

Disease Detecting: Nuclear Diagnostics

What should people know about nuclear diagnostic procedures?



overview

LESSON CONTEXT

Every day in Canada and around the world, thousands of people undergo nuclear medicine procedures involving radioisotopes to detect medical problems and diseases. These procedures help doctors look deep inside the body without surgery or more invasive diagnostic tests.

LEARNING GOALS

- Understand the importance to human health of diagnosis using radioisotopes.
- Describe technologies which allow radioisotopes to be detected in the body.
- Understand that there are risks as well as benefits to any medical procedure.

LEARNING ACTIVITIES

In this lesson, students will demonstrate an understanding of various procedures which employ radioisotopes for diagnosis and will communicate about the procedures, including their risks and benefits, to the general public in the form of a visual presentation (e.g. pamphlet, poster, PowerPoint, video, etc.).

BIG IDEAS

Nuclear medicine employs many types of cutting-edge procedures for the diagnosis of disease. Each of these procedures involves both risks and benefits to the patient.

assessment & evaluation

PRIOR KNOWLEDGE AND SKILLS

- Familiarity with various types of ionizing radiation (alpha particles, beta particles and gamma rays)
- Experience representing information visually (e.g. text together with graphics)
- Experience working in cooperative small groups
- Experience locating legitimate information using internet sources

SUCCESS CRITERIA

- Student research demonstrates understanding of radiation as it is used as a diagnostic tool
- Students provide thoughtful feedback to others about their presentations

ASSESSMENT STRATEGIES

- Review of **Patient Information Assignment BLM**
- Review of **Patient Information Peer Assessment BLM**



time

60-75
MINUTES



subjects








PHYSICS
BIOLOGY
HUMAN HEALTH
MEDICINE
TECHNOLOGY



skills

COLLABORATION
CREATIVITY

resources & materials required

-   **BLM – Patient Information Assignment** – one per student
-   **BLM – Patient Information Peer Assessment** – one per student
-   **BLM – Patient Information Rubric** – one per student
-  Curriculum alignment

- Sample tri-fold medical pamphlet (from your doctor’s office, dentist’s office, etc.)
- Electronic device with internet access

minds-on

 15 MINUTES

- Begin a class discussion with the question:
 - » *Imagine that someone you know, such as a grandparent, has been having heart trouble. It has been recommended to this person that that he/she should undergo a nuclear medicine procedure such as a myocardial perfusion scan. What might this person want to know about his or her procedure?*
- Students may suggest questions such as:
 - » *What is a myocardial perfusion scan?*
 - » *Will it hurt?*
 - » *Is it safe?*
 - » *Will I glow afterwards?*
 - » *Are there any side effects?*
- Record student questions on paper, interactive white board, etc.



DID YOU KNOW?

A myocardial perfusion scan is the most common cardiac nuclear medicine procedure. The purpose of the procedure is to create images of the blood-flow patterns to the heart muscles.

action

 15 MINUTES PLUS TIME OUTSIDE OF CLASS

- Explain to the students that their task will be to research the function and use of a medical procedure which uses ionizing radiation (radiotracer) for diagnoses of a given medical condition. Before the next class, students should individually identify three medical conditions/diseases which can be diagnosed using nuclear medicine.
- Compile a list of all of the medical conditions/diseases that were identified by the students. Do not include duplicate listings.
- Provide each student with a copy of the **Patient Information Assignment BLM** and the **Patient Information Rubric BLM** (if you choose to use it).
- Review the assignment to ensure that all students understand what is required.
- Arrange the students into groups of two or three (or have the students arrange themselves into small groups). Each group will choose one of the medical conditions/diseases from the list generated by the class and will do further research to learn about the nuclear medicine procedure which is used to diagnose the condition/disease. Together, each group will create a visual presentation about the procedure, understanding that the audience is a patient about to undergo the procedure.



DID YOU KNOW?

Over 10,000 hospitals worldwide use radioisotopes in medicine, and about 90% of the procedures are for diagnosis. The most common radioisotope used in diagnosis is technetium-99, with some 30 million procedures per year, accounting for 80% of all nuclear medicine procedures worldwide.

IMPLEMENTATION OPTIONS

- Ideally, students will be familiar with various types of ionizing radiation, in particular alpha particles, beta particles and gamma rays. If not, students could participate in the **It's All Greek to Me: Radioactive Decay** lesson or read the **Radiation Info Sheet BLM** in the **From the Outside In: Biological Effects of Radiation** lesson.

consolidation

 30 MINUTES

- After each group's presentation is completed, it will be shared and assessed by another group before being assessed using the rubric.
- The groups should be encouraged to ask questions about the given procedure. The groups would then assess the pamphlets they read, taking the role of potential patients, and record their assessments on the **Patient Information Peer Assessment BLM**.

extensions

- Have the students explore how radioisotopes can be used in treatment of disease.
- Have the students find out what is involved in having a career as a Nuclear Medicine Technologist.
- Manitoba Education, in partnership with the Manitoba Division of the Canadian Cancer Society, has created "Health and Physics: A Grade 12 Manitoba Resource for Health and Radiation Physics." The resource was developed using a case-study approach that follows the cancer journey of a young woman who is diagnosed with cancer while having routine imaging done following a sport-related injury.

Student's Guide

Teacher's Guide



additional resources

CANADIAN NUCLEAR ASSOCIATION WEB PAGES

- [What is radiation?](#)
- [Quantifying radiation](#)
- [Effects on the body](#)
- [Diagnosis](#)
- [Therapy](#)

RELATED TEACHNUCLEAR LESSON PLANS

- [Attack of the 50 Foot Mutant: Radiation in Popular Culture](#)
- [From the Outside In: Biological Effects of Radiation](#)
- [It's All Greek to Me: Radioactive Decay](#)
- [Understanding Isotopes](#)



DID YOU KNOW?

Nuclear medicine can determine:

- if the heart is pumping blood adequately;
- if the brain is receiving adequate blood supply;
- if the kidneys are functioning normally;
- if the stomach is emptying properly;
- lung function;
- vitamin absorption;
- body density;
- fractures (before they can be seen on x-rays);
- sites of seizures (epilepsy);
- damage to the heart after a heart attack; and
- how transplanted organs are functioning.

background information

[Retrieved August 2019]

NUCLEAR MEDICINE

- **Fact Sheet: What is Nuclear Medicine and Molecular Imaging? – Society of Nuclear Medicine & Molecular Imaging**
Learn about nuclear medicine and molecular imaging, why they are unique and how they are used.
- **Technologist Careers in Nuclear Medicine – Society of Nuclear Medicine & Molecular Imaging**
This website identifies technologist careers in nuclear medicine.
- **radiologyinfo.ca**
Information about diagnostic imaging exams and procedures.
- **How Nuclear Medicine Works – HowStuff Works**
Positron Emission Tomography (PET) scans, SPECT, cardiovascular imaging and bone scanning.

DIAGNOSIS

- **Radioisotopes in Medicine – World Nuclear Association**
Diagnostic techniques and radiopharmaceuticals are explained, as well as an extensive list of isotopes used in medicine, including what the given isotope is used to diagnose (or treat).
- **Atoms for Health: The Role of Nuclear Techniques in Medicine – International Atomic Energy Agency**
A video about diagnostic methods and the types of isotopes used to diagnose different medical conditions.

EXAMPLES OF PATIENT INFORMATION PAMPHLETS

- **Fact Sheets – Society of Nuclear Medicine & Molecular Imaging**
Molecular imaging of diseases, including Alzheimer's, heart disease and cancer.
- **PET PROS Patient/Advocacy Resources – Society of Nuclear Medicine & Nuclear Imaging**
Fact sheets about PET Scans and nuclear medicine.