uBEATS Teacher's Guide:

Anti-Bacteria

(Grades 11-12)

This teacher guide is a supplementary text to support the use of the uBEATS Anti-Bacteria module for grades 11-12.

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

- Discuss the ways of controlling bacterial growth, both in the body and the environment.
- Describe the history of modern antibiotics.
- Identify concerns regarding the overuse of antibiotics.

ubeats@unmc.edu

Introduction

Bacteria live all around us—they even live inside our bodies. Many types of bacteria are beneficial to human life, but there are some bacteria that can cause serious health problems for humans and animals. Some bacteria will make you sick, and other bacteria can spoil your food or poison your drinking water. Because bacteria can reproduce so quickly, it takes only a very small amount of them to put you in danger. There are many different types of bacteria. For the most part, bacteria can be broken down into one of three types: spherical, rod-shaped, or spiral. Within these groups there are many variations. Different types of bacteria require different environments in which to grow. Some bacteria thrive on arctic ice, others prefer hot springs. Some need oxygen to live, some don't. Some even prefer the conditions inside your body. In general, each type of bacteria requires a unique blend of food, acidity or pH, temperature, oxygen, and moisture in order to grow and thrive. Controlling bacteria in our environment and our bodies generally consists of depriving them of one or more of these resources.

Prior Knowledge

Before beginning this module, the student should understand the Next Generation Science Standards (NGSS) featuring Three-Dimensional Learning.

Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics A Framework for K-12 Science Education

- Organisms and populations of organisms are dependent on their environmental interactions both with other living things and with nonliving factors. Growth of organisms and population increases are limited by access to resources. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms.
- Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.

Science and Engineering Practices NGSS

- Using mathematics and computational thinking

Crosscutting Concepts NGSS

- Scale, Proportion, and Quantity

Key Terms/Vocabulary

Bacteria, pathogens, sterilization, disinfection, sanitation, sepsis, asepsis, antisepsis, degerming, personal hygiene, physical methods, chemical methods, immune system, antibiotics, antibiotic resistance.

Science Standards

This module is related to the content of **UNMC High School Alliance: Introduction to Pathology and Microbiology**

Pathology is the study of disease processes. The field lays the foundation for all of clinical medicine and medical research. All diseases begin at the cellular level and changes in the structure and function of tissues ultimately lead to symptoms that health care providers see on a daily basis. This course will introduce students to medical terminology, normal histology and gross/microscopic pathology, allowing students to correlate the findings they see into basic clinical concepts.

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

Engineering in Health Sciences: SC.HSP.17.1.A

- Obtain, evaluate, and communicate information related to health science careers.

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 at home regarding prevention and treatment of various bacterial infections experienced by members of the family.
- As student misconceptions become apparent, the teacher may need to reinforce these important concepts:
    - Certain bacteria are beneficial. Other bacteria are harmful.
    - Sterilization destroys all bacteria, whether beneficial or harmful. This process is used on non-living surfaces and instruments.
    - Disinfection is used to destroy almost all bacteria. This process is used when sterilization is too costly or when total sterilization is not needed.

- Unlike sterilization, sanitization does not remove all bacteria. Sanitization does reduce the amount of bacteria to a safe level for public health. This is especially helpful around food items, drinking water, and eating utensils.
- Sepsis is an extreme life-threatening reaction within the body that is triggered by the presence of bacteria involved in a massive infection. Asepsis is the sterile condition in which such bacteria are not present. Antisepsis is the attempt to get rid of bacteria that are already present.
- Degerming does not sterilize the hands. After washing with soap or hand sanitizer, bacteria are still present on the skin, but at levels that do not encourage the spread of diseases.
- Antibiotics have saved many lives by stopping bacterial infections that could not be otherwise controlled. However, antibiotics also destroy good bacteria in the body. In addition to this problem, improper use of antibiotics can lead to antibiotic resistance as surviving bacteria proliferate. For these reasons, your doctor may be reluctant to prescribe antibiotics.

Enrichment

- For information about career opportunities, see UNMC's Careers in Healthcare.
- Students should be watchful in current events for recent stories about antibiotics.
- The World Health Organization warns against improper use of antibiotics. See their brief video WHO: Antibiotics--Handle with care.
- The U.S. National Library of Medicine offers resources about antibiotic resistance: Antibiotics vs. Bacteria: Fighting the Resistance.
- A 30-minute 2016 video about the dangers: Antibiotic Resistance--Are we creating super bacteria?
- An example of a classroom activity regarding antibiotic resistance can be found at Antibiotic Resistance Lesson.
- To make connections in your community, contact the American Red Cross, local hospitals, healthcare clinics, nurses, doctors, veterinarians.