

Signature Projects Our CBNS Signature Projects draw on the capabilities of our expert researchers to solve the big questions in bio-nano research.

OVERCOMING CHALLENGES OF *IN VIVO* TARGETING

Leaders: Associate Professor Kris Thurecht, Professor Frank Caruso

Co-Leaders: Dr Zach Houston, Mr Matt Faria

THE PROJECT

To develop an in-depth understanding of the role that the physiochemical properties of nanomaterials have on overcoming the different biological barriers that can impede nanoparticle accumulation in tissue.

THE BIG QUESTIONS

? Can we directly assess the contribution that targeting cellular proteins has on the degree of accumulation of nanomedicines within disease tissue? Is it really beneficial to use active targeting? This includes assessment of how active targeting influences immune response, accumulation in disease tissue.

? How do targeting ligands affect intra-tissue distribution and ultimate efficacy of imaging agent/therapeutic? Does the targeting ligand affect how the drug or therapeutic is distributed throughout the disease site and consequently its efficacy?

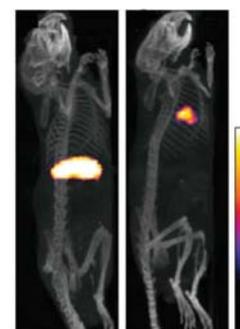
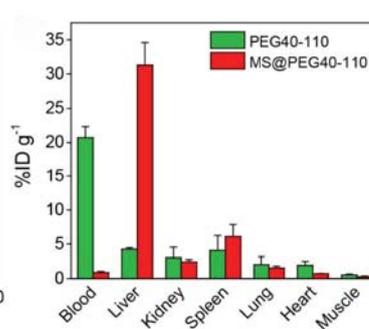
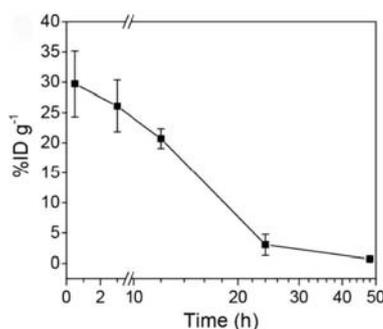
The benefits of this research

- By developing a better understanding of factors that influence effective *in vivo* targeting, we will be able to design better targeted materials, assisting both our clinical and commercial partners with advancing the field of nanomedicine.

- By obtaining high-quality investigative data into the mechanisms and dynamics of *in vivo* nanoparticle trafficking, we will be able to build a solid foundation for researchers inside and outside of the centre.

Our goals

- To combine and exploit the knowledge in the CBNS across biology, materials science, and advanced imaging to investigate the roles of particle physical properties on active targeting and *in vivo* localisation.



Biodistribution of different nanoparticles in mice determined by PET-CT showing the effect of nanomaterial properties on organ accumulation.

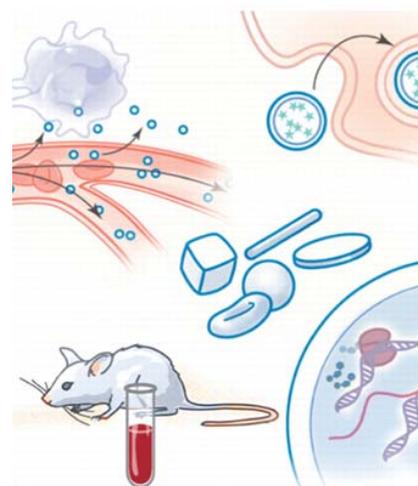
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Media highlight

- Collaborative research on targeted vaccine and therapeutic delivery entitled: Engineering Polymer Hydrogel Nanoparticles for Lymph Node-Targeted Delivery; was rated as a "Hot Paper" by the Wiley journal, *Angewandte Chemie (International Edition)*; 2016.
- Future Tense; ABC Radio National: Program featured Associate Professor Kris Thurecht describing the influence of targeting on improving nanomedicine efficacy; 2016.

Recent publications

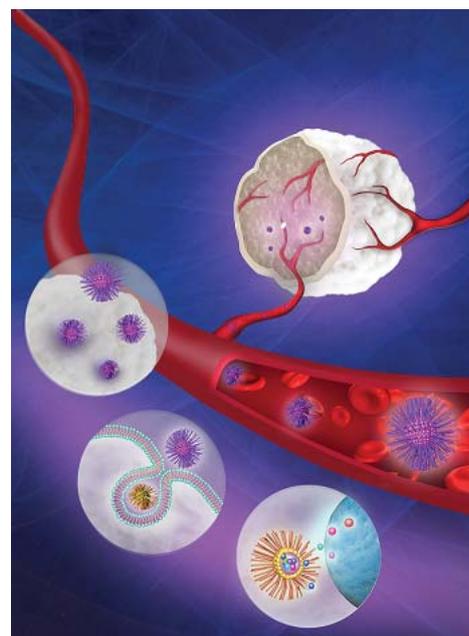
- Localised Delivery of Doxorubicin to Prostate Cancer Cells through a PSMA-Targeted Hyperbranched Polymer Theranostic; *Biomaterials*; 141, 330-339; 2017.
- Engineering Polymer Hydrogel Nanoparticles for Lymph Node-Targeted Delivery; *Angewandte Chemie International Edition*; 55, 1334; 2016.
- Nanoengineered Templated Polymer Particles: Navigating the Biological Realm; *Accounts of Chemical Research*; 49, 1139; 2016.
- Engineering Poly (ethylene glycol) Particles for Improved Biodistribution; *ACS Nano*; 9, 1571; 2015.
- Evaluation of Polymeric Nanomedicines Targeted to PSMA; Effect of Ligand on Targeting Efficiency; *Biomacromolecules*; 16 (10), 3235; 2015.



Schematic representation of the different biological barriers encountered by nanomaterials following administration into the bloodstream.

Signature Project collaborations: Overcoming challenges of *in vivo* targeting

Institution	Collaborator
University of Nottingham	Professor Cameron Alexander
University of New South Wales	Professor Maria Kavallaris
University of Melbourne	Professor Stephen Kent Dr Georgina Such
Monash University	Professor Chris Porter Dr Angus Johnston
University of Queensland	Professor Steve Mahler
Minomic International	Dr Brad Walsh
InterK Peptide Therapeutics	Dr Michael Agrez



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