uBEATS Teacher's Guide:

Heredity

(Grades 6-8)

This teacher guide is a supplementary text to support the use of the uBEATS "Heredity" module 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

- Determine the structures in the cell that affect inherited traits.
- Demonstrate understanding of the mechanics that create variety among organisms.
- Compare the relationship between mutations, genes, and traits.
- Analyze the acquisition of genes and inheritance of genetic information.

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Introduction

How can individuals of the same species and even siblings have different characteristics?

Have you ever wondered why there are so many variations of eye colors? What about hair colors, nose shapes, and body types, or why some children in a family are tall while others are short? This module will teach you how traits are passed down from one generation to the next, and how genes can vary from one organism to another.

Prior Knowledge

Before beginning this module, the student should understand the Grade Band Endpoints for Core Idea LS3.B. A Framework for K-12 Science Education

- ***By the end of grade 2.*** Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.
- ***By the end of grade 5.*** Offspring acquire a mix of traits from their biological parents. Different organisms vary in how they look and function because they have different inherited information. In each kind of organism, there is variation in the traits themselves, and different kinds of organisms may have different versions of the trait.

Key Terms/Vocabulary

Inheritance, genes, traits, variation, cells, nucleus, mitochondria, ribosomes, endoplasmic reticulum, chromosomes, DNA, sexual reproduction, alleles, nucleotides, sequence, protein, gene expression, mRNA, mutation, environment.

Science Standards

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

- Growth, Development, and Reproduction of Organisms: SC.6.9.3.C, SC.8.9.4.A

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

Core Idea LS3.A: Inheritance of Traits A Framework for K-12 Education

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of a specific protein, which in turn affects the traits of the individual (e.g., human skin color results from the actions of proteins that control the production of the pigment melanin). Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.

Core Idea LS3.B: Variation of Traits A Framework for K-12 Science Education

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.

Science and Engineering Practices NGSS

- Developing and using models

Crosscutting Concepts NGSS

- Cause and effect

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.
- To help the students see personal relevance, suggest that they have a private conversation with their parents to discuss family characteristics, such as facial traits, height, family history of diseases, etc.
- The teacher may need to address student misconceptions by emphasizing these important concepts:
    - A variety of traits within a population are normal and healthy.
    - In sexually reproduced organisms, the offspring MUST be different from each of the parents, because the offspring carries a new combination of DNA from two different sources.
    - Just because an individual has a particular allele for a gene does not mean that the allele will show up in their physical appearance.
    - Sometimes the offspring has a mutation that neither parent had.
    - Genes in the DNA of the cell's nucleus carry specific codes, but those codes must be transcribed by mRNA, which then delivers the message to the cell's ribosomes where the code is translated into protein molecules that make the traits show up. This is called gene expression. Just because a particular gene is present in an organism's cells does not mean that the code will become a trait.
    - Environmental factors can also influence gene expression.

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.
- To learn more about the pathway from DNA code to visible physical traits, see the Ubeats Grade 9-10 module From DNA to Protein.
- To explore how some genes are “hidden” and do not show up in a person’s traits, see the Ubeats Grade 9-10 module Gene Expression.
- Classroom activities about protein synthesis can be explored on the Duckster site Biology for Kids.