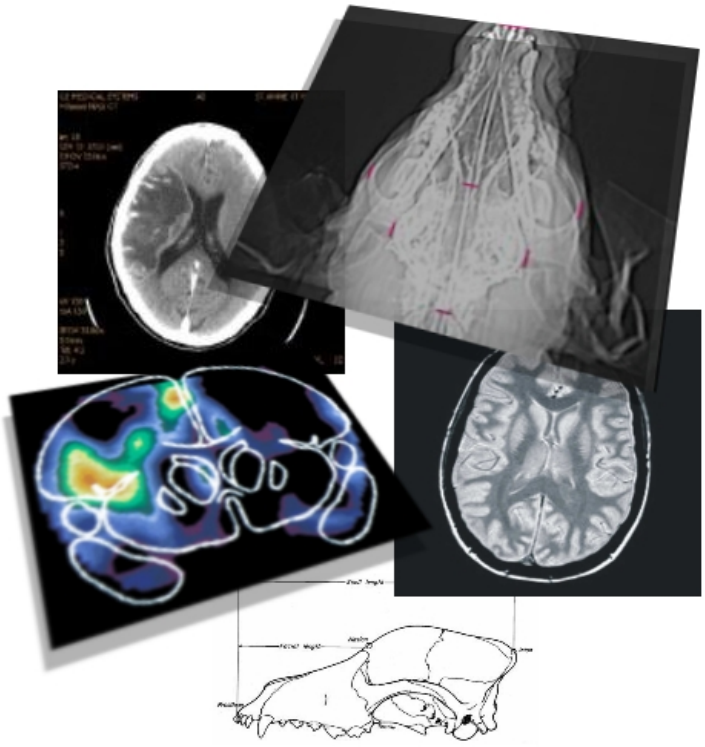
UNIT 2
Medical Technology: Imaging

Unit Overview



I. Introduction

Technology has drastically changed the medical profession, and as a result, everyday life. The phrase "medical technology" frequently evokes thoughts of x-rays. X-rays, however, are just one of the many technological tools that make up medical imaging technology. Prior to the end of the nineteenth century, doctors lacked the ability to definitively diagnosis many internal medical problems without having to cut open the patient. William Roentgen drastically changed the face of medicine in 1895 with his unintended scientific discovery of x-rays. While Roentgen was mystified by the origin of the new rays, it didn't take others long to see how this scientific discovery could be harnessed to improve human life. The first revolution in medical imaging technology occurred during the beginning of the twentieth century as physicians, technologists and scientists raced to improve upon Roentgen's discovery. During the late 1920s however, individuals began laying the groundwork through new scientific discoveries for the second technological revolution that would begin in the 1970s and continues today.

The x-ray is now a household word, whether referring to medical technology, Superman's supernatural vision, or security measures at the local airport. While many people are familiar with the term, very few truly understand the technology that laid the groundwork for this and other lifesaving medical imaging technologies, such as CT (computed tomography) scanning, MRI (magnetic resonance imaging), PET (positron emission tomography) scanning, and ultrasonography. In addition, few understand the dangers that may or may not be posed by man-made radiation sources, including medical imaging technologies. In this unit, you will explore the history, uses, and societal

implications of medical imaging technologies developed for both human and veterinary practices.

II. Unit Learning Goals

- Students will develop an understanding of the historical perspective of medical imaging technologies, including the key technological and scientific advancements and the people involved in these advancements.
- Students will develop an understanding of the relationship of medical imaging and the electromagnetic spectrum, including how electromagnetic waves are measured.
- Students will develop an understanding of how various medical imaging technologies operate and their uses.
- Students will develop an understanding of how radiation is measured, its sources and the relative risks of individuals in various occupations, including radiological technicians and technologists.

III. Unit Connections to ITEA's Standards for Technological Literacy

This unit is focused on Medical Technologies of the Designed World, Standard 14, and Information and Communication Technologies of the Designed World, Standard 17. The following matrix identifies the Standards for Technological Literacy that are addressed by the projects within the unit. The standards addressed are based on the basic projects. Extensions to the projects may result in additional standards being covered.

Unit 2	Medical Technology: Imaging																			
Target Standards for Technological Literacy																				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Introductory Level Projects																				
Project 1-History of Imaging	X		X	X		X	X	X			X	X		X			X			
Project 2-Electromagnetic Spectrum			X	X				X			X	X		X			X			
Project 3-Digital X-rays								X			X	X		X			X			
Project 4-Radiation Risks			X	X				X			X	X	X	X			X			
Intermediate Level Projects																				
Project 5-The X-ray Machine								X			X	X		X			X			
Project 6-Digital CT Scans								X			X	X		X			X			
Project 7-Societal Impacts--Imaging				X				X			X	X	X	X			X			

IV. Navigating the Unit

Students using the Medical Technology: Imaging Unit should progress from the introductory level to the intermediate level, finishing with the advanced level if desired. Within the introductory and intermediate levels there is a fair amount of flexibility. While all of the projects are linked together through the topic of medical imaging technologies, most of them are independent of each other. There is only one circumstance in which a project is a prerequisite to another. Project 6 in the intermediate level, Digital CT Scan Images, has been designed with the assumption that students will have completed the Digital X-ray Imaging Project (Project 3) in the introductory level. Both projects require that students use the digital imaging software, eFilmLite™, to obtain measurements from digital medical images. Measurements obtained during the introductory level are used in the intermediate level.

Projects relating to historical, societal, and ethical issues are to be used at the instructor's discretion. The projects are briefly described in the following section to assist

you in determining which projects will be completed and the order in which they will be presented to the students.

V. Projects

Introductory Level Projects

Project 1: History of Medical Imaging Technologies

This project provides a historical perspective of the various branches of medical imaging technology. This project is useful in developing students' understandings of the nature of technology and its relationship with society.

Project 2: Medical Imaging and the Electromagnetic Spectrum

Students will develop an understanding of the behaviors of electromagnetic (sine) waves through an interactive Excel worksheet. Students will research the electromagnetic spectrum and how it relates to the various types of medical imaging.

Project 3: Digital X-ray Imaging

Students will use a medical image viewing software tool to analyze various x-ray images of skulls from different breeds of dogs. They will collect measurement data by choosing appropriate views, using image processing techniques to reveal key landmarks on the dog skulls, and then taking size measurements. Using these measurements, students then will determine the skull type of each dog.

Project 4: Radiation Risks of Medical Imaging

Students will discuss medical imaging techniques from a societal perspective, focusing on people's perceptions of radiation risks and consequences of exposure to radiation. In order to understand the risks associated with radiation exposure, students will research how radiation exposure is measured and risks associated with various amounts of exposure. Students will estimate the average amount of radiation they are exposed to annually by completing an interactive Excel worksheet. Finally, they will compare their data to others in their class and to occupations that have higher than average radiation exposure.

Intermediate Level Projects

Project 5: The X-ray Machine

Students will research x-ray machines and visually represent how the technology works through the creation of conceptual graphics. These graphics may be drawn by hand or computer-generated, and can range from static graphics to simple animations.

Project 6: Digital CT Scan Images

Students will analyze CT scans of different dog breeds to calculate the volume of the brain for each breed. Based on a brain volume—cranial index ratio, students will determine which breed might be more intelligent assuming that a larger brain volume—cranial index ratio indicates higher intelligence.

Project 7: Societal Impacts of Medical Imaging Techniques

Students will research the impact that technology has had on medical imaging techniques. Specifically, students may research technology's impact on health care costs and the distribution of advanced health care technologies. Students may participate in a classroom debate regarding these various issues.

Advanced Projects

Students will complete an independent project through the use of visualization tools by researching a new topic dealing with medical imaging technologies or by expanding on topics covered in this unit. The objective of the advanced level is for students to further their skills in integrating research, problem solving through the design brief approach, and presentation. It is up to the teacher to work with students to negotiate the topic, time allocated to the project, and design constraints.

VI. Unit Resources

The Resource index document contains a listing of all resources associated with the Unit. Included are relevant web site links, books and other publications. Listed in the document are additional files found in the Resources folder under each Unit folder on the CD-ROM. Also included are the Glossary, Evaluation rubric, Lecture PowerPoint® slides, and Unit test questions.