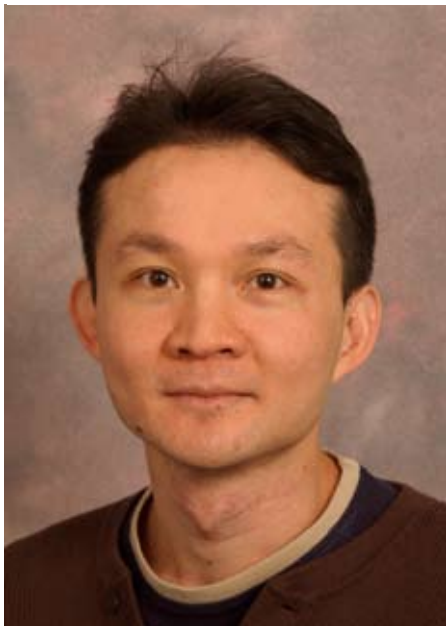


# Mike Price Fellowship: Anthony Kong

*A report from Anthony Kong, Winner of the Mike Price Fellowship 2007, who undertook a project in cutting edge radiation technology, tomotherapy intensity modulated radiation therapy (IMRT) with Professor Gregoire at St. Luc hospital in Brussels*



I am currently a final year specialist registrar in clinical oncology at the Royal Marsden Hospital in London. Following my clinical oncology FRCR exams in 2004, I undertook a PhD project at the Lincoln's Inn Laboratories (Cancer Research UK London Research Institute), looking at EGFR activation in relation to prognosis of head and neck cancers as well as investigating HER receptor activation in relation to targeted therapies in breast cancer cells. My long-term plan is to carry on doing translational research, crossing between laboratory science and clinical oncology. However, following three years in the lab ending in April 2007, I was eager to spend some time doing a much more clinical based project, especially in an area that has made a major advance in the radiation oncology. I therefore chose to do a four-month project in cutting edge radiation technology, tomotherapy intensity modulated radiation therapy (IMRT) with Professor Gregoire at St. Luc hospital in Brussels where this

advanced irradiation technique has been pioneered in head and neck cancer patients.

Many cancer centres in the world still use the older methods of radiation therapy to treat tumours. One such way is to plan radiotherapy in a two dimensional way, using bony landmarks as the guide and giving radiotherapy using anterior and posterior radiation beams, and thus irradiate all the normal structures which lie closely to the tumours to a similar dose as the tumours. Conformal radiotherapy using conventional clinical linear accelerator uses beams of radiation from more than two directions converging in the centre of tumour volume. This is combined with multi-leaf collimator (MLC) that helps to conform the radiation beams to the tumour shape to a certain extent, minimising the dose to normal structures. However, an even more advanced way of giving conformal radiotherapy is to use helical tomotherapy intensity radiation therapy (IMRT). Tomotherapy IMRT combines the art of spiral CT and intensity modulated radiation therapy. During treatment, multiple linear accelerators spirally rotate around the patient while the patient moves through the machine. The art of this technology lies in the fact that the system uses hundreds of pencil beams of radiation focusing in the tumours from all directions instead of the older ways of giving radiation through two to six radiation beams. The tomotherapy IMRT technology uses these dynamically rotating beamlets, each varying in intensity, to deliver a high dose of radiation to shape around the tumour in a highly precise way. This offers the potential

of dose escalation to the tumours while minimizing the radiation dose to the organs at risk and normal structures.

FDG-PET is a highly sensitive imaging modality that may offer better visualisation of local and locoregional tumour extension than CT scan. It may be used in delineating target volume for radiotherapy planning. Previously Professor Gregoire's team has shown that PETs based planning tumour volume was closest to pathological tumour volume in comparison with CT and MRI scans which may over-estimate the true tumour volume. Therefore, combining the FDG-PET imaging with helical tomotherapy IMRT may offer a highly attractive way of localizing the tumour and giving a high dose of radiation to the tumour in a most precise way while minimizing the dose to the normal structures.

Under Prof Gregoire's guidance, the radiation oncology unit at St. Luc Hospital has been investigating the role of FDG-PET in radiotherapy planning in head and neck cancers using tomotherapy IMRT. I was therefore delighted to be offered an opportunity to learn the state of the art technology from him. The project assessed the value of functional imaging using FDG-PET for tumour volume delineation in comparison with CT scan and its impact on dose distribution in dose escalation IMRT study using Simultaneous Integrated Boost (SIB) approach for advanced hypopharyngeal cancer patients. This is a theoretical study that aimed to escalate the prescribed therapeutic dose to the tumour volume from current 69 Gy to 81 Gy over 30 fractions. The radiotherapy plans

were generated and doses to organs at risk and normal structures were analyzed although no patient was treated based on these plans.

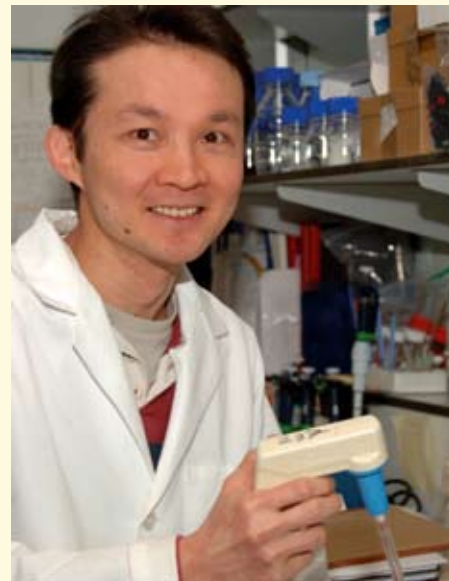
The study showed that using PET to delineate target volumes resulted in a mean reduction in the proposed target volume to be irradiated. Tomotherapy IMRT allowed dose escalation to the tumour volumes without exceeding the acceptable dose limits to critical organs in head and neck cancers. The dose to critical organs was not a limiting factor in IMRT dose escalation. Using FDG-PET in the delineation of target volumes for the tomotherapy IMRT dose escalation study resulted in only a small decrease in the mean dose to the organs at risk in comparison with CT planning although the doses to organs at risk and normal structures were consistently lower in PET delineated volumes. The limiting factor of dose escalation in our study was not the dose to organs at risk but the doses to the immediate surrounding normal structures or structures within PTV, such as laryngeal cartilage. Laryngeal oedema is the late complication of radiotherapy to laryngeal structures and the rate of this late complication is strongly correlated with dose per fraction and total dose to laryngeal structures. In our theoretical dose escalation study, the increased total dose as well as dose per fraction to the tumour volumes may also increase the rate of late complications to the surrounding normal structures. Therefore, the theoretical dose escalation IMRT study showed that dose escalation using helical IMRT is possible up to 81 Gy in advanced hypopharyngeal cancer patients without exceeding the acceptable dose to critical organs. However, in view of the possible accelerated rate of late complication rate to the surrounding normal structures, such dose escalation should not be given to patients without further research. We are currently writing up our research findings for future publication.

I am very grateful to the European Association for Cancer Research for awarding me the Mike Price fellowship to carry out the IMRT project at St. Luc Hospital in Brussels. I have learnt a lot from

Professor Gregoire who is a world leader in head and neck cancer treatment using tomotherapy IMRT and I have thoroughly enjoyed my time in Brussels. I hope to use the state of the art tomotherapy IMRT technology one day in the UK when it is available in NHS hospitals (At present only one private hospital in the UK has tomotherapy IMRT technology).

I have secured a conditional clinician scientist fellowship from the Breakthrough Breast Cancer. My plan is to combine a career in translational research and clinical oncology following the completion of my specialist training next year. I am excited about the future, especially in combining the state of the art technology in radiation oncology with translational and laboratory research to improve patient care.

*Anthony Kong*



*Sotiris Missailidis  
has been awarded the  
2008 Mike Price Fellowship*



Molecular targeted therapeutics and diagnostics is an area of growing interest for the design of agents with much higher affinity and specificity for their targets, thus achieving early diagnosis and improving therapeutic intervention. Such targets include various

classes of tumour markers that have been associated with disease prognosis, diagnosis or progression. In this project we aim to couple my group's expertise on the design, selection and functionalisation of aptamers, oligonucleotide-based targeting moieties with unparalleled affinity, specificity and selectivity for their targets, with the expertise of Dr Sotiropoulou's group at the University of Patras on molecular tumour markers, to devise novel therapeutic and diagnostic reagents for the treatment and diagnosis of epithelial cancers. This is a great opportunity, made possible with the support of the EACR and ECCO, to study different tumour markers, develop new collaborations and potentially develop novel agents of significant diagnostic and/or therapeutic value.

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