uBEATS

uBEATS Teacher's Guide:

Cell Division and Differentiation

(Grades 9-10)

This teacher guide is a supplementary text to support the use of the uBEATS "Cell Division and Differentiation" 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

- Distinguish differences between mitosis and meiosis.
- Explain the progression from fertilization to differentiation.
- Describe how cell autonomy and anaplasia can cause cancerous growth.

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Introduction

How do organisms grow and develop?

What do kittens, babies and hedgehogs all have in common? They grow! These processes are not perfect, but they normally lead to a healthy organism. In this module you will study the progression from gametes to zygote to stem cells to differentiated tissues that contribute to the development of a functional organism.

Prior Knowledge

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

- ***By the end of grade 8.*** Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. Animals engage in characteristic behaviors that increase the odds of reproduction. The growth of an animal is controlled by genetic factors, food intake, and interactions with other organisms, and each species has a typical adult size range.

Key Terms/Vocabulary

Mitosis, meiosis, replication, haploid, diploid, gonad, testes, ovaries, gamete, zygote, fertilization, stem cells, differentiation, genes, traits, cell autonomy, anaplasia, cancer, mutation, tumor.

Science Standards

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

- Structure and Function: SC.6.9.3.A, 6.9.3.B, 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 Education

- In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells.
- As successive subdivisions of an embryo's cells occur, programmed genetic instructions and small differences in their immediate environments activate or inactivate different genes, which cause the cells to develop differently—a process called differentiation.
- Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

Science and Engineering Practices NGSS

- Developing and using models
- Constructing explanations and designing solutions

Crosscutting Concepts NGSS

- Systems; Energy; Structure and function; Stability and change

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 about these important concepts:
    - The single cell of the zygote undergoes mitosis to create two identical cells. The DNA in each of these "daughter" cells is identical.
    - Mitosis continues making more and more cells, each containing the exact same DNA.
    - The first event of differentiation occurs when a group of these cells develop into a placenta; the remainder of the cells continue replicating as identical stem cells.
    - The DNA within each stem cell carries the code for all the potential various body cells to be developed in the future of the organism.
    - As the stages of differentiation proceed, specialized cells begin to develop. These cells still have the same set of DNA, however, they lose their potential for becoming all organs. The specialized cells become dedicated to the structure and function of their own special tissue.
    - When anaplasia occurs, the cells lose their specialized characteristics and become poorly differentiated.

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.
- Encourage students to follow current events involving the use of stem cells.
- An example of a classroom activity on differentiation can be found at Cell Differentiation.