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Production of unconventional radioisotopes, radiochemistry development and preclinical studies for cancer theranostics at TRIUMF

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Using unconventional radionuclides for cancer treatment has been gaining popularity in recent years thanks to the remarkable results from the clinical studies with 177Lu, 223Ra and 225Ac1–3. TRIUMF launched a campaign to produce 225Ac from 232Th spallation4. Benefiting from this program, several other interesting alpha-emitters are co-produced, including 213Bi, 227Th, and 212Pb, which we have developed processes to purify5. TRIUMF's ISOL facility allows the production of Tb isotopes, including 155Tb which we use as an imaging companion for 225Ac and 177Lu6.

Those unconventional radionuclides require specific chelators for efficient and stable labelling, due to their larger sizes and different chemical properties compared to conventional radiometals. We have developed several novel chelators for those radionuclides7. The novel chelators were attached to tumour targeting peptides and were subsequently labelled with radioisotopes.

Preclinical imaging and biodistribution studies with peptides targeting melanoma or neuroendocrine tumour were performed, and the results demonstrated tumour specific uptake and low background uptake, indicating the promises of the novel radionuclides and chelators. Therapy studies with 225Ac is undergoing.

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