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From Physics to Medical Applications

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Physics has been and continues to be instrumental in the development of technologies in the biomedical domain especially the use of ionizing radiation for medical imaging and therapy ever since the discovery of X-rays by Roentgen in 1895.

The challenging demand for particle physics has pushed the detector performance to very high limits both in terms of spatial and time resolution and the cross-fertilization between particle physics detectors and imaging tools is bringing real benefits to the medical field especially in diagnosis and treatment of disease. Accelerators are routinely used in hospitals for conventional cancer radiotherapy with X-rays as well as for the production of radioisotopes, which are used for diagnosis and treatment of cancer.
Cancer is a critical societal issue. Worldwide, in 2012 alone, 14.1 million cases were diagnosed, 8.2 million people died and 32.5 million people were living with cancer[1]. The main aim of radiation therapy is to deliver a maximally effective dose of radiation to a designated tumour site while sparing the surrounding healthy tissues as much as possible.
Radiotherapy using charged hadrons (protons and light ions), with their unique physical and radiobiological properties, allows highly conformal treatment of various kinds of tumours, while delivering minimal doses to large volumes of surrounding healthy tissues. Harnessing the full potential of hadrontherapy requires the expertise and ability of physicists, physicians, radiobiologists, engineers, and information technology experts, as well as collaboration between academic, research, and industrial partners.
The necessity to catalyse efforts for collaboration among these disciplines resulted in the establishment of the European Network for Light Ion Hadrontherapy (ENLIGHT[2]). The network was launched in 2002 and was envisaged not only as a common multidisciplinary platform, where participants could share knowledge and best practices, but also as a provider of training and education.
In almost 15 years since its creation, ENLIGHT has witnessed a large increase in dedicated centres that use proton and carbon ions to treat cancer. In addition, despite the continuing high cost, innovative medical imaging techniques are starting to make their way into routine diagnostic methods. Adapting and evolving is an intrinsic feature of the ENLIGHT network while maintaining its cornerstones of multidisciplinarity, integration, openness and attention to the future generation.

1 J. Ferlay et al., European Journal of Cancer 49, 1374–1403 (2013). This is most recent global survey available to date.
2 www.cern.ch/enlight

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