CNIC Member Spotlight: TRIUMF

How Canada's Particle Accelerator Centre is expanding the supply network of a critical medical isotope

In 1937, brothers John and Ernest Lawrence were concerned about the health of their mother Gunda, who was suffering from abdominal cancer and was given 3 months to live. John was a doctor and Ernest was a physicist who had invented a particle accelerator called a Cyclotron. The two were collaborating on research and had an idea for how to treat their mother's cancer. They used Ernest's cyclotron to direct a radiation beam at Gunda's abdomen. It was risky since this was the first time such a procedure had been attempted before. Miraculously, it worked. Gunda's cancer had gone into remission after a few treatments and she lived another 22 years.

Today, medical cyclotrons are used to produce a variety of medical isotopes. Examples include Fluorine-18, used for Positron Emission Tomography (PET) scans. At the TRIUMF facility in Vancouver, British Columbia, researchers are developing methods to produce another in-demand medical isotope Technetium-99m (Tc99m) at existing medical cyclotron facilities.

TRIUMF is a particle accelerator research centre and was founded in 1968 as a collaboration between Simon Fraser University, the University of British Columbia, and the University of Victoria. The three founding universities named it the Tri-University Meson Facility (TRIUMF). The University of Alberta joined shortly after and today TRIUMF has grown to 21 members and associate members across Canada. The facility houses 600 research staff and hosts nearly 900 guest users per year researching topics such as particle physics, detector development, and nuclear medicine (including Tc99m production).

Tc99m is the most widely used medical isotope worldwide. It is the isotope of choice in Single Photon Emission Computed Tomography (SPECT) imaging which is used to diagnose a wide variety of medical conditions including cancer, heart disease, and Alzheimer's to name a few.

Canada has long been one of the world's leading suppliers of Tc99m. Approximately a third of the world's supply used to come from the NRU nuclear reactor in Chalk River, Ontario. NRU reached its end of life and was permanently shut down in 2018.

The CycloMed99 project at TRIUMF aims to diversify the supply of this critical isotope by developing an innovative process to produce it at existing medical cyclotron facilities with minimal modification.

The solution involves using a cyclotron to create a beam of radiation. When the beam is aimed at a target containing the isotope Molybdenum-100, Tc-99m is produced. After irradiation, the target is dissolved and filtered using an ion exchange column to separate the Tc99m. Finally, the Tc-99m is sterilized and prepared for use.

Through innovation, TRIUMF is carrying on the tradition of Canadian leadership in Tc-99m production and ensuring that patients around the globe will continue to benefit from the world's most widely used medical isotope.

For more information on TRIUMF and the CycloMed99 project, visit www.triumf.ca. For more information on the Canadian Nuclear Isotope Council, visit www.canadianisotopes.ca.

References

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