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Medical radioisotopes made at TRIUMF: Accelerating medicine for Canada

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One of TRIUMF's main objectives is to develop isotopes for use across applications in science and medicine. The nuclear medicine division has a long history of producing short-lived F-18 and C-11 as Positron Emission Tomography (PET) tracers for the Pacific Parkinson's Research Centre. Recently, we have expanded to investigate the production of isotopes to help address looming shortages of important clinical isotopes and promising new isotopes that are of increasing interest to chemists, biologists and medical researchers.

Herein, we present the status of our Tc-99m effort, which is used in 20-40 million nuclear medicine procedures worldwide every year. Typically, Tc-99m is made available via a generator through the beta decay of Mo-99, which originates from nuclear reactors. Canada has played a pivotal role in the Mo-99 supply with a capacity of producing 80% of the world's demand with the NRU nuclear reactor but due to its planned shutdown in 2016 an alternative production method is needed. TRIUMF in collaboration with other Canadian institutions is leading the effort to produce Tc-99m directly on a small cyclotron via the Mo-100(p,2n) reaction. Recent successes have seen 10 Ci (370 GBq) of Tc-99m produced, enough to supply the Greater Vancouver area.

Proton-induced cyclotron production of radiometallic isotopes requires the irradiation of solid material, mandating non-trivial upgrades to most medical cyclotrons. We are investigating the use of liquid targets to produce radiometals in order to increase their availability to the medical community. With this new approach, we hope to open the door for the development of novel PET. To date, Ga-68, Zr-89, Sc-44, Y-86, and Cu-61 have been demonstrated.

Finally, a brief discussion will ensue on TRIUMF's efforts to apply our ISOL technique for the isolation of radiotherapeutic isotopes at the ISAC facility at TRIUMF. Progress on the isolation of At-211 (via Rn-211 decay) and At-209 (via Fr-213) will be presented. At-211 is an alpha emitting isotope with the potential to treat malignancies such as leukemia. At-209, a gamma-ray emitter, can be used together with At-211 to follow its progression through and accumulation in the body. At-209 was produced and separated to perform the first successful phantom images on a SPECT camera, demonstrating it to be a new promising asset for cancer therapy research.

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