



Nanoscale Organisation
and Dynamics Group

**From Safeguarding to Image Guiding of Radiotherapy
Challenges and Opportunities for quantitative MRI**

Yves De Deene

Department of Engineering, Macquarie University

Abstract In radiotherapy, ionizing radiation is delivered to the tumour in order to destroy the cancer cells. Several technological innovations in radiotherapy have enabled the treatment of cancer in a conformal manner while accounting for patient and organ motion. With these improvements in radiation treatment modalities, new medical physics and engineering challenges are on the rise. Firstly, the complexity of high-precision conformal radiation treatments has increased the need for three dimensional (3D) dosimetric quality assurance (QA) to guarantee that the radiation dose distribution in the patient matches the aimed dose distribution. Secondly, as the treatment volume is now more confined to the tumour, delineating the tumour has become more critical. In contemporary radiotherapy, the tumour volume is regarded as an invariant geometrical target during the course of the treatment. However, it is known that the tumour changes during fractionated radiotherapy. The development of quantitative magnetic resonance imaging (MRI) and spectroscopy (MRS) techniques will enable the assessment of tumour biology non-invasively, increase treatment efficiency and will give more insights in the biology of carcinogenesis.

In this talk, it will be shown how humanoid shaped hydrogel phantoms can be used to safeguard the entire treatment chain of high-precision radiotherapy. In the perspective of using quantitative MRI parameters in assessing treatment response, the physical link between tissue microstructure, tumour physiology and quantitative MRI properties will be demonstrated. Finally, a method to enhance the MRI signal sensitivity with several orders of magnitude will be discussed. This method based on hyperpolarization through spin exchange optical pumping (SEOP) will enable physiological imaging of the lungs and molecular imaging with magnetically labelled tracers. We believe that quantitative MRI has also great potential in treatment follow-up and guidance of many other diseases.

Profile Yves De Deene is a professor of Biomedical Engineering at Macquarie University who started his academic career at the Ghent University in Belgium where he worked as a medical physics researcher at the Ghent University Hospital in the field of radiotherapy and medical imaging. His primary research interest is in safeguarding modern radiotherapy and improving quantitative magnetic resonance imaging (MRI) for the guidance of radiation treatment. He collaborates with several medical centres in Sydney. More info and contact details are available at: <http://science.mq.edu.au/~dyves/>

Staff and students at all levels are welcome to attend.

Venue and Time:

This talk will be held at 2 pm on Thursday February 16 at the Campbelltown Campus in Building 21, Lecture Theatre CA.21.G.03.

Enquiries:

Prof. William S. Price

Ext. 3336 e-mail: w.price@westernsydney.edu.au