

<p>Grade: 10-12</p>	<p>Subject: Science 10, Health Science 20, Physical Science 20, Physics 30 (Extension)</p>	<p>Units: Career Investigation, Modern Physics</p>
<p>Rationale: Students will analyze a variety of careers related to the development, testing, and implementation of a diagnostic tool (PET scans).</p>		
<p>Background Information:</p> <p>[NOTE: This activity is entirely student-directed, with all materials available on the website (you can print out the student handout ahead of time) and thus a great lesson for you to leave for a substitute teacher (which can typically be difficult in secondary science courses). It covers several indicators of the Career Investigation unit in one lesson.]</p> <p>This activity has the potential to expand students' understanding of careers in science. The webquest follows the development of a new PET scan tracer molecule, highlighting the careers of the various scientists who are involved in the process. These scientists include the professor and graduate students who design and make the molecule as well as the health professionals who test, label, and administer the radiolabeled final product.</p> <p>The goal of the webquest is to get students to understand that there are many steps, and thus many people, involved in research and development in modern science. The intent is to expose them to different roles and careers, and to highlight people that are from their province to make it more relatable. There will be questions for them to answer as they watch the short videos and read the short biography summaries.</p> <p>The webquest follows sequential steps, beginning with the development of the radiotracers and background science (1. Dr. Chris Phenix, Department of Chemistry) and then highlighting the collaboration and guidance that is necessary to foster innovation (2. Carly Olafson, Graduate Student). The project involves a veterinarian (3. Dr. Kurtis Swekla, Animal Welfare Veterinarian) who cares for the animals used in testing and abides by ethical guidelines and protocols. The next step is testing and data collection at a state-of-the-art cyclotron facility (managed by the Fedoruk Centre for Nuclear Innovation and 4. Shannon Colbert, Quality Assurance Manager, Saskatchewan Centre for Cyclotron Sciences). Finally, the development process ends with the supervised delivery of the radioisotope at the hospital (5. Scott Mildenberger, Radiology Technician-Supervisor, Royal University Hospital in Saskatoon Health Region).</p> <p>There will be opportunities for students to extend their learning during the webquest as they will be asked to think of additional roles/careers involved in this pathway, and to develop</p>		

their own pathway of careers that may be involved in another realm. (ex. People involved in a hospital visit from the 911 call to release from hospital).

Lastly, there will be an opportunity for Physics 30 students to explore medical isotopes further, in the extension activity. They will look at different types of medical isotopes and their characteristics and develop decay series, with half-life timelines.

Curriculum Connections:

- SCI10-CI1b. Explore the breadth of science-related work roles and who is engaged in those work roles in the community.
- SCI10-CI1i. Represent the range of career options available related to a specific branch or sub-branch of science.
- HS20-CE1b. Explore the connection between topics in Health Science 20 and occupations of personal interest.
- HS20-CE1d. Examine the roles, responsibilities, educational qualifications and personal and professional qualities common to people involved in health-science related jobs.
- HS20-CE1e. Reflect upon personal suitability or non-suitability for a specific health-science related occupation considering a variety of criteria.
- PS20-CE1d. Examine the roles, responsibilities, educational qualifications and personal and professional qualities common to people involved in physical-science related jobs.
- PS20-CE1e. Reflect upon personal suitability or non-suitability for a specific physical-science related occupation considering a variety of criteria.

Extension Activity:

- PH30-MP2d. Represent nuclear reactions involving alpha, beta and gamma decay using words, diagrams and equations.
- PH30-MP2e. Explain that some isotopes undergo natural radioactive decay, and that half-life is a measure of the rate of radioactive decay.
- PH30-MP2f. Assess the short- and long-term implications of radiation on living things, including the effects on different types of tissues and cells.
- PH30-MP2n. Analyze societal and environmental impacts of applications of nuclear technologies such as medical isotopes, food irradiation, smoke detectors, industrial radiography, pesticide tracers, nuclear weapons, nuclear reactors and nuclear waste disposal.

Lesson Objectives/Concepts:

- Students will develop an understanding of the connection between science topics and careers.
- Students will investigate different career pathways - their role, responsibilities, and required education.
- Students will reflect on different careers and their predicted suitability in that role.

- Students will explore and develop an additional career pathway related to an area of personal interest.
- [Extension] Students will analyze medical isotopes used in modern society - their decay, half-life, short- and long-term effects, and any societal and environmental impact.

Materials: Internet access to webpage, student handout

Time: Approx. 60 minutes

Introduction (5 minutes):

1. If you haven't discussed PET scans in class, then give an overview of the topic. Explain that PET scans are a diagnostic tool that uses very small (high nanogram amounts) of a radioactive isotope that is injected in order to form an image of a targeted area of the body.
2. Ask students if they know of anyone who has had a PET scan.

Activities/Procedure (about 60 minutes):

1. Distribute the student handout to be completed by the students.
2. With internet access they can complete the assignment individually. They will have 5 video interviews to watch and reflect on. Webpage access:
<https://renayez9.wixsite.com/careerswebquest>

Summary:

Discuss their answers to a pathway that they came up with from the assignment.

Assessment:

Using the answer key in the TEACHER RESOURCE document, their assignment can be assessed.

Extensions/Connections:

Students who wish to do further exploration, can look at the different medical isotopes that are used. There is an opportunity to explore indicators from the Physics 30 course in this extension assignment: representing nuclear decay, half life, implications of radioactive materials, societal and environmental considerations, etc.

Step 2: Research/Testing

To put an idea/innovation into action, a lot of testing and research is required. This next step explains what a graduate student, Carly Olafson, does and her role in the development of a new PET scan radiotracer.

1. Explain what Carly's research involves.
2. Outline the education and training Carly has taken thus far.
3. How is a graduate student's day different from that of a high school student? How is it different from an undergraduate university student's day?
4. Outline 3 pieces of information that Carly shares that can be encouraging to high school students.
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5. Does being a grad student/researcher interest you? Explain.

2. Outline her educational pathway to this career.
3. What advice does she have to offer to high school students?
4. Would you consider this career? Explain.

Step 5: the PET Scan

After all the testing has been done and the process has been approved, patients will benefit from the opportunity to use the new diagnostic tool. At the Royal University Hospital in the PET/CT scan department you will be introduced to Scott Mildenerger and his career highlights.

1. What is Scott Mildenerger's job description?
2. What schooling and training did he need for his job?
3. What types of diseases and medical conditions do PET scans help to diagnose?
4. Would you consider this career? Explain.

List one more career that could fit into this pathway. What would its job description be?
Where do you think it would fit in the steps of this pathway?

Trace your own pathway related to research, development, or an event associated with science
or the healthcare system. Outline at least 4 careers that would be involved.

Watch the additional videos on the EXTRA VIDEOS page. Choose one of the video topics and
discuss any ethical considerations involved in the process of the medical advancement.
Comment on whether you think all the resources needed (money, people, research time,
testing of subjects, etc.) is worth it for the technique they are discussing.

ETHICS:

IS IT WORTH IT? EXPLAIN.

EXTENSION ACTIVITY

This activity is geared toward Physics 30 students, but anyone can take on the task of learning more about medical isotopes. Some areas to research are suggested, but the opportunity to add to them is yours.

Choose any number of medical isotopes from the following list and research their use and functionality. Add others to the list as well.

- Fluorine-18
- Molybdenum-99/Technetium-99
- Cobalt-60
- Iodine-131
- Iodine-125
- Xenon-133
- Iridium-192
- Other-
- Other-

In a chart format, find information on the following for each isotope chosen:

- Characteristics/uses
- Decay series or equation
- Half-life
- Short and long term effects

In addition, answer the following questions:

1. What are the societal impacts of the use of medical isotopes?
2. What are the environmental impacts of the use of medical isotopes?