Radiation Research Society Scholars in Training (SIT) Newsletter November 2013

SIT Programme 2014

The SIT committee has already started putting together the programme for next year's workshop (RRS 2014) in Las Vegas! Thank you to all who filled out the SIT Survey. We will be putting your suggestions to practice right away. Please send further ideas and suggestions to k.butterworth@qub.ac.uk.

New SIT committee members

The SIT committee welcomes its new members who will continue working hard to ensure our success. The new committee members are:

Olivia Kelada, MSc (Yale University), **Reza Taleei**, PhD (MD Anderson), **Thomas Friedrich**, PhD (GSI Helmholtz), **Balázs G. Madas,** PhD (Hungarian Centre for Energy Research), **Mary-Keara Boss,** DVM (North Carolina State University), **Adeola Makinde**, PhD, (National Cancer Institute).

SIT Publications

Are you a SIT member who just had a publication accepted? **Please let us know** so we can highlight your accomplishments here in the SIT Newsletter! Just email your citation and abstract to k.butterworth@qub.ac.uk.

Recent SIT publications, underline indicates SIT author:

Sensitivity analysis of the relative biological effectiveness predicted by the local effect model

Thomas Friedrich, Rebecca Grün, Uwe Scholz, Thilo Elsässer, Marco Durante, Michael Scholz, Phys Med Biol. **58** (19):6827-49 (2013)

The relative biological effectiveness (RBE) is a central quantity in particle radiobiology and depends on many physical and biological factors. The local effect model (LEM) allows one to predict the RBE for radiobiologic experiments and particle therapy. In this work the sensitivity of the RBE on its determining factors is elucidated based on monitoring the RBE dependence on the input parameters of the LEM. The relevance and meaning of all parameters are discussed within the formalism of the LEM. While most of the parameters are fixed by experimental constraints, one parameter, the threshold dose Dt, may remain free and is then regarded as a fit parameter to the high LET dose response curve. The influence of each parameter on the RBE is understood in terms of theoretic considerations. The sensitivity analysis has been systematically carried out for fictitious in vitro cell lines or tissues with α/β = 2 Gy and 10 Gy, either irradiated under track segment conditions with a monoenergetic beam or within a spread out Bragg peak. For both irradiation conditions, a change of each of the parameters typically causes an approximately equal or smaller relative change of the predicted RBE values. These results may be used for the assessment of treatment plans and for general uncertainty estimations of the RBE.

Physical and biological factors determining the effective proton range

Rebecca Grün, Thomas Friedrich, Michael Krämer, Klemens Zink, Marco Durante, Rita Engenhart-Cabillic, Michael Scholz, Med. Phys. **40** (11), 111716 (2013)

Purpose: Proton radiotherapy is rapidly becoming a standard treatment option for cancer. However, even though experimental data show an increase of the relative biological effectiveness (RBE) with depth, particularly at the distal end of the treatment field, a generic RBE of 1.1 is currently used in proton radiotherapy. This discrepancy might affect the effective penetration depth of the proton beam and thus the dose to the surrounding tissue and organs at risk. The purpose of this study was thus to analyze the impact of a tissue and dose dependent RBE of protons on the effective range of the proton beam in comparison to the range based on a generic RBE of 1.1.
Methods: Factors influencing the biologically effective proton range were systematically analyzed by means of treatment planning studies using the Local Effect Model (LEM IV) and the treatment planning software TRiP98. Special emphasis was put on the comparison of passive and active range modulation techniques.
Results: Beam energy, tissue type, and dose level significantly affected the biological extension of the treatment field at the distal edge. Up to 4 mm increased penetration depth as compared to the depth based on a constant RBE of 1.1. The extension of the biologically effective range strongly depends on the initial proton energy used for the most distal layer of the field and correlates with the width of the distal penumbra. Thus, the range extension, in general, was more pronounced for passive as compared to active range modulation systems, whereas the maximum RBE was higher for active systems.
Conclusions: The analysis showed that the physical characteristics of the proton beam in terms of the width of the distal penumbra have a great impact on the RBE gradient and thus also the biologically effective penetration depth of the beam.

Implications of Intercellular Signaling for Radiation Therapy: A Theoretical Dose-Planning Study.
McMahon SJ, McGarry CK, Butterworth KT, O'Sullivan JM, Hounsell AR, Prise KM.

Int J Radiat Oncol Biol Phys. 2013 Oct 9. pii: S0360-3016(13)03027-7. doi. [Epub ahead of print]

Purpose: Recent in vitro results have shown significant contributions to cell killing from signaling effects at doses that are typically used in radiation therapy. This study investigates whether these in vitro observations can be reconciled with in vivo knowledge and how signaling may have an impact on future developments in radiation therapy.
Methods and materials: Prostate cancer treatment plans were generated for a series of 10 patients using 3-dimensional conformal therapy, intensity modulated radiation therapy (IMRT), and volumetric modulated arc therapy techniques. These plans were evaluated using mathematical models of survival following modulated radiation exposures that were developed from in vitro observations and incorporate the effects of intercellular signaling. The impact on dose-volume histograms and mean doses were evaluated by converting these survival levels into "signaling-adjusted doses" for comparison.
Results: Inclusion of intercellular communication leads to significant differences between the signalling-adjusted and physical doses across a large volume. Organs in low-dose regions near target volumes see the largest increases, with mean signaling-adjusted bladder doses increasing from 23 to 33 Gy in IMRT plans. By contrast, in high-dose regions, there is a small decrease in signaling-adjusted dose due to reduced contributions from neighboring cells, with planning target volume mean doses falling from 74 to 71 Gy in IMRT. Overall, however, the dose distributions remain broadly similar, and comparisons between the treatment modalities are largely unchanged whether physical or signaling-adjusted dose is compared.
Conclusions: Although incorporating cellular signaling significantly affects cell killing in low-dose regions and suggests a different interpretation for many phenomena, their effect in high-dose regions for typical planning techniques is comparatively small. This indicates that the significant signaling effects observed in vitro are not contradicted by comparison with clinical observations. Future investigations are needed to validate these effects in vivo and to quantify their ranges and potential impact on more advanced radiation therapy techniques.

Pictures from RRS 2013 in New Orleans!

The Radiation Research Society has established a Flickr account and has posted pictures from this year's annual meeting in New Orleans! You can access these photos by following this link. If you wish to add more photos to this album, please contact the website committee. Enjoy!

RRS Podcast

Throughout the year, interviews of prominent scientists within the radiation research society are conducted by SITs, focusing on a recent, high impact publication of theirs in the field. These podcasts are available here.

Upcoming professional meetings and courses

Do you know of any upcoming professional meetings? Please let us know, email details to k.butterworth@qub.ac.uk

The Clatterbridge Cancer Centre
NHS Foundation Trust

NHS

A course on

Radiobiology & Radiobiological Modelling in Radiotherapy

28 category-1 CPD points (Royal College of Radiologists UK) awarded

23 - 27 February 2014

Leverhulme hotel Port Sunlight, Wirral, UK.

See also www.clatterbridgecc.nhs.uk

The course provides an understanding of both the radiobiological basis of radiation treatment for cancer and the use of radiobiological models in the evaluation and optimisation of radiotherapy treatment plans. It is aimed at all professionals involved in Radiotherapy: Clinical/Radiation Oncologists, Physicists, Therapy Radiographers, Dosimetrists / Treatment Planners, Researchers and University Teachers.

For more information:
http://www.clatterbridgecc.nhs.uk/professionals/education_courses/radiobiologycourse2013.html

ICTR-PHE 2014

February 10-14, 2014

A conference that brings together the International Conference on Translational Research in Radio-Oncology and Physics for Health in Europe.

http://ictr-phe14.web.cern.ch/ictr-phe14/

ARR **Association for Radiation Research Annual Conference**

University of Sussex

29th June – 2nd July 2014

At University of Sussex, Brighton

Organisers:, Penny Jeggo, Rhona Anderson, Ester Hammond, Eric O'Neill, Marie Boyd..
Email arr@sussex.ac.uk

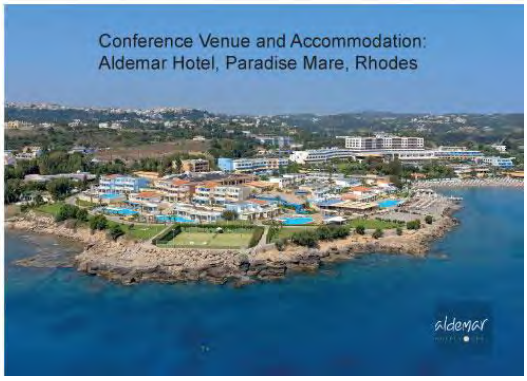
Topics:

DNA damage response (repair and signalling) and its influence by chromatin, LET and cell cycle phase.
Predictive markers for the response to radiation: imaging biomarkers, predictive biomarkers for sensitivity to RT
Radiation Protection: is low dose radiation exposure a concern; monitoring low dose radiation exposure.
Enhancing radiotherapy: hypoxia, 3D imaging and combinational therapy.
Tumour microenvironment.
Nuclear Medicine and its exploitation for tumour control
Stem Cells and their response to radiation

Confirmed speakers
Steve Jackson, Marco Durante, Mats Harms-Ringdahl, Martin Brown, Markus Lobrich, Mark Pearce, Ester Hammond, Mike Atkinson, Marie Boyd, John Waterton, Kai Rothkamm, Kate Vallis.

Weiss Award Lecture | **Travel Awards/poster prizes** | **SIT session**

http://www.le.ac.uk/cm/arr/home.html



http://www.err2014.gr/

Career opportunities

Assistant Professor, Analytical Chemistry
University of Toledo
Toledo, OH, USA: More Information

Postdoctoral Fellow, Radiation Oncology
Emory School of Medicine
Atlanta, GA, USA: More Information

Radiation Biologist, Kansas University School of Medicine
Kansas City, KS, USA: More Information

AAAS Science and Technology Policy Fellowships

Mission:

The S&T Policy Fellowships provide opportunities to outstanding scientists and engineers from a broad range of disciplines, backgrounds, and career stages to learn first-hand about policymaking and implementation while contributing their knowledge and analytical skills to policymakers. The Fellowship experience builds the capacity of scientists and engineers to effectively inform individuals and organizations that influence and determine public policies, regulations and funding decisions. The ongoing program results in a growing corps of policy-savvy leaders working across academia, government, nonprofits, and industry to serve the nation and citizens around the world.

For more information: http://fellowships.aaas.org/

SIT Committee contact details

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