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REVOLUTIONISING RADIOTHERAPY

The University of Queensland's Centre for Advanced Imaging are using Kromek's Quant GR1 in preclinical studies with the focus of developing alpha therapies for more effective cancer treatment.

Summary

The Australian Institute for Bioengineering and Nanotechnology (AIBN) at the University of Queensland's Centre for Advanced Imaging (CAI) have integrated Kromek's Quant GR1 into their preclinical workflow to assess the efficacy and behaviour of new alpha radiotherapies. The small footprint and ease of use of the Quant GR1 has already allowed the team to develop a key understanding of the degradation process of the alpha-emitting radioisotopes and identify their daughter radioisotopes. The detector will continue to be a key element in the preclinical workflows, helping expand modern cancer treatment.

It's life-changing work

As the only facility of its kind in Australia, and one of only a handful globally, the University of Queensland's Centre for Advanced Imaging (CAI) stands strong at the forefront of imaging science. Recently, considerable investments have been made in the advanced manufacturing and study of radiopharmaceuticals at CAI in the Australian Institute for Bioengineering and Nanotechnology. This branch of the CAI with its new funding can further its research into the development and production of novel imaging techniques and radiotherapeutic compounds for more effective cancer treatments.

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

AIBN
Australian Institute for Bioengineering and Nanotechnology

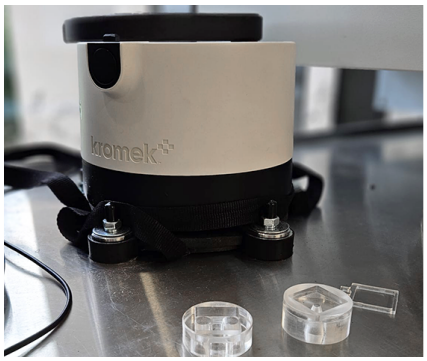
Getting new treatments ready for release

Molecular radiotherapy involves the administration and selective delivery of radioisotope payloads to the tumour to cause localized cell death and tumour regression. Increasing focus has been given to the development of new alpha therapies, incorporating alpha-emitting radioisotope payloads. Before new radiotherapeutics are used in clinical settings, their efficacy and behaviour in the body must be investigated extensively, following various steps laid out in a preclinical workflow.

This is achieved largely through translational imaging and developing a mechanistic understanding of material trafficking; discovering how the radiopharmaceuticals interact with, and accumulate within, different parts of the body and its biological/biochemical processes.

During radiotherapy, a targeted carrier is used to ensure the radioisotope payload arrives at the tumour site. However, many radioisotopes decay through sequential daughter isotopes, which can be ejected from the carrier, and go elsewhere in the body. This is particularly true for alpha-emitting radioisotopes with high energy emissions. As a result, to understand the complete effect of novel alpha therapies on the body, these daughter isotopes need to be identified and quantified in the bodily tissues they've accumulated in.

Investigating these materials is time-dependent, as some daughter isotopes decay rapidly. Therefore, the technology used for such analysis must collect and analyse results quickly, and meet the demands of the preclinical workflows to complete effective and comprehensive preclinical studies.



The Quant GR1 slotted right in

Kromek's Quant GR1 matched the requirements of the CAI team's preclinical workflow. Its small form factor and small footprint made it an ideal benchtop solution, taking up little space in the lab, and low power to operate. Real-time spectral analysis ensured the daughter isotopes with the shortest half-lives could still be recorded.

The device is versatile in its application, with a broad-spectrum count range of 4096 channels and custom efficiency calibrations, meaning a wide variety of radioisotopes can be identified and their associated dose quantified. Different sample sizes and formats, both point and distributed, can be measured using the radbeaker supplied, or custom beakers or fixtures most suited to the application. Highly accurate results are guaranteed with the CZT-based detector's high resolution.

A wealth of knowledge gained

CAI have successfully used Quant GR1 in the novel study of radiopharmaceuticals. It has been suitably implemented into research studies conducted by PhD students, academic researchers and other associated professional staff working broadly across radiochemistry, radiobiology, molecular imaging method and probe development, as well as in preclinical studies of pharmaceutical efficacy.

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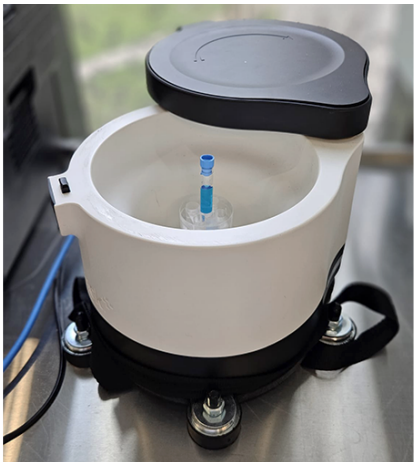
Using their own 3D printed sampler holders, the CAI team were easily able to integrate the Quant 4 GR1 into their preclinical workflows; identifying the daughter radioisotopes and probing their distribution within the small tissue samples taken.

More specifically, the Quant 4 GR1 has been utilised in experiments looking at the retention of daughter radiometals in the kidney during renal clearance. Investigating the radioisotopes' involvement in biological processes such as this is key for predicting the downstream dosimetry of radiopharmaceuticals, helping inform dosing regimens for clinical application.

"The small footprint and ease of use of the Quant 4 GR1 means it's position in the preclinical lab provides a simple and rapid approach to identifying unknown material. The Quant 4 GR1 is performing well and has demonstrated the capability to achieve desired results".

Nick Fletcher, AQIRF Research Fellow at the Centre for Advanced Imaging AIBN

Although the methods and projects are still in development, the Quant 4 GR1 has allowed the team at CAI to develop a strong foundational understanding of the degradation process of the alpha-emitting radioisotopes, the decay products present and their impact on the final biodistribution of materials in the body from the treatment.

The research programs involving the Quant 4 GR1 continue to expand, with researchers at the CAI now examining new radiometals with even more complex decay chains. Throughout this program, the Quant 4 GR1 will be able to reliably identify the daughter isotopes and continue to be a key element in the preclinical workflows in expanding modern cancer treatment.