms and Mollusks
- Echinoderms
- Arthropods

Concepts

- appendage
- hermaphrodite
- larva
- regeneration
- spicules
- water vascular system

Lesson 3. Chordate Animals

Code: C430G0SU08L03

Objectives

By the end of this lesson, students will:

- identify the characteristics that distinguish vertebrates from invertebrates;
- describe the Agnatha superclass;
- describe the anatomy and physiology of different groups of vertebrate animals, highlighting those that distinguish them from other groups;
- compare and contrast the different adaptations of each group that have allowed them to survive and evolve over time;

- explain the ecological importance of the different groups of vertebrates;
- describe amphibians;
- describe birds;
- describe mammals;
- describe what a monotreme is;
- create models of specimens from the different classes of vertebrates that show their main characteristics.

Topics

- Chordates
- Fish and Amphibians
- Reptiles
- Birds
- Mammals

Concepts

- amphibian
- bone
- cartilage
- chordates
- ectotherm
- marsupial
- monotreme
- oviparous
- placenta
- reptile
- tetrapod
- vertebrate
- viviparous

Lesson 4. Animal Behavior

Code: C430G0SU08L04

Objectives

By the end of this lesson, students will:

- define behavior;
- explain what innate behavior is;
- describe the four types of learned behavior;
- use a diagram to compare and contrast the different types of animal behavior and provide an example for each one;
- predict how different types of animal behavior influence the relationship between animals and their environment;
- explain the relationship between language and communication;
- explain how the study of animal behavior helps us better understand the natural world.

Topics

- Animal Behavior and Leaning
- Language and Communication

Concepts

- behavior
- circadian rhythm
- classical conditioning
- communication
- courtship
- habituation
- innate behavior
- insight learning
- language
- learned behavior
- migration
- operant conditioning
- territory

Unit 9. Human Anatomy and Development

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. The Human Body

Code: C430G0SU09L01

Objectives

By the end of this lesson, students will:

- differentiate between the body's tissues;
- explain what homeostasis is and how it works;
- explain why human beings are organized systems;
- design a model to illustrate hierarchical structure and interactions from single cells to systems;
- justify the study of the human body;
- describe the function of the integumentary system;
- describe the anatomy of the skin and analyze several conditions that affect it.

Topics

- Levels of Organization
- Homeostasis

Concepts

- anatomy
- cell
- connective tissue
- epithelial tissue
- homeostasis
- muscle tissue
- negative feedback
- nervous tissue
- organs
- organ systems
- systems
- tissue

Lesson 2. Systems Responsible for Movement

Code: C430G0SU09L02

Objectives

By the end of this lesson, students will:

- explain the functions and structures of the human skeleton;
- identify the mobile and semi-mobile joints;
- provide examples of types of joints;
- analyze types of bone fractures;
- describe some conditions that affect the bones;
- describe the function of the musculoskeletal system;
- identify the types of muscles;
- describe the movements of extension and contraction;
- establish the relationship between ATP and muscular movement;

- describe certain conditions that affect the muscles;
- create a comparative chart detailing the structure and functions of the integumentary, skeletal, and muscular systems;
- describe the role of technology in the study of these systems;
- identify a disease that attacks each of the systems and describe its treatment;
- create a model of the integumentary, skeletal, or muscular system in any of the stages of human development (childhood, adulthood, old age).

Topics

- The Integumentary System
- The Skeletal System
  The Muscular System

Concepts

- acne
- actin
- appendicular skeleton
- axial skeleton
- bone
- bone marrow
- cardiac muscle
- carcinoma
- cartilage
- compact bone
- dermis
- epidermis
- fracture
- joint
- melanin
- melanoma
- muscle
- muscle fiber
- musculoskeletal
- myofibril
- myosin
- sarcomere
- skeletal muscle
- skeleton
- skin
- sliding filament theory
- smooth muscle
- spongy bone

Lesson 3. The Command Center

Code: C430G0SU09L03

Objectives

By the end of this lesson, students will:

- differentiate between nervous system and nerve impulse;
- identify neuron structure;
- distinguish the three types of neurons;
- explain the three divisions of the nervous system;
- identify the structures of the brain;
- describe the structures of the sensory system;
- identify known structures that operate like or resemble the nervous and sensory systems, and justify the responses;
- explain how the nerve impulse is transmitted;

- evaluate the effect of drugs on the nervous system;
- compare and contrast diseases or conditions that affect the nervous system with those that affect other systems;
- evaluate and describe the impact that a nervous system condition or disease would have on life, using criteria such as cost, benefit, safety, reliability, and aesthetic considerations, as well as possible social and cultural impacts and the changes this would entail in order to have quality of life.

Topics

- The Nervous System
- The Sensory System
- The Effects of Drugs

Concepts

- addiction
- autonomic nervous system
- axon
- central nervous system
- dendrite
- drug
- ear
- interneuron
- motor neuron
- nerve impulse
- nerves
- nervous system
- neuron
- neurotransmitter
- parasympathetic nervous system
- peripheral nervous system
- reflex
- retina
- sensory neuron
- sight
- smell
- somatic nervous system
- sympathetic nervous system
- synapse
- taste
- touch

Lesson 4. Circulation and Oxygenation

Code: C430G0SU09L04

Objectives

By the end of this lesson, students will:

- define circulatory system;
- describe the structure and function of the heart;
- identify the components of blood;
- describe the process of coagulation;
- describe the process of circulation;
- establish the relationship between the circulatory and respiratory systems;
- identify the structures of the respiratory system;
- create a model that represents the structure and functioning of the circulatory or respiratory system;

- identify a series of diseases or conditions of the circulatory system based on the described symptoms, and describe the action to be taken against them;
- identify a series of diseases or conditions of the respiratory system based on the described symptoms and describe the action to be taken against them.

Topics

- The Circulatory System
- The Respiratory System

Concepts

- albumin
- alveolus
- aorta
- arteries
- arterioles
- atrium or auricle
- blood
- blood vessels
- bronchi
- capillaries
- circulatory system
- coagulation
- exhalation
- fibrinogen
- globulin
- heart
- inhalation
- lungs
- plasma
- platelets
- red blood cells
- respiratory system
- trachea
- veins
- venules
- white blood cells

Lesson 5. Nutrition and Regulation

Code: C430G0SU09L05

Objectives

By the end of this lesson, students will:

- differentiate between nutrition and diet;
- define the concept of calories;
- identify the primary and secondary structures of the digestive system;
- describe how food is transformed into nutrients for the body;
- relate chemical and mechanical digestion;
- describe the relationship between the digestive and excretory systems;
- identify and describe the enzymes that participate in the process of digestion;
- explain the process of fecal matter formation;
- describe some of the conditions of the digestive system;
- explain how different organs participate in the process of excretion;
- identify and describe the structures of the urinary system;
- explain the formation of urine;
- define endocrine system;
- explain the function of hormones;

- design an appropriate nutrition plan for the proper functioning of a teenager's digestive and excretory systems;
- explain the impact of an unhealthy diet over time on the endocrine and immune systems in terms of organ damage, medical expenses, quality of life and life expectancy, among others;
- explain the impact of a vegan diet on the digestive, excretory, immune and endocrine systems.

Topics

- Nutrition
- The Digestive System
- The Excretory System
- The Endocrine System

Concepts

- absorption
- bladder
- calories
- chemical digestion
- diet
- digestion
- elimination
- endocrine system
- esophagus
- excretion
- fecal matter
- glomerulus
- hormones
- ingestion
- insulin
- kidney
- large intestine
- liver
- mechanical digestion
- minerals
- nephron
- nutrition
- pituitary gland
- renal cell
- small intestine
- sweat
- urea
- ureter
- urethra
- vitamins

Lesson 6. Our Defense

Code: C430G0SU09L06

Objectives

By the end of this lesson, students will:

- describe the function of the immune system;
- explain what an antigen is;
- establish the difference between antigen and antibody;
- establish the function of the five types of white blood cells;
- distinguish between the types of lymphocytes;
- differentiate between the primary and secondary humoral responses and the cellular response;

- establish differences between bacterial and viral infections in terms of means of infection and treatment;
- identify different infectious agents and the diseases that they cause;
- discuss the role of bacteria and viruses in the economies of countries in terms of drug development, considering criteria such as cost, benefit, safety, reliability, and aesthetic considerations, as well as possible social, cultural, and environmental impacts.

Topics

- The immune system
- Vaccines
- Infectious Diseases

Concepts

- allergies
- antibody
- antigen
- basophil
- cell-mediated immunity
- eosinophil
- HIV
- humoral immunity
- immune system
- immunization
- infectious diseases
- inflammatory response
- lymphocytes
- monocytes
- neutrophils
- pathogen

Lesson 7. Human Reproductive Systems and Fertilization

Code: C430G0SU09L07

Objectives

By the end of this lesson, students will:

- define the concept of fertilization;
- establish the differences between the female and male reproductive systems;
- identify and describe the structures that make up the male reproductive system;
- describe gametes;
- describe sex hormones;
- describe the phases of the menstrual cycle;
- create a diagram of the reproductive system of their biological sex and create a 3D model of the opposite reproductive system;

- describe how the female and male reproductive systems complement each other to produce a new human being;
- identify warning signs that could suggest a malfunction in the female and male reproductive systems;
- argue for or against the use of technology to help people with reproductive problems be able to conceive a child, taking into consideration criteria such as cost-benefit, safety, reliability and ethical considerations, as well as possible social, cultural and environmental impacts.

Topics

- The Reproductive System
- Fertilization

Concepts

- bulbourethral glands
- clitoris
- ejaculatory duct
- epididymis
- estrogen
- Fallopian tubes
- fertilization
- labia
- menstrual cycle
- menstruation
- ovaries
- ovulation
- ovum
- penis
- progesterone
- prostate
- puberty
- semen
- seminal vesicle
- sexual reproduction
- spermatozoid
- testicles
- testosterone
- urethra
- uterus
- vagina,
- vas deferens
- vulva

Lesson 8. Human Development

Code: C430G0SU09L08

Objectives

By the end of this lesson, students will:

- describe embryonic development from fertilization to embryo formation;
- describe the structures that form from germ layers;
- explain senescence;
- use a comparative chart to describe the conditions that must be present to conceive a new human being and those that could obstruct or interrupt the development of the first cells after fertilization;
- compare and contrast female hormonal regulation during pregnancy and during the menstrual cycle;

- use a model to summarize and portray fetal development during each trimester of gestation;
- discuss the benefits of prenatal care;
- describe the stages of birth;
- discuss how medical advances have helped reduce the mortality rate of both mothers and infants during childbirth;
- argue for or against midwife-assisted home births or physician-assisted hospital births, considering criteria such as cost-benefit, safety, reliability, and ethical considerations, as well as possible social, cultural, and environmental impacts;
- create a comparison chart describing the changes that occur during the stages of human development and aging;
- describe how the human growth hormone works;
- argue in favor or against the use of the growth hormone to treat people of short stature from an ethical point of view.

Topics

- Prenatal development and birth
- Stages of Human Development

Concepts

- adolescence
- adulthood
- amniotic fluid
- birth
- blastocyst
- childhood
- dilation
- embryo
- expulsion
- fertilization
- fetus
- infancy
- labor
- morula
- old age
- placenta
- pregnancy
- prenatal
- puberty
- senescence
- zygote

Unit 10. Ecology

At the end of this unit, the students will have accomplished the objectives established in the following lessons.

Lesson 1. Principles of Ecology

Code: C430G0SU10L01

Objectives

By the end of this lesson, students will:

- define what ecology is;
- describe the branches of ecology;
- differentiate between levels of ecology;
- identify the biotic and abiotic factors in an ecosystem;
- identify the different types of symbiotic relationships between species in a given example;
- create a diagram of the levels of organization of life and describe how they interact with each other.

Topics

- Ecology
- Biotic and abiotic factors
- The levels of organization of ecology

Concepts

- abiotic factors
- biome
- biosphere
- biotic factors
- community
- Earth
- ecology
- ecologist
- ecosystem
- environment
- habitat
- organism
- population
- species

Lesson 2. Populations and Communities

Code: C430G0SU10L02

Objectives

By the end of this lesson, students will:

- differentiate between the types of competition;
- define the concept of succession and describe its two types;
- explain how tolerance ranges influence population distribution;
- create a model to contrast the two types of succession in a forest.

Topics

- Relations between organisms
- Ecological Succession

Concepts

- climax community
- commensalism
- competition
- ecological succession
- habitat
- interspecific competition
- intraspecific competition
- key species
- limiting factors
- mutualism
- niche
- parasitism
- pioneer species
- predation
- primary succession
- secondary succession
- succession
- symbiosis
- tolerance range

Lesson 3. Biomes and Ecosystems

Code: C430G0SU10L03

Objectives

By the end of this lesson, students will:

- describe the trophic levels;
- identify the characteristics of producers, consumers and decomposers;
- use a trophic pyramid to identify the energy of an ecosystem;
- establish the difference between a food chain and a food web;
- compare and contrast the ways in which nitrogen, carbon and water circulate in the biosphere;
- create a quantitative model to describe the carbon cycle in the hydrosphere, atmosphere, geosphere, and biosphere;
- develop models to illustrate the role of photosynthesis and cellular respiration in the carbon cycle of the biosphere, atmosphere, hydrosphere and geosphere;
- explain how biogeochemical cycles influence the flow of energy in ecosystems;
- describe the main characteristics of biomes;
- distinguish between types of deserts;
- identify the layers that make up bodies of water according to the amount of light that they receive;
- identify the main abiotic factors that determine the location of the different terrestrial and marine biomes;
- create a model of an ecosystem that represents and identifies the type of ecosystem, biotic and abiotic factors, and food web representative of the ecosystem's energy flow.

Topics

- Energy in ecosystems
- Biogeochemical cycles
- Types of biomes

Concepts

- autotroph
- benthos
- biogeochemical cycle
- biome
- carbon cycle
- carnivore
- climate
- consumer
- decomposer
- ecological pyramid
- ecosystem
- epilimnion
- food chain
- food web
- herbivore
- heterotroph
- hypolimnion
- metalimnion
- nekton
- nitrate
- nitrogen cycle
- omnivore
- permafrost
- primary consumer
- producer
- secondary consumer
- tertiary consumer
- thermocline
- trophic level
- water cycle

Lesson 4. Population Dynamics

Code: C430G0SU10L04

Objectives

By the end of this lesson, students will:

- calculate population change;
- distinguish between migration, immigration and emigration;
- define exponential growth;
- describe logistic growth;
- explain what carrying capacity is;
- describe how populations grow, as well as the factors that limit growth;
- explain how population growth and carrying capacity are related using mathematical or technological representations;
- identify and explain aspects that limit human population growth;
- discuss possible issues that could cause emigration and immigration;
- make a graph representing the country's population growth trends over the last five decades and discuss what its effects have been;
- evaluate scientific evidence of group behavior of individuals and their chances for survival and reproduction.

Topics

- Population growth
- The limiting factors
- Human population

Concepts

- birth rate
- carrying capacity
- demography
- emigration
- exponential growth
- human population
- immigration
- limiting factor
- logistic growth
- migration
- mortality rate
- population change
- population growth

Lesson 5. Biodiversity

Code: C430G0SU10L05

Objectives

By the end of this lesson, students will:

- describe the direct and indirect value of biodiversity;
- explain how human activities pose a threat to biodiversity;
- describe the primary methods used in biodiversity conservation;
- design, evaluate, and refine an original solution to reduce the impact of human activities on the environment and biodiversity, and evaluate this solution based on criteria such as cost, benefit, safety, reliability, and aesthetic considerations, as well as possible social, cultural, and environmental impacts;
- predict the long-term effects of failing to conserve biodiversity;
- analyze and describe how humans are responsible for keeping the environment in good condition for the survival of all species.

Topics

- The value of biodiversity
- Threats to biodiversity
- Conserve to preserve

Concepts

- biodiversity
- bioremediation
- climate change
- conservation
- ecosystem diversity
- endangered species
- endemic species
- extinction
- genetic diversity
- habitat fragmentation
- invasive species
- overexploitation
- preservation
- species diversity
- sustainability