There is evidence that the LQ model becomes less reliable at doses per fraction < 1 Gy, due to possible low-dose hyper-radiosensitivity, and also at > 6 Gy per fraction for reasons not yet understood though increasing vascular damage and immunological/inflammatory effects occur at higher doses per fraction. It is axiomatic that LQ must indeed overestimate effect at very high doses per fraction because the effective D0 would become unrealistically low. This makes the outcome of hypofractionated regimes less predictable: using LQ at high doses per fraction would be playing safe in predicting toxicity of hypofractionation, while overestimating the effect on the target malignancy, noting that possible hypoxia in a tumor could also limit the effectiveness of large dose fractions.

Debate: Have we reached the technology edge in radiation therapy?

SP-0507
In radiotherapy, technology without radiobiology is like driving a Porsche at 40 kilometres per hour
A. Nahum
1The Clatterbridge Cancer Centre - Wirral NHS Foundation Trust, Physics Department, Bebington Wirral, United Kingdom

Today's external-beam radiotherapy (EBRT) is technologically sophisticated but radiobiologically primitive. Since the late 1980s 'Hi-tech' has dominated EBRT at the expense of 'radiobiological intelligence'. Furthermore we have become slaves to the mantra 'evidence-based medicine', with evidence = phase-3 clinical trials: this ties our hands behind our backs. We prostrate ourselves before the 'Collective Dose-Escalation Deity e.g. via advances such as MLCs, IMRT, even protons but largely reject individual dose-escalation based on (normal-tissue) patient DVHs - this is illogical and does patients a disservice. We have become 'hostages to commercial fortune' - if the companies say 'oh we cannot give you TCP or NTCP in our planning system in case someone sues us' we meekly accept this! This lamentable 'worship of radiobiological intelligence' - our patients expect no less.

SP-0508
Against the motion: No, new technological developments will always appear
P. Munck af Rosenschöld
1Rigshospitalet, Department of Radiation Oncology, Copenhagen, Denmark

The debate revolves around the impact of technology in radiotherapy (RT). RT as a field has a long tradition of high technology involvement, and practitioners are used to frequent technology advances. Recent technology advances include advanced imaging for planning and treatment verification, as well as rotational intensity modulation RT delivery. The ability to deliver the correct dose efficiently and with millimeter precision is now feasible at most modern RT departments. The question whether we have reached "the edge in radiotherapy" is therefore warranted. Even though the technology for planning and delivery has evolved, RT clinics rely much on manual procedures for tumor delineation, treatment planning, quality control test and treatment adaptation. Simultaneously, many RT clinics face the challenge of rising patient numbers to treat using the same equipment and with less staff. Further, most RT clinics lack systematic follow-up of treatment outcomes. I argue in this talk that new technology can improve RT cost-effectiveness and patient outcomes. In addition, improved technology is warranted for safe personalized dose prescription and adapted radiation therapy. Technology advances can allow for automated procedures in the preparation of treatments, including delineation and planning information technology solutions could automate the follow-up procedures, including evaluation of quality of life, local control, patterns of relapse and survival.

Symposium: MRI throughout the treatment chain

SP-0509
MR Imaging in Radiotherapy: The evolving role of the RTT
G. Perkins
1Hamad Medical Corporation National Centre for Cancer Care & Research, Doha, Qatar

There is increasing interest and application of Magnetic Resonance Imaging simulation (MRI-SIM) into the radiotherapy localization and planning process. However, the knowledge base within the context of Radiation Therapy practice is still in development. Further, workforce development and the training plans for RTTs working in this developing area of practice has been not yet been standardized. This session targeted at RTTs, aims to provide an overview of the issues involved in developing a service where MRI scans are acquired in the treatment position, for RT planning (MRI SIM). The session will review the basic principles of MR imaging, the rationale for its use in radiotherapy and typical pulse sequences and scan protocols used for radiotherapy localization (MR-SIM). The session will also provide an overview of MR scanner modifications and accessories utilized for MR-SIM. The typical clinical workflow for MR-SIM including patient preparation, safety issues, scan optimization and CT-MR image registration using clinical examples will be presented. An overview of common staffing models and training plans for RTT’s working in MR-SIM will be reviewed

SP-0510
Dose planning based on MRI as the sole modality: Why, how and when?
J.M. Edmund
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J. M. Edmund,1 D. Andreasen,1 H.M. Kjer,2 K. Van Leemput3
1Copenhagen University Hospital, Department of Oncology, Herlev, Denmark
2Technical University of Denmark, Department of Applied Mathematics and Computer Science, Lyngby, Denmark
3Massachusetts General Hospital Harvard Medical School, Department of Radiology, Boston, USA

The debate revolves around the impact of technology in radiotherapy (RT). RT as a field has a long tradition of high technology involvement, and practitioners are used to
CT is currently routinely combined with MRI in the planning of radiotherapy (RT) at many centers in Europe. MRI is mainly introduced into the RT workflow due to a superior delineation precision of target volume and organs at risks compared to CT. This procedure, however, introduces a systematic error arising from the registration between the two modalities. Removing the CT scan and basing the entire treatment workflow, i.e., simulation, planning and delivery on MRI as the sole modality, so-called MRI-only RT, would eliminate this registration error. Electron densities, however, need to be assigned to the MRI images for dose calculation and patient setup based on digitally reconstructed radiographs (DRRs). Further, recent inventions such as the integrated MRI/PET and MRI/Linac systems have increased this need for attenuation map correction and plan adaptation based on the MRI. This presentation will present examples of the rationale behind MRI-only RT and review the past and current developments within this area. Further, the different strategies for assigning electron densities to the MR images in different parts of the body will be discussed.

SP-0511
MR Linac, continuous IGRT during radiotherapy
S.P.M. Crijns

In the current radiotherapy clinic MRI is used to support tumour and organ at risk delineations as well as tumour characterisation because of its good soft tissue contrast. Moreover, with MRI, soft-tissue structures can be visualised at high temporal resolution. Future integrated MRI/radiotherapy systems promise to visualise soft tissue structures in real-time during radiation delivery. This opens possibilities to better tailor the treatment to the momentary patient anatomy. In this presentation, we will take a look at MRI-linac hardware and explore therapy delivery prospects that arise from several dedicated MR sequences.

Symposium: Working smarter to create "my dream career"

SP-0512
A physicist’s perspective
K. Tanderup

A dream career in medical physics must be actively shaped by being pro-active, making good choices and exploiting opportunities. You need to know your field: A good career is based on the development of expertise in a multidisciplinary setting involving physics, oncology, and radiobiology. Regardless whether you are foreseeing a career in the direction of e.g. clinics, research, product development or administration: broad clinical medical physics training will always give you a sound insight in clinical workflows as well as importance/relevance/potential of new developments. Research training as accomplished during a PhD study will complement your clinical training. Explore opportunities at you University and at other Universities. Basic and advanced education within radiation therapy is available through ESTRO. This is an excellent opportunity to receive education of high quality and relevance. In particular: look out for the Physics Master Course which is taking place for the first time in autumn 2015. At ESTRO courses you will meet faculty and peers who may become professional partners and good friends. You need to do choose your field: When choosing a field, you need to take into account the relevance over the next decades. What has potential in your own department? Do your interests fit with current activities in your department? What has interest and potential on the international scene? Think in terms of the impact your research and developments would have: 1) How many patients are treated? 2) What are the prospects over the next years? 3) How can your research change clinical practice? Finally, choose your field with passion. You need to know people: Networking inside and outside your institution is of immense importance for your development. Most of us are working in highly specialized fields, and you will have benefit from finding peers who have the same interests across departments and countries. Long or short term exchanges increases your network, and broadens your view. Look out for job opportunities abroad. Do not hesitate to write emails to colleagues with your CV and your interests. Furthermore, ESTRO has multiple activities where enthusiastic young people are highly appreciated for contributing to projects. You need to exploit and create opportunities: A great CV is not only a bunch of publications. Collaborative and organisational talents and experience is of high value in modern departments of Medical Physics. Your active contribution to your department and internationally creates the best opportunities. Such contributions may be in terms of e.g. coordination of projects/meetings, doing measurements, support of your mentors, and helping peers. Knock the door of the Professor and ask "What can I do to contribute?". The best investments for your career are often on the long term and will not readily show up on your CV.

SP-0513
A clinician’s perspective
S.E. Combs

When finishing medical school and starting to work as a physician, there are many paths you can follow: Besides pure research work or movement into industry, clinical work is probably the most classical road to take after completing medical studies. However, although it can be the most rewarding, becoming a (successful) clinician can be the most demanding task. For every beginner in medicine and/or research, it is essential to evaluate the different perspectives, and to define your personal goals. During residency, a main priority is to become an excellent clinician, to acquire the knowledge to treat every patient in the best way. Keeping “up to date” and integrating novel data and results into daily practice is essential. Moreover, especially in the University setting, clinical but perhaps also preclinical projects are a main part of the daily tasks. After defining your personal goal and objectives, it is necessary to re-define your perspective, re-evaluate your personal achievements, and re-adjust your focus regularly along the road. In this context, it is equally important to keep to your personal budget in terms of Quality of Life (QOL), Work-Life-Balance as well as other personal interests. In spite of all personal planning and organization, an effective work surrounding as well as a mentor, teacher, supporter... are not only helpful, but vital.