

# The Encyclopaedia of Medical Physics II Edition: The update of Nuclear Medicine and Ultrasound Sections

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**Abstract:** The paper describes briefly the update of the Medical Physics Thesaurus of terms and the related update of Nuclear Medicine and Ultrasound fields of the Encyclopaedia of Medical Physics II Edition (published 2021).

**Keywords** – Medical Physics Encyclopaedia, Medical Physics Education, Medical Physics resources.

## I. INTRODUCTION

The Encyclopaedia of Medical Physics development and its update are parts of a large project, which took over 20 years. The articles of the Encyclopaedia I Edition (published by CRC Press in 2013 [1]) were based on the Medical Physics Thesaurus of terms, developed in 2003 and updated in 2008. An additional minor update of the full Thesaurus was made in 2011. Thus, the Encyclopaedia Edition I included over 2800 articles explaining the foundation terms in medical physics. These were published by CRC Press (in paper) 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](http://www.emitel2.eu) as a free reference and educational resource.

During the following 10 years materials for the Thesaurus update were collected and a major update was made in the period 2019-2020. This update included about 650 new terms. The Encyclopaedia II Edition is naturally listed alphabetically, but it has specific parts (fields), managed by different teams, as per the narrow specialty of the contributors. These fields are on Physics of: Diagnostic Radiology; Radiotherapy; Nuclear Medicine; Ultrasound Imaging; Magnetic Resonance Imaging; Radiation Protection; Non-ionising radiation protection; General terms (including Management). This new II Edition of the Encyclopaedia of Medical Physics was printed and published by CRC Press in 2021 [2]. The materials from the update were uploaded at the same website: [www.emitel2.eu](http://www.emitel2.eu).

This paper describes briefly the nature of the update and the new terms in the fields of Nuclear Medicine and Ultrasound. Since the initial publication of the Thesaurus of Diagnostic Radiology terms (from 2003) which included topics related to gamma cameras and ultrasound transducers, both the fields have undergone significant development,

which was necessary to be included in the medical physics knowledge bank.

The Encyclopaedia Editorial Board decided to keep the historical parts in all fields, as a number of these included some important methods and scientific approaches, which can be used for future references.

## II. NUCLEAR MEDICINE UPDATE

In Nuclear Medicine, the retained topics included basic physics, radiation interaction, functioning of gamma cameras and SPECT systems etc. However, about 40 topics were updated and /or added to reflect the advances in the field since the last publication of this Encyclopaedia. For example, this edition includes an article on the revolutionary new total-body PET system as well articles on PET radiopharmaceuticals such as Rb-82, N-13 etc. Other new topics include nanoparticle and quantitative imaging.

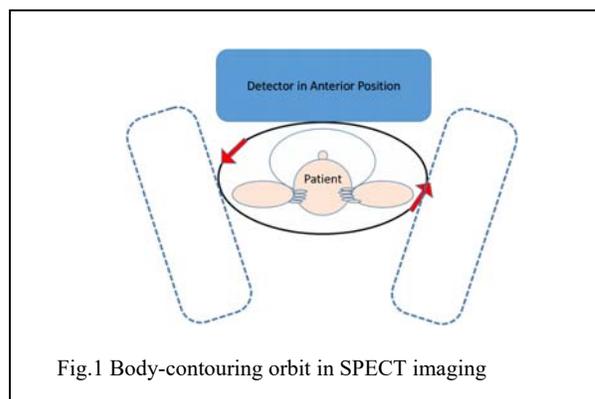
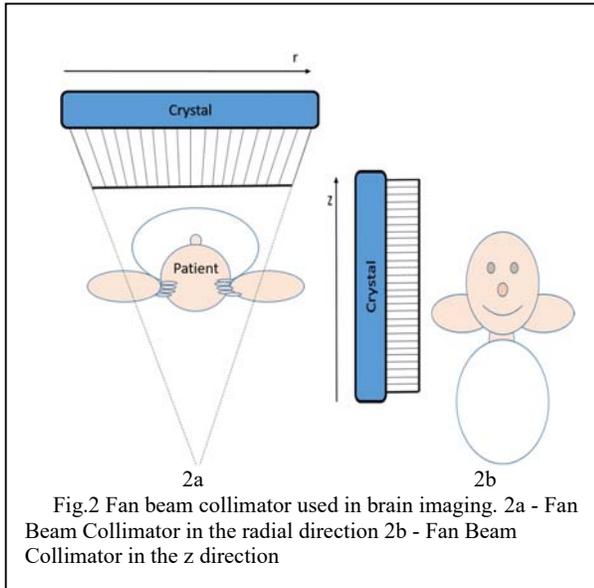


Fig.1 Body-contouring orbit in SPECT imaging

Some new articles emphasised the practical aspects of acquiring clinical data, such as the role of body-contouring orbits in SPECT data acquisition (see Fig. 1) and the role of fan-beam collimators for brain imaging (see Fig. 2).

Additionally, several new radiopharmaceuticals used in clinical nuclear medicine imaging such as pentetreotide, oxine, mebrofenin were added. These articles describe the practical use of these agents in clinical practice and should serve well to educate the reader about their specific roles in clinical imaging.



### III. ULTRASOUND UPDATE

In Ultrasound imaging, the retained topics included basic physics of transducers, propagation of sound waves and interference phenomenon. About 35 topics were updated and

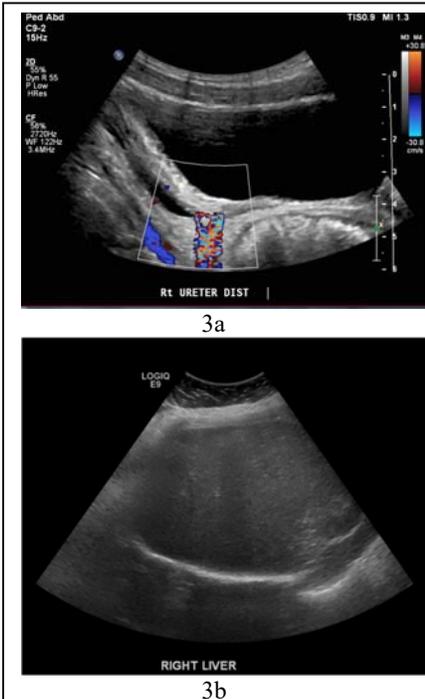
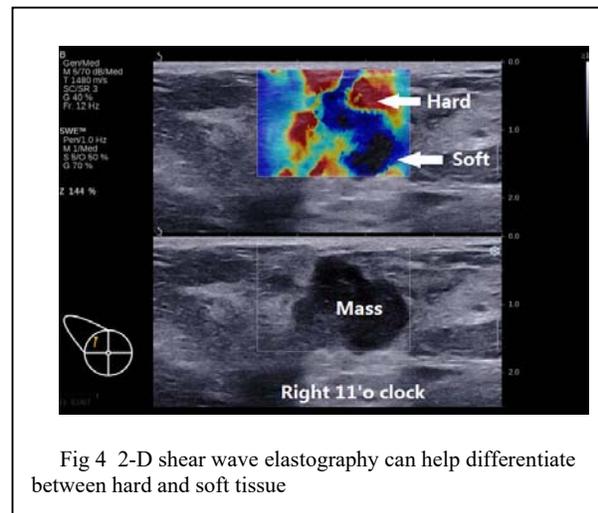


Fig 3a. Twinkle artefact in doppler imaging. 3b. Speed displacement artefact

/or added to reflect the advances in the field since the last publication of this Encyclopaedia. Of note is the inclusion of clinically relevant and common artefacts such as the twinkle artefact (Fig. 3) (common in doppler imaging) and speed displacement artefact. Other new topics include nanoparticle and quantitative imaging.

Several other topics, such as 1.5 D transducer array, 4D ultrasound as well as techniques such as spatial compounding which are common to modern clinical ultrasound imaging were included.

Some new emerging fields, such as shear wave elastography are also included in this edition. While these techniques are were not commonly used about 10 years ago, advances in electronics, techniques and sophisticated transducers have now allowed them to be used for diagnostic imaging in many modern clinics. Fig. 4 is a clinical example of the shear wave elastography image.



### IV. CONCLUSION

The update of the nuclear medicine and ultrasound imaging includes about about 75 new articles. These were managed by the Coordinators of the Working Group on Nuclear Medicine and Ultrasound Imaging: Sameer Tipnis and Kwan Ng.

The update covered most new areas of these fields. The Editorial Board shall be grateful to information from our colleagues about new methods and equipment to be included in the III Edition of the Encyclopaedia (possibly around 2031).

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2. Tabakov S, Milano F, Stoeva M, Sprawls P, Underwood T, Editors in Chief (with 152 Co-authors) of the Encyclopaedia in 2 volumes (2021) Encyclopaedia of Medical Physics – 2nd Edition, CRC Press (Taylor and Francis Publishing Group), ISBN 978-0-367-60910-8, New York, Boca Raton

3. Tabakov S, (2021), The Second Edition of the Encyclopaedia of Medical Physics and Brief History of its Development, Journal Medical Physics International, v.9, p 125-131

#### REFERENCES

1. Tabakov S, Strand S-E, Milano F, Lewis, C, Sprawls, P, (2013), Editors in Chief (with 108 Co-authors) of the EMITEL, CRC Press (Taylor and Francis Publishing Group), ISBN 978-1-

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