



uBEATS Teacher's Guide:

Careers in Medical Imaging and Therapeutic Sciences

(Grades 6-12)

This teacher guide is a supplementary text to support the use of the uBEATS "Careers in Medical Imaging and Therapeutic Sciences" 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 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

- Make a list of health science careers in Medical Imaging and Therapeutic Sciences.
 - Discuss high school science, technology, engineering, and math courses that can prepare a person for a career in health sciences.
 - Identify a real-world human health problem and explain how Medical Imaging is involved in solving that problem.
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Introduction

The field of medical imaging and therapeutic sciences involves techniques and processes used to create images of the human body for both diagnostic and treatment purposes. A career in medical imaging and therapeutic sciences often begins with radiography. Radiography is used as a general term to describe several types of imaging studies that record internal body structures. The individuals trained to work in this field are known as radiologic technologists or radiographers. As a radiographer, you will acquire images of patients' internal organs, soft tissues, and bones using X-ray equipment. Doctors use these images to assess the presence or absence of disease, foreign objects, and structural damage or anomaly. Radiography is a challenging and rewarding career in which you will be an integral part of the diagnosis and treatment of patients with a wide range of ailments.

Prior Knowledge

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

Core Idea PS4.B Electromagnetic Radiation [A Framework for K-12 Science Education](#)

- All electromagnetic radiation travels through a vacuum at the same speed, called the speed of light. Its speed in any given medium depends on its wavelength and the properties of that medium. At the surface between two media, like any wave, light can be reflected, refracted (its path bent), or absorbed. What occurs depends on properties of the surface and the wavelength of the light. When shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) is absorbed in matter, it can ionize atoms and cause damage to living cells. However, because X-rays can travel through soft body matter for some distance but are more rapidly absorbed by denser matter, particularly bone, they are useful for medical imaging. Photovoltaic materials emit electrons when they absorb light of a high-enough frequency. This phenomenon is used in barcode scanners and “electric eye” systems, as well as in solar cells. It is best explained using a particle model of light.

Science and Engineering Practices

- Obtaining, evaluating, and communicating information [NGSS](#)

Crosscutting Concepts

- Cause and effect [NGSS](#)

Key Terms/Vocabulary

Medical imaging, therapeutic science, radiography, magnetic resonance imaging (MRI), diagnostic medical sonography, ultrasound, radiation therapy, ionizing radiation, therapeutic radiation, interventional radiology, fluoroscopy, nuclear medicine, mammography, bone densitometry, radiopharmaceuticals.



Science Standards

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. Examples include researcher, bio-medical engineer, medical professional, technician, manufacturer and distributor, administrator, and data storage and security professional.

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

- Evaluate a solution to a complex real-world human health problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. Solutions could include the effects on the human body or solutions for environmental public health issues.

Nebraska Health Science Standards

- HS.HS.6.1.c. Describe the various healthcare career pathways
- HS.HS.7.1.a. Compare various careers from multiple pathways
- HS.HS.7.1.b. Compare job outlook projections for healthcare careers on a local, state, and national level.
- HS.HS.8.4.b. Compare levels of healthcare professionals and their roles within the healthcare system.

Nebraska Family and Consumer Education Standards

- HSE.MS.8.3 Explain the connections between education, career, and lifetime earnings.
- HSE.MS.8.12 Use the Nebraska Career Education Model, Nebraska Career Connections and related resources to investigate and learn about the world of work.
- HSE.HS.27.1 Apply career-readiness skills and identify potential career opportunities.
- HSE.HS.29.2 Apply career readiness skills to develop a personal career plan.

National Health Science Standards (NCHSE)

- 4.3.1 Research levels of education, credentialing requirements, and employment trends in health professions.
- 4.3.2 Distinguish differences among careers within a health science pathway.
 - Biotechnology research and development
 - Diagnostic services
 - Health informatics
 - Support services
 - Therapeutic services



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 privately ponder people they know (particularly relatives, friends, neighbors) who work in any of the careers mentioned in this module.
- As student misconceptions become apparent, the teacher may need to reinforce these important concepts:
 - The field of radiography harnesses the incredible power of radiation to look inside the body. Preparation for careers in radiography includes coursework in physics and anatomy.
 - A radiographic technologist is focused on producing clear images when looking inside the body. Therefore, the technician must have excellent communication skills in order to calm patients who may be nervous, in pain, or frightened. The patient must be motionless in order to achieve a clear picture.
 - Some techniques are diagnostic, looking for possible injuries or diseases. Other procedures are for treatment, such as the precise delivery of radiation to fight cancer.
 - Most of us are familiar with the concept of static X-ray pictures, but movie-like images can also be produced on a monitor to guide doctors during real-time interventional procedures.

Enrichment

- For information about career opportunities, see UNMC's [Careers in Healthcare](#).
- The [Occupational Outlook Handbook](#) provides detailed information about [Radiologic and MRI Technologists](#).
- UNMC's College of Allied Health Professions describes various programs in radiography-related fields on the webpage [Education Programs](#).
- A sample lesson plan can be located at [X-Ray Vision: Basics of Radiography](#).
- To make connections in your community, contact local hospitals, healthcare clinics, nurses, doctors.