uBEATS Teacher's Guide:

Mendelian Genetics

(Grades 6-8)

This teacher guide is a supplementary text to support the use of the uBEATS Mendelian Genetics 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

- Analyze the approaches to science that made Gregor Mendel's genetic experiments successful.
- Construct Punnett Squares to predict and evaluate the results of a genetic cross.

Introduction

Why do individuals of the same species vary in how they look, function, and behave?
Gregor Mendel was an Austrian monk and scientist who was interested in how traits were passed from parents to offspring. By breeding the pea plants in a monastery garden, Mendel discovered that purebred pea plants only passed identical parent traits such as color, texture, and height to offspring, uncovering the rules of heredity which earned him the title "The Father of Modern Genetics."

In this module you will explore Mendel's groundbreaking work with pea plants and how he unlocked the rules that govern inheritance.

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, traits, alleles, purebred, monohybrids, fertilization, segregation, dominant, recessive, Punnett Square, heterozygous, homozygous, genotype, phenotype.

Science Standards

Nebraska's College and Career Ready Standards for Science 2024 Nebraska Science Standards

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

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

Core Idea LS3.B: Heredity: 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.
- The teacher may need to address student misconceptions by emphasizing these important concepts:
  - In sexually reproducing organisms, the term "fertilization" describes the joining of genetic information carried in two different reproductive cells, one from each parent. The term does not refer to chemicals added to the soil for growth.
  - Since information for each trait is coming from two different parents, different versions (alleles) are possible for each genetic trait.
  - When the offspring matures and gets ready to become a parent of the next generation, only one allele from each pair of alleles can be passed into a reproductive cell. This is Mendel's "Law of Segregation."
  - If the two alleles for a gene are identical, the pair is called "homozygous."
  - If the two alleles for a gene are different, the pair is called "heterozygous."

- When the two alleles for a gene are different, the one that gets expressed is called “dominant.” This term does not refer to strength or size, but rather reflects the circumstances of expression.
- The “Law of Dominance” does not apply to every kind of allele. Some follow “incomplete dominance”, others have “codominance”, and some traits are controlled by multiple (more than two) alleles.
- A Punnett Square can be used to identify possible random allele combinations, but it does not predict what will happen.

Enrichment

- For information about career opportunities, see UNMC’s Careers in Healthcare.
- To make connections in your community, contact local hospitals, healthcare clinics, zoo, nurses, doctors, veterinarians.
- To learn more about Gregor Mendel, see Gregor Mendel.
- To learn more about inheritance, explore Learn.Genetics.
- For fun ways to practice Punnett Squares, search for sites such as Don't Be a Square.