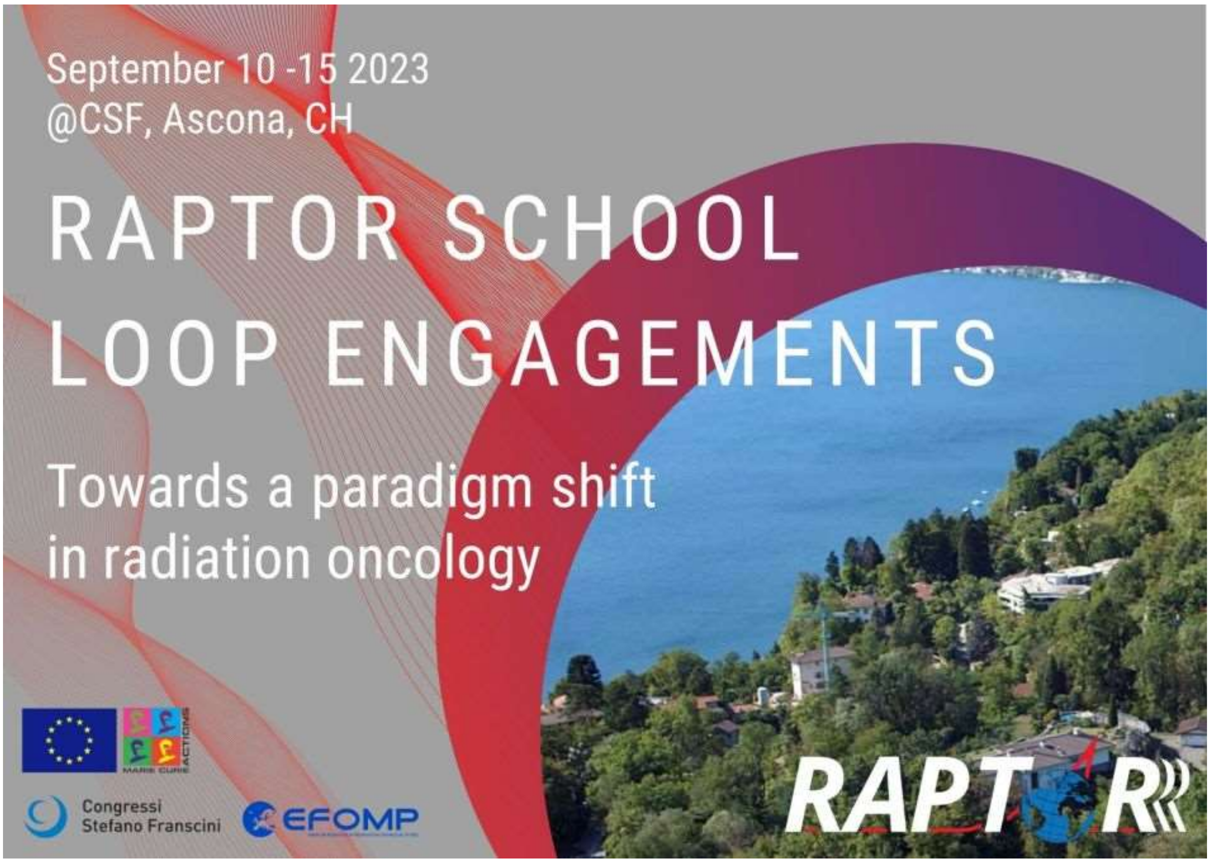

Speaker's Bio

and

Presentation abstract

Barbara BACHTIARY

Dr. Barbara Bachtiary is an experienced radiation oncologist specializing in the treatment of patients with head and neck, and skull base tumors using protons.

She received her MD from the University of Vienna and completed her general medicine and radiation oncology training at the University Medical Center of Vienna, Austria.

Throughout her career, she has conducted research at various institutions, including the Princess Margaret Hospital and the Department of Radiation Oncology at the University of Toronto (UT), Canada. Her work has been recognized with numerous awards, including the Whiteside Award from the Institute of Medical Science at UT. She has also served as Clinical Director of the H&N Tumor Group in the Department of Radiation Oncology at the University of Vienna and as Medical Director of the Rinecker Proton Therapy Center in Munich, Germany.

Barbara joined the team of the Center for Proton Therapy at PSI in 2017. She is conducting important research on H&N and various psychosocial issues affecting patients undergoing proton therapy at CPT-PSI, with support from the Swiss Cancer Society.

Financial Toxicity

Treatment-related financial distress affects patients' quality of life, choice of treatment, adherence and compliance and outcomes. It can be as toxic as chemotherapy or radiotherapy. In the worst cases, it can lead to financial insolvency and increase patient mortality. Therefore, treatment-related financial toxicity has been defined as financial toxicity.
Reported risk factors for financial toxicity include younger age at cancer diagnosis, lower income, race and ethnicity, and loss of employment. Even patients with good insurance coverage may experience financial toxicity and require family or social support.
This educational session aims to understand that a significant number of cancer patients undergoing proton therapy will experience financial hardship during and after treatment. It is important for the medical team to understand the impact of financial toxicity on the well-being of their patients and to find ways to reduce the burden. Data from the PSI will also be presented, highlighting the importance of financial toxicity in the treatment of patients.

Hedwig BLOMMESTEIN

Dr. Hedwig Blommestein obtained her PhD in 2016 at the Erasmus University Rotterdam. Her thesis was entitled "The added value of real-world evidence" and mainly focused on the value of clinical practice data for cost-effectiveness analyses of expensive cancer treatments. She was involved in setting up the Population based HAematological Registry for Observational Studies (PHAROS) and is member of the haematology executive committee of Netherlands Comprehensive Cancer Organisation. Blommestein was involved in several access and reimbursement dossiers in the Netherlands and was part of an evidence review committee for single technology appraisals by the National Institute for Health Care Excellence in the United Kingdom.

She is currently appointed associate professor at the Erasmus University Rotterdam. Her current research activities focus on disease modelling for patients with cancer, improving existing and developing new research streams for cost and outcome analysis of medical devices, and the value proposition of proton therapy. She is appointed at the Holland Particle Therapy Center (HollandPTC) to perform cost-effectiveness research on proton therapy and part of the PROTECT-trial consortium investigating the clinical and cost-effectiveness outcomes of proton therapy and state of the art photon radiotherapy for locally advanced esophageal cancer. Blommestein coordinates the Health Technology Assessment course in the master programs Health Economics, Policy & Law (HEPL) and European Master in Health Economics and Management (EuHEM). Since 2020 she is appointed as member of the scientific advisory board of the Dutch Health Care Institute in the Netherlands.

Cost effectiveness of PT

Proton therapy (PT) is an advanced form of radiation therapy, delivering high radiation dose focused on the tumor site and less dose to surrounding healthy tissues. PT has the potential to reduce side effects (e.g. fatigue, memory loss, problems with swallowing) and provide better outcomes but is also associated with high investment costs. The value of PT is assessed using the health technology (HTA) framework. The HTA framework includes amongst others an assessment of the cost-effectiveness and this part will be the focus of the presentation. Cost-effectiveness assessments are performed to inform implementation and reimbursement decisions. Given the scarcity of resources, such analyses are increasingly required. In this session we will discuss the required data collection of patient reported outcomes measures and costs. Preliminary findings as well as the challenges in analyzing these data and performing cost-effectiveness analyses will be presented.

Heinz DEUTSCHMANN

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Designing and launching a new business

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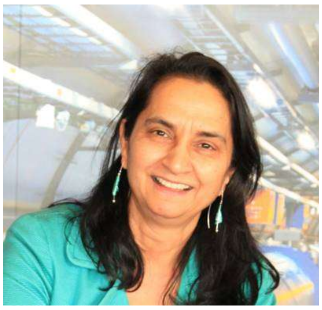
Manjit DOSANJH



Manjit Dosanjh is the former senior advisor for medical applications at CERN and Visiting Professor at University of Oxford. She is the Project Leader for STELLA (Smart Technologies to Extend Lives with Linear Accelerators) for ICEC and coordinator of the ENLIGHT (European Network for Light Ion Hadron Therapy) Network. She holds a PhD in Biochemical Engineering from the UK and her professional efforts in the fields of cancer and medical applications of physics spanning more than 30 years, during which she has held positions in various academic and research institutions in Europe and the U.S., including the Massachusetts Institute of Technology (MIT), the Lawrence Berkeley National Laboratory (LBNL), the European Commission Joint Research Centre (EC-JRC) in Italy. She joined CERN in 1999, where she was instrumental in application of technologies developed at CERN to the medical field.

Her recent research has focussed on developing robust cheaper Linacs for developing countries with project STELLA (Smart Technologies to Extend Lives with Linear Accelerators) which is addressing the lack of access to cancer treatment in LMICs (Low- and Middle-Income Countries). In addition, in collaboration with the CERN CLEAR team she is looking at VHEE (Very High Energy Electrons) technologies for the FLASH therapy.

For over 20 years she has concentrated on raising awareness in disparities in access to STEM and importance of STEM for empowerment and development helping non-profit health and science education and gender related organizations in the Geneva area and served as the UN representative in Geneva for an NGO.

ENLIGHT Network and Multidisciplinary Collaboration for Particle Therapy

The European Network for Light Ion Hadron Therapy (ENLIGHT) was established in 2002 initiated by CERN and ESTRO. Over the last 20 years, the landscape of cancer treatment with radiotherapy has never stopped improving and ENLIGHT has been an active participant in the huge changes that have taken place, in particular in Europe. At the end of the 90s the PIMMS (Proton Ion Medical Machine Study) study had just been completed and it was the trigger for establishing ENLIGHT network as it appeared that both enhanced information sharing and knowledge exchange, while keeping a common goal, was needed to bring together international experts from accelerator physics, imaging, medical physics, radiobiology and clinical medicine in the truly multidisciplinary field of particle therapy.

At that time, "multidisciplinarity" was not yet a buzzword and the network was a real pioneer in the field. Clinicians, physicists, biologists and engineers with both experience and interest in particle therapy gathered for the first time under the network's umbrella. Started with the networking funding from EU Commission, ENLIGHT itself has been involved in a number EU-funded projects. In fact, the network has worked as an open collaborative tool and has served as a common multidisciplinary platform for all the communities involved. Since its foundation, ENLIGHT has relied on the variety of skills of its members to be able to identify and tackle the technical challenges, train young researchers, support innovation and lobby for funding.

ENLIGHT has come a long way since the kick-off meeting at CERN in 2002 when only about 70 specialists from different disciplines took part and it continues to grow and flourish with now well over 1000 participants, from over 100 institutions, from over 50 countries around the globe.

Martin FAST

Martin Fast studied physics at the University of Heidelberg (2005-2010). From 2010-2013 he conducted his PhD studies on “New Methods for Motion Management During Radiation Therapy” at the German Cancer Research Center in Heidelberg. After postdoc appointments at The Institute of Cancer Research - Royal Marsden hospital in London (2013-2016) and the Netherlands Cancer Institute - Antoni van Leeuwenhoek hospital (2017-2019), Dr Fast was appointed as associate professor in the radiotherapy department of the UMC Utrecht in 2019. Dr Fast’s main research interest is the development of MRI-guided real-time adaptive radiotherapy. He is currently the (co-)author of approximately 45 peer-reviewed publications with more than 1300 citations. A full list of publications is available on GoogleScholar.

Future of real-time adaptive: 4DMRI

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Simona GIORDANENGO

Simona Giordanengo is a senior Scientist at National Institute for Nuclear Physics (INFN) in Turin (Italy) carrying research activity on detectors and instrumentation for medical applications. In 2009, she got a PhD in Physics at the University of Turin contributing in the design and development of the clinical beam delivery system in use at the Italian National Center for Oncological Hadrontherapy (CNAO, Pavia). In 2013, Simona gained a Grant for Young Researcher to lead the RIDOS project focused on GPU-based dose verification tool integrated in the dose delivery system towards real-time adaptive particle therapy. Her main interests and expertise are on gas and silicon based detectors, readout electronics and data acquisition for charged particle therapy and now her projects are focused on development of new detectors for beam monitoring able to track the single protons and ions.

Since 2022, Simona is Coordinator of the technological research activities in the INFN division of Turin.

Detectors development for advanced treatment delivery

Advanced dose delivery techniques enabling better treatment outcomes need wider range of beam characteristics as well as more and more precise beam delivery system (BDS). The challenge includes the development of new detectors for monitoring primary beams and secondary radiation.

Higher and lower beam intensities will be provided by the accelerators to improve the BDS overall shaping and timing capabilities and allow, for example, FLASH therapies and volumetric rescanning methodologies.

In this talk, basic concepts on beam delivery process and instrumentation will be reviewed, with a focus on radiation detectors guiding the pencil beam scanning and the ones measuring prompt gamma and secondary charged particles for online range verification. The ongoing efforts to improve the detectors performances and to develop new sensors, advanced readout and data acquisition system will be presented. Further work to integrate the range verification and the beam delivery systems will be also discussed together with the expected impact in the treatment verification accuracy.

Aswin HOFFMANN

Aswin Hoffmann obtained his MSc degree in Electrical Engineering at Eindhoven University of Technology (The Netherlands). He subsequently worked for four years as a research scientist on thermal imaging at the Department of Urology of the Radboud University Medical Center in Nijmegen (The Netherlands), before starting his training as a Medical Physicist in radiation therapy at the same institute. In 2007 he became certified as a Medical Physicist and continued to work at the Department of Radiation Oncology with research interests in brachytherapy, MR imaging and mathematical optimization of radiation therapy planning. On the latter subject, he obtained his PhD degree from the Radboud University in 2013. Two years earlier, he moved to MAASTRO clinic in Maastricht (The Netherlands), where he was appointed Chief Medical Physicist for brachytherapy. There, he also worked on the development of MRI-guided radiotherapy. In 2015 he moved to Dresden (Germany), where he became head of the Experimental MR-integrated Proton Therapy research group at the OncoRay – National Center for Radiation Research in Oncology. His current research interest includes the development of a prototype system for real-time MR-integrated proton therapy. He was a regular member of scientific committees of the Dutch Society for Medical Physics (NVKF) and the Netherlands Commission on Radiation Dosimetry (NCS). Since 2015 is co-chairing the Image Guidance in Particle Therapy working group of the European Particle Therapy Network (EPTN), a task force of the European Society for Radiotherapy and Oncology (ESTRO). Since 2017, he has been a faculty member of the Faculty of Medicine at the Technische Universität Dresden, and is lecturing in the Medical Radiation Sciences master's program of the same institute. In 2021, he was appointed adjunct professor at the Faculty of Medicine at the Technische Universität Dresden. He is author and co-author of over 90 peer reviewed papers and over 100 invited and proffered conference presentations.

Antje-Christin KNOPF

After obtaining her PhD degree in Physics in 2009 from the Ruperto Carola University Heidelberg, Germany (carried out at MGH/Harvard Medical School, Boston, USA), Dr. Antje-Christin Knopf pursued an academic career in medical physics with a focus on adaptive treatment approaches, image guidance, motion management and particle therapy. She worked as PostDoc at the Paul Scherrer Institute, Switzerland and at the Institute of Cancer Research, UK. She was a visiting research fellow at the National Institute of Radiological Sciences, Japan and at the University Medical Center Utrecht, Netherlands. In 2016, Dr. Knopf was appointed as Associate Professor at the University Medical Center Groningen, Netherlands and since 2022 she is a full Professor for Medical Image Processing at the FHNW, Switzerland. She successfully secured significant national and international research funding and her work is published in over eighty peer reviewed scientific articles. Over the past 10 years, Dr. Knopf built a large network of national and international collaborations with Clinical and Academic Institutions as well as private Companies.

In 2019, Dr. Knopf interrupted her scientific career for 2 years to work as scientific project management at the University Clinic Cologne in Germany, coordinating efforts to leverage the existing national potentials in innovative clinical cancer research to establish highly competitive pipelines for the transfer of innovations into patient care, the health system, the economy, and the society. At the same time, she completed an executive Master of Business Administration with a focus on innovative and strategic management in academia.

Project Management basic skills, tools and methodology resentation

Following up on the lecture self-and time management of the first RAPTOR school, we will now look at project management. We will review the different stages of a project, before we will discuss the difference between the PhD project and future projects in an academic career. We will review different project management styles and will reflect on different teamwork dynamics.

Project management can be described as the process of leading the work of a team to achieve all project goals within the given constraints. Information about the goal and the constrains is usually given in the project documentation, created at the beginning of the development process. The primary constraints are scope, time, and budget. The secondary challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined objectives.

Sibylla MARTINELLI

Grant writing and individual fellow applications

Yoland PREZADO

Research director at the French National Center for Scientific Research (CNRS). She is the founder and head of the interdisciplinary team New Approaches in Radiotherapy (NARA); based at the Institut Curie (France). The main research pathway of the NARA team is the conception and development of innovative methods in radiotherapy, with the aim of reducing its toxicity. One of its main projects is radiotherapy with proton mini-beams, funded by the European Union via an ERC consolidator grant.

Yolanda Prezado is a clinical medical physicist (Spain, France) with a multidisciplinary background. She has developed her career mainly in the field of radiotherapy, first at the University Hospital of Salamanca (Spain), then at the Biomedical Line of the European Synchrotron Radiation Facility (Grenoble, France) and, since 2011, at the CNRS. She has been chair of the scientific committee of the European Federation of Medical Physicists and is the deputy spokesperson of the International Biophysics Collaboration. Her work in proton therapy has been rewarded with the Mr et Mme Peyre prize of the French Academy of Sciences in 2021.

Mini Beams

Despite remarkable advancements, the dose tolerances of normal tissues continue to be the main limitation in radiation therapy (RT). One possible solution could be to employ distinct dose delivery methods, activating different biological processes from those ones in standard RT. Along this line, the strong spatial modulation used in minibeam radiation therapy (MBRT) has already demonstrated a significant reduction of normal tissue toxicity and an important increase of the therapeutic index for some (radio-resistant) tumors. The studies performed in that years on the combination of MBRT and charged particles promise to further increase the advantages of both approaches. This presentation will provide a general overview on MBRT, and its evolution towards protons and heavy ions.

Learning objectives

1. Learn about spatial fractionation of the dose in radiation therapy and its advantages
2. Physics aspects on MBRT
3. Radiobiology in MBRT

Serena PSOROULAS

My expertise is in proton gantries and spot scanning technology. My research activities focus on fast treatments in two main domains: 1) techniques for motion mitigation and treatments of moving tumors, and 2) ultra-high dose rates treatments (FLASH irradiations). I am currently PI of an ongoing research grant on increasing dose rate for moving targets treatments, and I am coordinating radiobiology FLASH experiments at one former clinical gantry at our institute. I am also the physics partner of a starting animal trial on FLASH proton therapy. Aside from my research activity, I am also involved in support of our clinical gantry beamlines, and in supporting external users at our facilities.

High dose rate treatments

Improvement in accelerator technology in the last 30 years resulted in very stable clinical accelerator performance. Photon and particle treatments could therefore increase in efficiency, with consequences for patient comfort, delivery throughput, and (QA) measurement efficiency. Recently, delivery of fields at ultra-high dose-rate (UHDR) has been shown to trigger an interesting differential effect between tumour and healthy tissues called the 'FLASH effect'. Despite the biology is still unknown, there is high interest in bringing this technology to the clinic, partly because of its availability (clinical accelerators require apparently limited modifications to deliver UHDR).

However, delivery of a (U)HDR external beam therapy to a patient does not come for free, and we will highlight different discussion points in the presentation: How to handle motion mitigation in a slow vs (ultra-)fast treatment? Are more treatment adaptations necessary than with standard dose rates? Where are the technological limitations? What are possible clinical benefits or limitations as function of dose rate? Are current dosimetry protocols appropriate or do we need to integrate them with additional monitoring information?

We will review the current literature to provide an overview of state-of-the-art fast treatments.

B.W. (Bas W.) RAAYMAKERS

Bas Raaymakers is working to improve cancer therapy by investigating, as well as developing, new high precision radiotherapy.

Together with prof Jan Lagendijk but also with industrial partners Elekta and Philips he designed and built a hybrid MRI accelerator to facilitate high precision, soft-tissue based image guidance for radiotherapy. This enables better radiotherapy via dose escalation while decreasing toxicity.

At the same time, the translation of this new technology to the clinic is pursued. For instance fast, on-line treatment planning, so that the patient is treated based on the latest state of the anatomy. This improves the current radiotherapy practice and at the same time is a requirement for smooth clinical introduction of the MRI accelerator.

Clinical work flow and procedures for different tumour sites are under investigation. Two major categories can be distinguished: The first is improving the existing radiotherapy patient treatments, so better conform the dose distribution to the tumour shape to minimise harm to the surroundings. The second is enabling radiotherapy as an alternative for surgery for patients currently not eligible for radiotherapy, e.g. highly mobile tumours in the kidney. The motion is too large to safely administer dose with conventional radiotherapy technology, with the on-line MRI guidance the motion uncertainty can be mitigated and radiation can be safely administered, offering a completely non-invasive treatment.

Adaptive Radiotherapy (ART) – Experiences from the photon world

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Valeria RIZZOGLIO

Valeria Rizzoglio graduated in Medical Physics at the University of Turin (Italy) in 2012 and continued her research in medical and accelerator physics at TERA Foundation-CERN for 2 years. She got her PhD at the ETH Zurich working at PSI on beam dynamics simulations and commissioning of the beamline towards Gantry 3. While at PSI, she also contributed to the design study of a new superconducting Gantry. Valeria joined the FLUKA Group at CERN in 2018 to work, as senior fellow, on Monte Carlo simulations for the upgrade of LHC dump and beam-intercepting devices within High-Luminosity LHC project. Since 2020 she works as accelerator physicist at the MedAustron Ion Therapy Center (Austria), where she is a member of the Accelerator and Beam Physics Group. Valeria is currently involved in several beam commissioning projects for different particle types and she is also responsible of the accelerator Quality Assurance program.

Accelerators for proton and particle therapy

Since 1990 the installation of hospital-based facilities with a dedicated accelerator has grown worldwide encouraged by clinical benefits arising from particle therapy. In this context, the accelerator becomes the core of the facility and must be able to provide particle beams suitable for cancer treatment. This lecture provides an overview of the accelerators commonly used in particle therapy and their working principle. For each of them, advantages and limitations with respect to the beam transport and treatment modalities are discussed. Additionally, this lecture covers the cutting-edge technology developments in particle accelerators which mainly focus on the reduction of cost and size of the facilities.

Reinhard SCHULTE

REINHARD W. SCHULTE received his diploma degree (M.S. equivalent) in physics (Diplom Physiker, Dipl. Phys.) from the University of Dortmund, Germany, in 1978 and a doctorate in medicine (Doctor of Medicine, Dr. med., summa cum laude) from the University of Cologne, Germany, in 1986. He completed residencies in radiology and radiation oncology in 1989. Dr. Schulte is now Full Professor at Loma Linda University, School of Medicine, Division of Biomedical Engineering Sciences. His research focuses on new technology in particle therapy for cancer, including proton therapy, ion therapy, and BNCT.

2D and 3D Particle Imaging

Proton therapy and ion therapy continue to grow worldwide. Image guidance for proton therapy, adaptive proton therapy technology, and respiratory motion-adapted proton therapy are relatively underdeveloped and unfit for the most advanced beam delivery techniques of pencil-beam scanning and intensity-modulated proton therapy. For example, X-ray cone beam computed tomography (CBCT) is insufficient for online treatment adaptation and motion mitigation strategies. Over the last 10 years, the proton CT (pCT) collaboration has developed the foundations of proton CT instrumentation and image reconstruction techniques. We have demonstrated the promise of pCT imaging based on analyzing individual particles but also identified shortcomings of the technology that require ongoing research and development. The goal of this talk is to present the latest developments in detector and data acquisition technologies along with more advanced computing, radiation transport Monte Carlo simulations, and AI-based tools for adaptive radiation therapy based on 2D, 3D, and 4D particle imaging and give an outlook of what it could lead to in the future.

Marco SCHWARZ

I studied Physics in Torino (IT) and then trained and worked as a clinical medical physicist at Mauriziano Hospital and at Candiolo Cancer Institute (IT). In 2001 I began my PhD project on intensity modulated radiotherapy techniques at the Netherlands Cancer Institute in Amsterdam. In 2006 I moved back to Italy to start a proton therapy project in Trento, being involved from the design phase to the commissioning of the equipment. The center in Trento started treating patients in 2014, and I worked there as Head of proton medical physics until early 2022. I am now Professor at the Radiation Oncology Department of the University of Washington and Fred Hutchinson Cancer Center in Seattle (USA). My research interests include dose calculation, plan optimization and the use of radiobiological models in treatment planning. My current research focus is on ultra-high dose rate and FLASH proton therapy. For the past 15+ years I have been involved in education with different roles and addressing different audiences, e.g. teaching Physics master students at Trento University, serving as course director and faculty member of ESTRO courses, and contributing to the new ESTRO core curriculum for medical physicists in radiation oncology. I am currently member of the Steering Committee for Physics Residency in our Department and I am co-chairing the Education and Training workpackage of the European Particle Therapy Network, an ESTRO taskforce.

Engaging education

Many scientists seem to have contradicting opinions about (their involvement in) education: on the one hand they acknowledge that a few excellent educators played a key role in their decision to be scientists, on the other hand education may be seen as something that 'distracts' away from their true passion and focus, i.e science.

I'll make the case that education is an integral part of being a scientist, or that at least it can be. Drawing from my own experience, I'll argue that there are more situations where education is a key component of our work than we often recognize, and that embracing it is one of the best way we have to make our work fulfilling and, ultimately, meaningful.

I'll shortly discuss some aspects of education that may seem at odds with the qualities of a good scientist and argue that they can be opportunities to be embraced.

I will then provide hints and examples on how to recognize the educational opportunities in activities such as writing a paper, giving a talk, or speaking to the general public.

Brita SINGERS SØRENSEN

Professor at the Department for Experimental Clinical Oncology and Danish Centre for Particle Therapy at Aarhus University Hospital in Denmark, and visiting Professor at Erasmus MC in Rotterdam. Finished her Master in Molecular Biology from Aarhus University in 2004 and her PhD in Medicine from the same institution in 2009. She worked as a Postdoc at Aarhus University from 2009, and at the Department of Integrative Oncology, British Cancer Research Institute, Vancouver, Canada from 2012-2013.

Has been working the last 15 years within the fields of tumor microenvironment, radiation biology and particle radiobiology. Her research has involved both in vitro and in vivo models, and has included studies in the area of modifiers of the tumor microenvironment. She has been leading a range of projects on the biological effects of particle beam radiation and the impact in the normal tissue, which has involved FLASH in vivo experiments.

Basic radiation biology of protons and heavier particles

Particle therapy as cancer treatment provide a more favourable dose distribution compared to x-rays. While the physical characteristics of particle radiation have been the aim of intense research, less focus has been on the actual biological response particle irradiation gives rise to. Protons and heavy particles have a higher radiobiological effect (RBE), but RBE is a complex quantity, depending on both biological and physical parameters. Currently in proton therapy a constant RBE of 1.1 is generically used, meaning that a given proton dose is expected to be equivalent to a 10% higher x-ray dose for all tumors and tissues. However, whether this is an adequate solution is under debate. There is currently no doubt that an RBE of 1.1 is an oversimplification of the actual biological response to proton irradiation, but most of the data to enlighten this is in vitro data, and there is very limited in vivo data available, although this is a more appropriate reflection of the complex biological response.

RBE is often established as measured by cell death, but emerging evidence also demonstrate an altered response in the surviving cells. This differential biological effect is not only relevant in the tumour, but also in the normal tissue. Current research in particle radiobiology is, in addition to the RBE, focusing on the molecular tissue response, and on the signalling pathways.

Olga SOKOL

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4D dose painting

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Stephanie Tanadini-Lang

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Online adaptive therapy with linacs (MRI and CBCT)

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Iuliana TOMA-DASU

Iuliana Toma-Dasu is Professor in Medical Radiation Physics and the Head of the Medical Radiation Physics division at the Department of Physics, Stockholm University, affiliated to the Department of Oncology and Pathology at Karolinska Institutet in Stockholm, Sweden, and the Editor in Chief of Physica Medica – European Journal of Medical Physics.

Iuliana Toma-Dasu studied Medical Physics at Umeå University, Sweden, where she also became a certified medical physicist and received a Ph.D. degree. She is the Coordinator of the Educational Program for the certification of Medical Physicists run at Stockholm University. Her main research interests focus on biologically optimised adaptive radiation therapy, including particle therapy, modelling the tumour microenvironment and the risks from radiotherapy.

RBE variations in protons and particle therapy and use of biological models

Current practice in proton radiotherapy planning is based on the assumption that the relative biological effectiveness (RBE) of protons has a constant value of 1.1 as recommended by the ICRU report 78. Nevertheless, increasing evidence is pointing nowadays towards to fact that the RBE of protons is not constant but it varies with the endpoint, the dose per fraction, the actual beam quality described by the linear energy transfer (LET) or other metrics and, of course, the tissue type. This talk will give a brief overview of the clinical evidence for variable proton RBE and will introduce the frame of the mathematical models for variable RBE based on in vitro cell survival data and the application of these models on proton treatment evaluation and optimisation. A critical discussion on the change from a constant 1.1 proton RBE to a variable value will also be presented.

Peter VAN LUIJK

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Presentation

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Marie-Catherine VOZENIN

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Flash RT with photons and electrons

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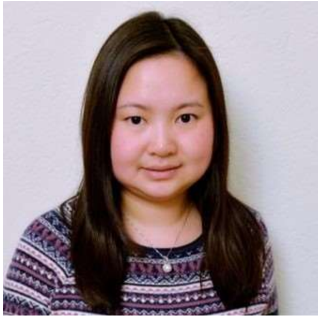
Ye ZHANG



Dr. Ye Zhang is a scientist at the Center for Proton Therapy (CPT) in Paul Scherrer Institute (PSI). Her main research is developing 4D and real-time adaptive treatments for scanned proton therapy, especially for 4D treatment planning and optimisation, motion mitigation, image guidance and motion modelling. Her curiosity extends to emerging areas like online MR-guided proton therapy, upright treatment, and leveraging artificial intelligence for radiation therapy applications.

Ye received her PhD from ETH Zurich (Switzerland) in 2013. Her academic journey includes a B.Sc and M.Sc in biomedical engineering from Xi'an Jiaotong University (China) in 2008 and the Royal Institute of Technology (KTH, Sweden) in 2010. She was a research scientist at Varian Medical Systems and later rejoined PSI as a postdoc in 2016. Her exceptional trajectory led her to become a tenure-track scientist in 2018, a distinction she solidified by achieving tenure in 2022.

Currently, she is engaging as PI for three funded research projects and has been supervising 5 PhD students and more than 30 master/bachelor theses. She is the author/co-author of over 40 peer-reviewed articles in major medical physics journals and contributed over 90 oral/post presentations to well-established conferences. She was honoured to receive the Chinese Government Award for outstanding student abroad (2012). Her influence extends to PTCOG's thoracic subcommittee memberships, reviewing 15+ journals, and serving on the Scientific Advisory Group for ESTRO 2023 and 2024.

Future of real-time adaptive: AI for 4D

Artificial intelligence (AI) is an emerging technology that is progressively reshaping the traditional radiotherapy workflow nowadays. This shift possesses the capacity to establish an innovative treatment framework characterized by its defining traits of standardization, personalization, automation, and enhanced precision and efficiency. Over an extended duration, the implementation of 4D treatment has grappled with persistent challenges, including but not limited to a laborious workflow, substantial interpatient variability, intricate planning and assessment, repetitive image acquisition and adaptation, and the lack of complete information during dose delivery. By integrating pertinent AI methods, 4D treatment can alleviate many of its challenges and evolve into a more efficient, precise, and patient-specific solution. The presentation will cover essential steps within the standard 4D workflow, providing an overview of the present status while also delving into future possibilities.