uBEATS Teacher's Guide:

Aseptic Technique

This teacher guide is a supplementary text to support the use of the uBEATS "Aseptic Technique" module for grades 6-12.

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 they 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 key elements of aseptic technique.
- Examine common causes of contamination.

Introduction

Microorganisms are everywhere: on your bed, on your phone, on your face. They are also in your doctor's office, in surgery rooms, and other health care settings where they can cause major issues. To protect patients from bacteria, viruses, or other harmful pathogens, healthcare workers employ aseptic technique.

This module was created for the Pediatric Cancer Research Group (PCRG) laboratory. Technicians preparing chemotherapy drugs and nurses administering these drugs to cancer patients must incorporate aseptic practices to help ensure the safety of these individuals with compromised immune systems. Aseptic technique is used to provide a barrier between microorganisms in the environment and our sterile cell culture. Cell culture is a means by which cells are grown under controlled conditions; it is an important process because it provides a platform to investigate the biology and biochemistry of cells. The goal is to keep our cell culture, solutions, and supplies free from contamination such as bacteria, fungi, viruses, dust, and even dead skin cells. Good aseptic technique helps promote consistency and success with our experiments as we test potential cancer treatments; contamination can stop an experiment in its tracks, costing us lost time and money, or lead us to incorrect conclusions.

Middle school and high school students learn aseptic technique to prevent contamination in classroom laboratory experiments and microbiology science fair projects.

Prior Knowledge

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

LS1.A. **Structure and Function**. A Framework for K-12 Science Education

Organisms can be made of a single cell or millions of cells working together and include animals, plants, algae, fungi, bacteria, and all other microorganisms.

Dimension 1. **Scientific and Engineering Practices**. A Framework for K-12 Science Education

Planning for controls is an important part of the design of an investigation. In laboratory experiments, it is critical to decide which variables are to be treated as results or outputs and thus left to vary at will and which are to be treated as input conditions and hence controlled.

Science and Engineering Practices NGSS

3. Planning and carrying out investigations

Crosscutting Concepts NGSS

2. Cause and Effect

Key Terms/Vocabulary

Aseptic, technique, microorganisms, contamination, contaminant, mycoplasma, bacteria, fungi, cell cultures, personal hygiene, sterile, reagents, pediatric cancer, chemotherapy, personal protective equipment (PPE), cross-contamination, disinfect, ethanol, Kim wipes, micropipette, growth media, UV light, chemical activity, biological activity, spores, hyphae, filtration, incubator, nuclear DNA stain, Hoechst dye, fluorescent.

Science Standards

- Nebraska's College and Career Ready Standards for Science 2017 **Nebraska Science Standards**
  - SC.HS.5.5.E. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

- National Consortium for Health Science Education **NCHSE**
  - Foundation Standard 7: Safety Practices

    7.1.2. Differentiate methods of controlling the spread and growth of pathogens.

a. Asepsis

b. Standard precautions.

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 review sessions.

Encourage students to check current events for the latest news involving contamination in hospitals or medical environments.

Advise students to reflect on their own daily practices involving sanitation, disinfection, and sterilization.

As student misconceptions become apparent, the teacher may need to reinforce these important concepts:

- Learning about handwashing begins in early childhood. More rigorous techniques for preventing laboratory contamination are practiced in middle school and high school. Aseptic safety procedures are critically important in hospitals and medical laboratories.
- Growing cell cultures involves growth media that provides food for the cells. However, unwanted organisms, including bacteria, fungi and viruses, also thrive in those same conditions, contaminating the entire culture. For that reason, prevention of contamination is absolutely essential for healthy cell cultures.
- Four key areas of aseptic technique are:
  - Good personal hygiene, including tying back long hair, careful hand washing, and proper wearing of personal protective equipment (PPE).
  - A sterile work area includes a lab hood that filters the air and ultraviolet (UV) light that sterilizes everything under the hood.
  - Tools should be disinfected by spraying with 70% ethanol and then wiped down with cleaning tissues (Kim wipes). The disinfected tools should then be sterilized by UV light in the lab hood. On the other hand, bottles of chemicals (reagents) and growth media must not be treated with UV light which could damage the chemicals. The outsides of the containers must be disinfected, but the contents should already be sterile.
  - Reagent bottles must be in the sterile hood environment when opened. The cap must be replaced immediately to prevent contamination.
- Common contamination sources are microscopic and found everywhere, including on cell phones and clothing. Even talking or coughing can spread bacterial mycoplasma and fungal spores.

Enrichment

- Search for online video explanations of **Aseptic Technique**.
- Explain the differences between **sanitation**, **disinfection**, and **sterilization**.
- **Design an investigation** that would demonstrate contamination of food by air exposure over differing lengths of time. Consider these items in the design:
    - Safety recommendations, sanitation, disinfection, sterilization.