uBEATS Teacher's Guide:

Organization for Matter and Energy Flow in Organisms

(Grades 6-8)

This teacher guide is a supplementary text to support the use of the uBEATS "Organization for Matter and Energy Flow in Organisms" for grades 6-8.

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

- Describe the molecular structure of glucose.
- Compare and contrast the processes of photosynthesis and celluar respiration.
- Examine the role of glucose in molecules in maintaining human health.

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Introduction

Has anyone ever told you that too many sweets will spoil your supper? They were probably right, but sugar does play a role in letting you live and do things. Of course, not all sugar comes in the form of lollipops and soda. You find natural sugars in lots of different foods. The food that you eat works as fuel to power your body, although it is a little different in different organisms. In this module, you will get to see some of the details of how this works and learn about how we work together with all types of living things to create a flow of energy that helps us all thrive.

Prior Knowledge

Before beginning this module, the student should understand the Grade Band Endpoints for LS1.C. A Framework for K-12 Science Education

- ***By the end of grade 2.*** All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

- ***By the end of grade 5.*** Animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals; anaerobic life, such as bacteria in the gut, functions without air. Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion. Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions (e.g., at night).

Key Terms/Vocabulary

Energy, matter, molecular structure, glucose, cellular respiration, photosynthesis, sugar, fuel, carbon, hydrogen, oxygen, carbohydrates, monosaccharide, polysaccharide, glycolysis, Kreb's cycle, electron transport chain, ATP, cytosol, mitochondria, chlorophyll, diabetes, hypoglycemia,hyperglycermia.

Science Standards

Nebraska's College and Career Ready Standards for Science 2017 Nebraska Science Standards

- Matter and Energy in Organisms and Ecosystems: SC.7.8.4.A, SC.7.8.4.B, SC.7.8.4.D.

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

Core Idea LS1.C Growth and Development of Organisms A Framework for K-12 Science Education

- ***By the end of grade 8.*** Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. Animals obtain food from eating plants or eating other animals. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. In most animals and plants, oxygen reacts with carbon-containing molecules (sugars) to provide energy and produce carbon dioxide; anaerobic bacteria achieve their energy needs in other chemical processes that do not require oxygen.

Science and Engineering Practices NGSS

- Developing and using models
- Constructing explanations and designing solutions

Crosscutting Concepts NGSS

- Cause and effect
- Systems and system models
- Energy and matter
- Structure and function

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, encourage students to examine carbohydrate information on food labels in their home.
- The teacher may need to address student misconceptions about these important concepts:
    - Carbohydrates are considered by some people to be undesirable. To the contrary, sugars (glucose) are essential for living organisms. These molecules are the fuel that gives us energy. We must have energy.
    - The amount of energy in food is measured in calories.
    - Calories are not harmful—they are required for life. However, hoarding calories is a problem. If a person consumes more calories than they use, the excess can be stored for later use. As this fuel storage continues, the body may develop fat deposits that interfere with healthy body function.
    - All matter is composed of atoms. The arrangement of atoms and the bonds within the molecules determine the amount of energy in a substance.
    - The original source of energy is the light from the sun. Plants can capture that energy and use it to rearrange the atoms from molecules of water and carbon dioxide during the photosynthetic process of building molecules of glucose.
    - Organisms that cannot capture energy directly from light are able to consume glucose molecules as their source of energy.
    - Cellular respiration is a series of chemical reactions by which the energy in glucose is released and packaged into molecules of ATP that act like little batteries in the body. Most living organisms, including plants and animals, use cellular respiration.
    - Too much, or too little, glucose in the bloodstream produces harmful consequences.

Enrichment

- For information about career opportunities, see UNMC's Careers in Healthcare.
- To make connections in your community, contact local hospitals, healthcare clinics, plant nurseries, zoo, nurses, doctors, veterinarians.
- Encourage students to follow current events regarding diabetes, malnutrition, and obesity.
- Examples of classroom activities on photosynthesis and cellular respiration can be found on NGSS Biology.