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NEW ASPECTS OF MEDICAL PHYSICS IN RADIATION ONCOLOGY AND IMAGING

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Medical Physics is the application of physics concepts, theories and methods to medicine and health care. Medical physicists play a vital and often leading role for any medical research team. Their activities cover some key areas such as cancer, heart diseases and mental illnesses. In cancer treatment, they primarily work on issues involving imaging and radiation oncology. Thus the medical physicists play a mandatory role in every radiation oncology team. The capability of controlling the growth of any cancer with radiation dose is always associated with the unavoidable normal tissue damage. Accordingly, many physical-technical developments in radiotherapy facilities are aimed to give a maximum radiation dose to tumour cells and at the same time minimize the dose to the surrounding normal tissue. For that reason, after the development of the Cobalt 60 (60Co) irradiation units in the 50 ties medical linear accelerators (linacs) were developed in the following decades. Advanced linear accelerators, helical tomotherapy and CyberKnife machines have been developed over the past two decades. Last but not least, neutrons, protons and even heavier ions have also been applied. At the same time, treatment calculation and delivery methods have been continuously improved from conventional multi-beam techniques to tumour shape conformal methods such as 3D conformal radiotherapy (3DCRT), radio surgery, intensity modulated radiotherapy (IMRT), image guided radiotherapy (IGRT), stereotactic body radiation therapy (SBRT) and adaptive radiotherapy (ART). The concentration of dose to tumour requires precise information on the shape and the anatomical geometry of the tumour within the body. The techniques providing such pieces of information in a visible form is summarized by the term of "Imaging". X-ray has played a dominant role almost from the time of its discovery in 1895. Up to now, the use of X-rays has been extended to tomographic imaging with computed tomography (CT) and other imaging modalities like ultrasound (US), magnetic resonance imaging (MRI) or positron emission tomography (PET) which have been developed over the last decades. By their combined use, the required information level on the clinical tumour target volume for radiotherapy has been tremendously raised. The physical and technical development of radiation oncology and imaging are discussed in this talk covering aspects in biology as well.

Biography

Prof. Dr. G. A. Zakaria studied physics at the University of Halle-Wittenberg in 1978, and post-graduated at the University of Goettingen and received his Ph. D in medical physics at Heidelberg University, Germany.

Prof. Zakaria is currently the chairman of the Department of Medical Radiation Physics at Gummersbach Teaching Hospital of the University of Cologne and professor of Biomedical Engineering at the University of Applied Sciences in Koethen. Furthermore he has been invited as Guest/honorary/adjunct professor in many institutes or universities in Germany, Italy, China and Bangladesh. Since January 2018, Dr. Zakaria is nominated as the Accreditation Committee-2 Chair (Radio-Oncology Physics) of the International Medical Physics Certification Board (IMPCB).

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