

The Encyclopedia of Medical Physics II Edition: The update of Magnetic Resonance Imaging Section

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Abstract: The update describes briefly the update of the Medical Physics Thesaurus of terms in the field of Magnetic Resonance Imaging (MRI) within the Encyclopedia of Medical Physics II Edition (published 2021).

Keywords – *Medical Physics Encyclopedia, Medical Physics Education, Medical Physics resources, Magnetic Resonance Imagin, MRI.*

I. INTRODUCTION

The Encyclopedia of Medical Physics (Edition I) was published by CRC Press in 2013 [1]. The terms included in the Encyclopedia were based on the Medical Physics Thesaurus of Terms developed in 2003 and updated in 2008. The first Edition of the Encyclopedia included articles explaining a wide range of terms in medical physics. Some of those terms were general terms, supporting a range of medical physics topics, and some were terms relating to specific imaging modalities. The Scientific Dictionary of Medical Physics Terms is a part of the Encyclopedia and it is available on the dedicated website www.emitel2.eu as a free reference and educational resource and is available in 32 languages.

In the years following the 2013 publication of the Encyclopedia, materials for the Thesaurus update were collected. A major update was made in 2019-2020. This update included about 650 new terms plus additional diagrams, tables and references. The Encyclopedia's second edition has specific fields managed by specialty teams. These fields are include; Diagnostic Radiology; Radiotherapy; Nuclear Medicine; Ultrasound Imaging; Magnetic Resonance Imaging; Radiation Protection; Non-ionising radiation protection; and General terms (including Management). The second edition of the Encyclopedia of Medical Physics was published by CRC Press in 2021 [2]. The updated terms materials from the update were uploaded to the website: www.emitel2.eu.

This article describes the update to the MRI section of the Thesaurus.

II. MAGNETIC RESONANCE IMAGING (MRI) UPDATE

Since the time of the last update of the encyclopedia, the field of MRI has expanded in both the number of scans conducted and the number of imaging devices in the field. Additionally, the range of techniques and the clinical applications of MRI has expanded. Finally, hardware improvements and developments have occurred. The update of the MRI section of the encyclopedia has attempted to reflect this change in the technology by adding terms and updating terms with new developments. In all, 30 terms were added or updated.

The MRI techniques added include new applications, which allow MRI to evaluate new biochemical pathways, for

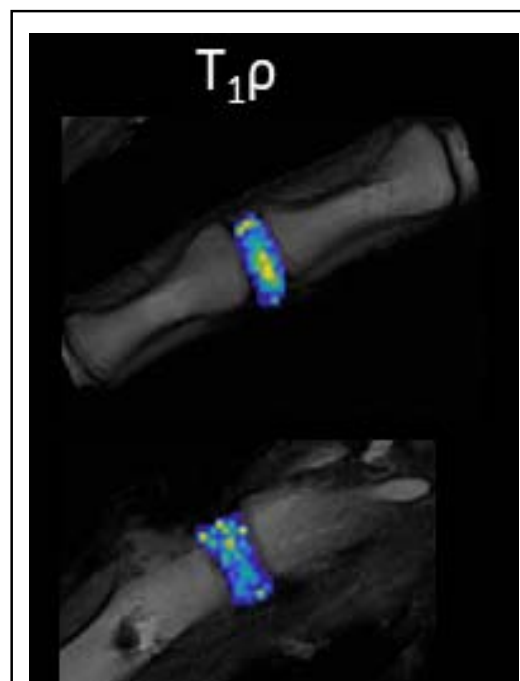


Figure 1. Images made with T1 ρ contrast. An intervertebral disk (IVD) with normal collagen (top) and an IVD with deteriorated collagen.

example, Chemical Exchange Saturation Imaging (CEST), or new contrast mechanisms, for example, Susceptibility-Weighted imaging (SWI), Diffusion Kurtosis Imaging (DKI) and Ultrashort TE (UTE) imaging.

The next set of terms added related to the new technology, which has been applied to MRI in recent years to accelerate imaging and or improve image quality. Some of these methods/techniques have been borrowed from other fields and applied to MRI, for example Compressed Sensing. Other technical developments are specific to MRI, for example Multi Band/Simultaneous Multi-Slice (SMS) Imaging.

A group of terms was added relating to hardware developments, mostly in the expansion of the available field strengths now in use with MRI as shown in the new entries for Ultra-High field MRI (7 T and more), Multi-coil transmit, and Helium-free magnets.

Finally, some terms that are not necessarily new, but were missing from the original encyclopedia were added. Some terms from the original encyclopedia were updated to ensure clarity and consistency among terms.

The majority of new terms come with figures and references. The figure are a mix of illustrations that clarify the concepts presented or illustrate images acquired with the techniques. The references allow the reader to explore topics more in-depth. Illustration for T1-rhp (T1r) imaging show below as examples.

III. CONCLUSION

The update of the Magnetic Resonance Imaging field included about 35 new or updated articles. These were managed by the Coordinators of the Working Group on MRI Terms including John Oshinski, Renata Longo from Universita di Trieste (Trieste, Italy) and Antonio De Stefano from NHS Trust Portsmouth Hospital (Portsmouth, UK).

The update covered the addition of new technologies and application of MRI and revisions of existing articles.

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