uBEATS Teacher's Guide:

Plant Genetics

(Grades 6-8)

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

- Identify specialized features and animal behaviors that increase the odds of reproduction.
- Differentiate between sexual and asexual methods of reproduction in plants and how genetic material is transferred during reproduction.
- Recognize environmental factors and genetic factors that influence the growth of adult plants.
- Interpret how artificial selection influences the types of foods we eat.

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Introduction

How do organisms grow and develop?

This module is an introduction to plant genetics. The basics of plant genetics include both sexual and asexual reproduction. You will learn about pollination, the names of the plant's reproductive organs, and the organisms that ensure the process of pollination. You will also learn how living and nonliving things contribute to the growth and development of plants. Finally, we will discuss how humans have used plant genetics to enhance the growth of fruits, vegetables, and grains.

Prior Knowledge

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

- ***By the end of grade 2.*** Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive.
- ***By the end of grade 5.*** Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles that include being born (sprouting in plants), growing, developing into adults, reproducing, and eventually dying.

Key Terms/Vocabulary

Sexual reproduction, asexual reproduction, pollination, fertilization, petals, sepals, stamen, anther, filament, pollen, nectar, carpal, pistil, stigma, style, ovary, ovule, gametes, egg cell, sperm cell, fruit, seed, dispersal, vegetative propagation, corms, tubers, stolons, nodes, rhizomes, buds, natural selection, artificial selection.

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.A, SC.6.9.3.B, SC.6.9.3.C

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

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

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring.
- Animals engage in characteristic behaviors that increase the odds of plant reproduction.
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features (such as attractively colored flowers) for reproduction.
- Genetic factors as well as local conditions affect the size of the adult plant.

Science and Engineering Practices NGSS

- Developing and using models
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communication information

Crosscutting Concepts NGSS

- Cause and effect
- Scale, proportion, and quantity
- Systems and system models
- 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.
- To review the basics of plant genetics, see the uBEATS module Mendelian Genetics.
- To help the students see personal relevance, it is suggested that they examine the flowers that appear on the plants that grow in their home and/or around their property.
- The teacher may need to address student misconceptions by emphasizing these important concepts:
    - Asexual reproduction produces a new individual having the same DNA as the parent.
    - Sexual reproduction produces offspring having a new combination of DNA from two sources.
    - Fertilization (joining of male gamete and female gamete) is sexual.

- The term “fertilization” can be used in two different ways: do not confuse fertilization (joining of egg and sperm) of sexual reproduction with fertilization as chemicals added to soil for plant growth.
- Pollination (transfer of male gamete to give access to female gamete) is sexual.
- Plant behaviors and animal behaviors increase the chances of fertilization in plants.
- Vegetative reproduction is asexual, so it does not use flowers (sex organs). Many plants, such as tomatoes and strawberries, can reproduce both ways, asexually by vegetative propagation and sexually by using their flowers.
- DNA carries the instructions for developing the proteins that determine body parts and characteristics.

Enrichment

- For information about Healthcare Career Opportunities, see the UNMC Health Career Book.
- To make connections in your community, contact the local extension service, local farmers, community horticulture clubs, botanical gardens, garden supply stores, plant nurseries.
- To investigate pollination and fertilization in the laboratory, see Fast Plants.