The Encyclopaedia of Medical Physics II Edition: Radiotherapy Update
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I. INTRODUCTION

The Encyclopaedia of Medical Physics aimed to collect, in our opinion for the first time, terms that contribute to a very extensive (if not total) knowledge of the most important applications of Physics in Medicine. The articles were originally based on a Medical Physics Thesaurus of terms, developed in 2003 and updated in 2008 and 2011. Thus, Edition I of the Encyclopaedia included over 2800 articles explaining the foundation terms in medical physics. These were published by CRC Press (in paper, in 2013 [1]) as a two-volume set and uploaded (together with the Scientific Dictionary of Medical Physics Terms in 32 languages) on the dedicated website www.emitel2.eu as a free reference and educational resource.

Over the period 2019-2020 our editorial sub-group made a major update of radiotherapy entries within both the Thesaurus and Encyclopaedia. This update included almost 200 new or substantially modified radiotherapy articles.

II. RADIOThERAPY UPDATE

Over the past decade, in particular, advances in: proton and ion therapy, radiobiology, dosimetry, dose-calculation, imaging / image registration, and equipment design have shaped our field. We felt it essential to add articles on these topics, expanding the Encyclopaedia’s bank of radiotherapy knowledge.

We paid special attention to proton and ion therapy, including over 30 new articles in this area. These articles include: ‘Pencil Beam Scanning (PBS)’, ‘Spot spacing’ (see Figure 1), ‘Multi-field optimisation’ (see Figure 2), ‘Proton Arc Therapy’ and ‘Single room particle therapy systems’, ‘Proton radiography’ and ‘Proton CT (pCT)’.

Fig.1 In scanned proton therapy, in order to produce a homogenous dose distribution, individual spots are delivered at a given distance from each other. The distance between each spot and the spot size will affect the homogeneity. If the spots are too far apart, the distribution becomes wavy. If spots are placed closer together, the weighting of each spot gets smaller. There is a limit to how low the weight of each spot can be, and below a certain limit they are undeliverable so the spacing must balance these two factors – extracted from the ‘Spot spacing’ article

The Encyclopaedia’s radiobiology provision was expanded with new articles such as ‘Track-structure’ (see Figure 3), ‘Double Strand Breaks’, the ‘Nonhomologous end-joining Repair Pathway’, ‘Hypoxia’ and ‘FLASH’.

For dosimetry, we added articles on topics such as ‘Dose-to-medium calculations’, ‘Dose-to-water calculations’,...
Considering imaging and registration, the encyclopaedia was updated to reflect advances in MR-guided radiotherapy with new articles such as: ‘MR-linac’, ‘MRI-guided radiotherapy (MRigRT)’, ‘MR-only treatment planning’, ‘Pseudo CT’ and ‘Deformable Image Registration (DIR)’ (see Figure 4).

We also took care to reflect advances in treatment planning with articles such as ‘Dose Painting’, ‘Multi-criteria Optimisation (MCO)’ and ‘Pareto Surface’.

Finally, we expanded the encyclopaedia to cover clinical terms relevant to radiotherapy, such as: ‘Clinical Trial Endpoints’, ‘Patient Reported Outcome Measures (PROMs)’, ‘Acute Morbidity’, ‘Long Term Morbidity’ and ‘Quality-adjusted life years (QALYs)’ (see Figure 5).
III. CONCLUSION

The update of the radiotherapy field included almost 200 new articles. These were managed by the Coordinators of the Working Group on Radiotherapy – Franco Milano, Eva Bezak and Tracy Underwood.

The update covered exciting new developments in radiotherapy and expanded the bank of terms related to clinical practice. The Editorial Board would welcome suggestions from colleagues regarding new radiotherapy methods and equipment that should be included in the III Edition of the Encyclopaedia (possibly around 2031).

ACKNOWLEDGEMENTS

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REFERENCES


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