



uBEATS Teacher's Guide:

Molecules of Life

(Grades 9-10)

This teacher guide is a supplementary text to support the use of the uBEATS "Molecules of Life" module for grades 9-10

To help students develop the knowledge necessary for an incredible future in health care, we created UNMC Building Excellence in Academics Through STEM (uBEATS), an online health science resource for Nebraska students.

UNMC uBEATS modules are short (15 minutes or less), interactive online health science modules to supplement curriculum taught in grades 6 – 12. These do not replace curriculum but are a supplement for teachers and students incorporating evidence-based information and UNMC expert guided material. Each module is chunked into sections with formative and summative assessments with immediate feedback provided.

Tips on how to utilize uBEATS modules:

- Internet access is required to view uBEATS modules.
- For those who have access to one-to-one technology, modules can be used in or outside of the classroom as a topic introduction, extension, or review.
- For classrooms without individual student devices modules can be used in whole group instruction. Formative assessment questions can use the teacher's preferred call and response method and summative assessment questions can be displayed on the board and answered individually by students or printed and distributed to students after viewing the module.

Objectives

- Arrange by size the structural components of an organism from the organism itself down to the atomic level.
 - Recognize that proteins, carbohydrates, lipids and nucleic acids are the molecules of life
 - Describe the role of homeostasis within an organism.
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Introduction

How do the structures of organisms enable life's functions?

In this module we will be taking a closer look at the structures within cells and the functions they perform to keep the cell and the organism alive. Understanding the ways cells work is vital to effectively diagnose and take care of patients in the medical field by understanding the root of the problem.

Prior Knowledge

Before beginning this module, the student should understand the Grade Band Endpoints for LS1.A. [A Framework for K-12 Science Education](#).

- **By the end of grade 8.** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). Unicellular organisms (microorganisms), like multicellular organisms, need food, water, a way to dispose of waste, and an environment in which they can live.
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues or organs that are specialized for particular body functions.

Key Terms/Vocabulary

Organism, organ system, organ, tissue, cell, organelle, molecule, atom, monomer, polymer, macromolecule, carbohydrate, energy, monosaccharide, lipid, fats, fatty acid, semi-permeable, protein, enzyme, chemical reaction, hydrolysis, digestion, amino acid, nucleic acid, chromosome, gene, DNA, RNA, asexual reproduction, nucleotide, thymine, adenine, cytosine, guanine, homeostasis, positive feedback system, negative feedback system, stimulus, response.



Science Standards

Nebraska's College and Career Ready Standards for Science 2017 [Nebraska Science Standards](#)

- Gather, analyze, and communicate evidence of the relationship between structure and function in living things. SC.6.6.2

Next Generation Science Standards (NGSS) featuring [Three-Dimensional Learning](#)

Core Idea LS1.A Structure and Function [A Framework for K-12 Science Education](#)

- Systems of specialized cells within organisms help them perform the essential functions of life, which involve chemical reactions that take place between different types of molecules, such as water, proteins, carbohydrates, lipids, and nucleic acids. All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.
- Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
- Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Outside that range (e.g., at a too high or too low external temperature, with too little food or water available), the organism cannot survive. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

Science and Engineering Practices [NGSS](#)

- Developing and using models
- Planning and carrying out investigations
- Constructing explanations and designing solutions

Crosscutting Concepts [NGSS](#)

- Systems and system models
- Energy and matter
- Structure and function
- Stability and change

Nebraska Health Science Standards

- HS.HS.8.1.a. Identify basic structures and functions of human body systems.

National Health Science Standards (NCHSE)

- 1.1.1 Describe the organization of the human body and directional terms
 - a. Identify levels of organization
 - Cellular
 - Chemical



- Organ
- Organism
- System
- Tissue

Extensions of the lesson

- To help students become more familiar with the Key Terms of this module, the teacher can use the vocabulary list for a classroom Word Wall or integrate the vocabulary into classroom word games during review sessions.
- For personal relevance, after using this uBEATS module, use its concepts to make sense of foods you eat by visiting the website [Decoding the Nutrition Label](#).
- The teacher may need to address student misconceptions about these important concepts:
 - In our overfed society, people are often urged to limit their intake of carbohydrates. However, students should understand that the role of carbohydrates is to provide needed energy. They are essential to our diet.
 - Likewise, fats have a negative reputation in our society, not because they are harmful, but because too much fat causes problems. Lipids serve many critical functions within the body.
 - Proteins are much more than static structural building blocks—they also serve as dynamic regulators in body chemistry.
 - Each cell in a person's body contains the exact same set of genetic instructions that serve the entire organism. However, within each cell only certain sections of DNA are actually expressed, resulting in much diversity among cells, tissues, organs, etc. within one organism.

Enrichment

- For information about Healthcare Career Opportunities, see the [UNMC Health Career Book](#).
- To make connections in your community, contact local hospitals, healthcare clinics, zoo, nurses, doctors, veterinarians.
- For examples of classroom lessons, see NGSS Biology [Food Label Lunch Lab](#).