

THE SECOND EDITION OF THE ENCYCLOPAEDIA OF MEDICAL PHYSICS AND BRIEF HISTORY OF ITS DEVELOPMENT

S Tabakov^{1,2}

¹ King's College London, UK, ² International Organization for Medical Physics;

Abstract

The paper describes the second Edition of the Encyclopaedia of Medical Physics - published by CRC (Taylor and Francis Group) at the end of 2021. This new edition is about 25% updated and in the next MPI Journal (May 2022) we shall explain in detail the updates.

The paper also describes the road of the Encyclopaedia idea – a huge project which development started some 25 years ago.

THE FIRST STEPS

The need of an Scientific Dictionary and Encyclopaedia of Medical Physics emerged from the practical application of our first e-learning materials EMERALD (developed in the period 1995-1998) [1]. These materials aimed at support for medical physics training (e-books and Image Databases). These were the first e-learning materials in medical physics and consisted of training tasks covering the physics of: X-ray Diagnostic Radiology, Nuclear Medicine and Radiotherapy, supported with an educational image database with over 1000 images. These materials were engraved on a CD – the second CD-ROM with ISBN number in the world.

These materials were first tested (in the period 1996-1999) at the ICTP College on Medical Physics and at the new MSC in Medical Physics at Plovdiv (developed in Bulgaria through our project ERM). The EMERALD materials were written in English and it was obvious that their use by the large community of international students would be facilitated by a Scientific Dictionary of Medical Physics Terms. This idea was also supported by the delegates of the First International Conference on Medical Physics Training, which we organised in 1998 at ICTP, Trieste, Italy. Developing a Dictionary, required the development of a Thesaurus, which was also the basis of an Encyclopaedia. This way we decided for both future projects (Scientific Dictionary and Encyclopaedia) to be developed together [1].

Our next project EMERALD – INTERNET ISSUE (EMERALD II, 1999-2000) developed the first educational web site in medical physics (now www.emerald2.eu) [1]. This activity assured us that the idea about an Encyclopaedia PLUS Scientific Dictionary will have to be developed initially as an open-access e-Encyclopaedia (at that time Wikipedia did not yet exist). Naturally, this was an extremely complex endeavour and it required careful planning in several phases, which will be summarized here below.

I. THE THESAURUS AND THE SCIENTIFIC DICTIONARY

Phase 1 of the large Encyclopaedia with Dictionary project was to develop a Thesaurus – a bank of necessary scientific terms. This task, plus the first steps of the Scientific Dictionary, was included in our next project EMIT (2001-2003), which widened the scope of the training materials created in project EMERALD [1].

EMIT added Ultrasound and MR Imaging training modules. It also planned to develop a Thesaurus and translate it initially in 5 European languages: English, French, German, Italian and Swedish (the languages were related to the members of the EU project Consortium).

Phase 2 – during this phase an original system for the Dictionary development was created, which uses Identification numbers (ID) for each term from the Thesaurus. This was necessary for the cross-translation between any of the languages in the Multilingual Scientific Dictionary. In this system, all translations to various languages were based on the IDs of the English terms from the Thesaurus. Phase 2 continues from that time gradually adding new languages to the Dictionary [2,3].

Groups of translators were formed for each language, usually including specialists in the main fields of the profession (Physics of: X-ray Diagnostic Radiology, Nuclear Medicine, Radiotherapy, Ultrasound Imaging, Magnetic Resonance Imaging, Radiation Protection). General terms were covered by all translators (mainly terms related to relevant frequently-used terminology from physics, mathematics, medicine, etc).

After several updates and consolidation, the Thesaurus reached 3500 terms by 2003. The Thesaurus and first-edit Scientific Dictionary were engraved on a mini-CD and distributed for free at the World Congress on Medical Physics and Biomedical Engineering in Sydney, Australia (2003). The need for a Dictionary triggered another wave of demands for additional translations, while some Asian countries even used our Dictionary CD as catalyst to create their own national Dictionaries to/from English. Later we developed a special web site for the Dictionary, which worked some 10 years and was merged with the web site of the e-Encyclopaedia.

The value of this Multilingual Scientific Dictionary was underlined by the delegates of the First International

Conference on e-Learning in Medical Physics, which we organised in November 2003 in ICTP Trieste. Further our unique Scientific Dictionary of Medical Physics Terms played a significant role in selecting the project among almost 500 applications for the coveted EU Award for vocational training – the Leonardo Da Vinci Award. The project was the first to receive this Award (in Maastricht, 2004) [1]. This Award added a lot for the visibility of our profession – medical physics.

The full development of the Thesaurus and the Scientific Dictionary were described earlier in MPI [2,3].

II. THE ENCYCLOPAEDIA DEVELOPMENT

Phase 3 – in this period was the development of the entries/articles for the Encyclopaedia of Medical Physics. The phase was based on the already developed Thesaurus. This phase was made as a consecutive EU project- EMITEL (2005-2009) supported by the core of the previous partners and also colleagues from all over Europe and other countries associated with the IOMP [1].

There were no guides on how to develop Dictionary or Encyclopaedia and we created original methodology for this. First was important to establish what type of Encyclopaedia was to be created. A number of specialist Encyclopaedias include a relatively small number of large articles plus an extensive Index of terms, mentioned in the articles. Other Encyclopaedias consist of a large number of small articles - these are easier to search and update, however such Encyclopaedias are more difficult to organise as they include many Authors, many entries and many Reviewers. A well-known general knowledge Encyclopaedia with large number of small articles is Larousse.

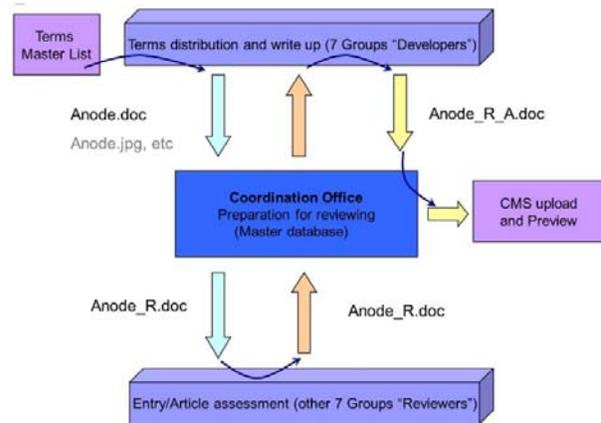
As we already had the Multilingual Scientific Dictionary, based on our Medical Physics Thesaurus, it was logical to accept the second design (with a large number of small articles). This was also suitable as a Reference in the dynamic profession of Medical Physics, where updates would be necessary quite often. This concept was also used by Wikipedia, which at that time was gaining popularity.

It was agreed that the level of the Encyclopaedic entries should be at Master level and above (MSc, or equivalent, which is usually the case for most medical physics university courses around the world). Being linked with the previous educational projects, EMITEL included a number of images from their image databases. The Encyclopaedia – First Edition was developed with around 2800 full articles/entries (all entries were written in English).

The coordination of such a huge project was extremely complex, as the articles/entries were developed by seven Groups working in parallel. These were Groups in Medical Physics of: X-ray Diagnostic Radiology, Nuclear Medicine, Radiotherapy, Ultrasound Imaging, Magnetic Resonance Imaging, Radiation Protection and General terms (Fig.2).

A special system was developed to organise the large amount of entries, each with its own text, image files and

other data (Fig.1). For ease of reference, we kept the ID numbers of the entries identical to those in the Dictionary and each Entry file had to go through several stages of reviewing. The internal process of reviewing included not only the authors and reviewers, but also the users of our materials – the students.



Swedish, Thai and Turkish. Many of these translations were made by former attendees to the ICTP College on Medical Physics.

The huge parallel coordination of so many simultaneous contributions to the Encyclopaedia and to the Dictionary by various Workgroups from many countries was made by the Project Manager and Coordinator (S Tabakov) and the Network Coordinator (V Tabakova), who devoted their spare time to the project (Fig.2). This activity was the largest international project in the profession, its results being used by thousands of colleagues each month.

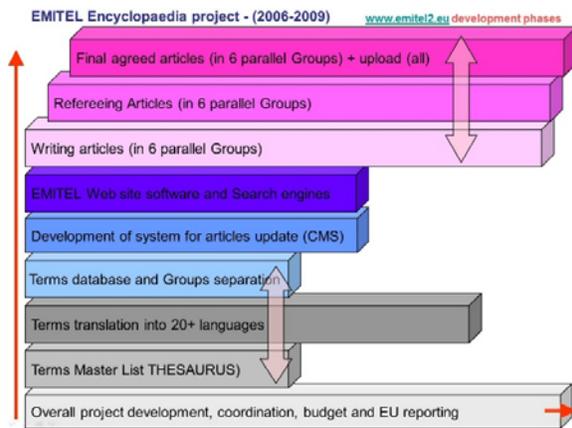


Fig.2 Phases of the Encyclopaedia and Dictionary development

In order to combine the Encyclopaedia entries (in English) with the Multilingual Dictionary, the website (www.emitel2.eu) was extended and was equipped with two search engines – one multilingual (for the Dictionary) and one in English (to search inside the text of the entries). This activity was made by M Stoeva and A Cvetkov. The fact that the Internet browsers at that time were already supporting various alphabets was very important for the work of the Dictionary.

III. FURTHER DEVELOPMENT OF THE ENCYCLOPAEDIA

Phase 5 of the Encyclopaedia (2010 – 2013) was a self-funded independent project. Its aim was to support and update the Encyclopaedia, including preparations for a paper print of the encyclopaedic entries by CRC Press.

The main CRC paper print phase was carried by the Coordination office of the Encyclopaedia and the first Editors - S Tabakov, F Milano, S-E Strand, C Lewis, P Sprawls and Editorial Assistant V Tabakova (all of them members of the previous projects). This activity underwent another editing of the content (together with CRC Press).

The CRC paper print was published in 2014 and a number of University Libraries included it in their catalogues [5]. Alongside this, the open-access web site continued to be used by colleagues from all over the world with thousands of users

per month especially from Low-and-Middle-Income (LMI) countries.

In the next several years the support for the Encyclopaedia update and web site was mainly through its coordination office. Another update of the Thesaurus and entries was made during this period and the Dictionary was enriched with 5 more languages - Finnish, Korean, Georgian, Ukrainian and Vietnamese. Currently the Multilingual Scientific Dictionary of Medical Physics Terms cross-translates in 32 languages (11 alphabets) [3].

Phase 6 was initiated in 2016 - also a self-funded independent project – preparing an update and second paper print of the e-Encyclopaedia by CRC Press. This phase was facilitated by a group of the active members of the initial stages of EMITEL. A new team of contributors was gathered to revise the existing material and to add new medical physics terms plus creating new encyclopaedic entries for these. This project was guided by the Encyclopaedia Editorial Board - S Tabakov (Chair), F Milano, M Stoeva, P Sprawls, S Tipnis, T Underwood - and was supported by many colleagues from various countries and by alumni from the MSc at King's College London.

This project phase also added new fields to the Encyclopaedia and the Scientific Dictionary – Non-Ionising Radiation Safety and Medical Equipment Management. The update of the Thesaurus included mainly the Editorial Team of the Encyclopaedia of Medical Physics (S Tabakov, F Milano, P Sprawls, M Stoeva, S Tipnis, T Underwood) and also F Fedele, E Chaloner, E Iadanza and L Pecchia. The update resulted in over 650 new terms related to the new developments of medical physics. This phase was completed in 2020.

Phase 7 - The update of some of the existing encyclopaedic articles and the inclusion of the new articles formed a new phase, which required a further system for coordinating activities of the Editorial Board (Fig.3). In parallel continued the update of all 31 translations of the Scientific Dictionary, based on the updated Curriculum. This phase was completed in 2021 and the paper print was available at the end of the year [6]. Currently the Editorial team updates the free web site of the Encyclopaedia and the Dictionary www.emitel2.eu

After this update the Encyclopaedia of Medical Physics Second Edition includes over 3300 cross-referenced full entries related to medical physics and associated technologies. The materials are supported by over 1300 figures and diagrams. The Encyclopaedia also includes over 600 synonyms, abbreviations and other linked entries. The details of the updates of the Encyclopaedia will be described in the MPI issue May 2022.



Fig.3 Work with several computers for the synchronized update of the Encyclopaedia second edition

IV. CONCLUSION AND ACKNOWLEDGEMENTS

About 150 contributors from 30 countries took part in the development of the Encyclopaedia of Medical Physics through its various stages.

Additionally over 200 colleagues took part in the translations of the Multilingual Scientific Dictionary of Medical Physics Terms into various languages.

Despite the long period of time, many of these colleagues continue to be among the leading figures in the national and international medical physics fields, but some retired and some are no longer with us. All these colleagues made free contributions to this huge project (mostly in their spare time) in order to support the global development of medical physics.

As I developed and coordinated the described projects/phases, and invited personally most of these colleagues, I am truly grateful to each one. Given the numerous and frequent use of the results from our projects during the past 25 years, I am also sure, that most young medical physicists around the world appreciate highly and are grateful for this generous collegial contribution.

In the Website (www.emitel2.eu), we have listed all colleagues who contributed to the project for Encyclopaedia of Medical Physics and Multilingual Scientific Dictionary of Medical Physics Terms. The entire network of these colleagues from over 50 countries is a real example of international collaboration.

We gratefully acknowledge the contribution of all colleagues to this huge endeavour, the initial financial support from EU to the listed projects, and the support from various institutions and organisations.

Medical Physics is a dynamic profession – in the past decades it changed dramatically and will continue to grow and develop. The constant introduction of new methods and equipment will require constant update of medical physics education. This will undoubtedly be reflected in the future

updates of the Encyclopaedia with Dictionary, as one of the main reference resources of the profession, supporting our educational activities, and also as evidence of the important contribution of medical physics to healthcare.

V. ENCYCLOPAEDIA CONTRIBUTORS

Encyclopaedia Contributors (Edition 1 and Edition 2):

ENCYCLOPAEDIA EDITORIAL BOARD:

Slavik Tabakov (Chair), King's College London, UK
Franco Milano, University of Florence, Florence, Italy
Magdalena Stoeva, Medical University Plovdiv, Bulgaria
Perry Sprawls, Sprawls Educational Foundation, NC, USA
Sameer Tipnis, Medical University South Carolina, SC, USA
Tracy Underwood, Manchester University, UK

ENCYCLOPAEDIA CONTRIBUTORS:

¹ Encyclopaedia 1st Edition; ² Encyclopaedia 2nd Edition

Barry Allen ¹, St George Hospital NSW, Australia
Monica Almqvist ¹, Lund University Hospital, Lund, Sweden
Amany Amin ², Oxford University Hospitals, Oxford, UK
Virginia Marin Anaya ², University College London Hospitals NHS Foundation Trust, London, UK
Cameron Anderson ², Imperial College Healthcare NHS Trust, London, UK
Philip Batchelor ¹, King's College London, London, UK
Stefano Bergamasco ², MedTech Projects Srl, Udine, Italy
Anna Benini ¹, Ringshospitalet, Copenhagen, Denmark
Eva Bezak ², University of South Australia, Adelaide, Australia
Adnan Bibic ¹, Lund University, Lund, Sweden
Jacques Bittoun ¹, CIERM-Hôpital de Bicêtre, France
Karin Bloch ¹, Lund University, Lund, Sweden
Kirsty Blythe ¹, King's College Hospital NHS Foundation Trust, London, UK
Cari Borrás ¹, University of Pernambuco, Brazil
Chloe Bowen ², Imperial College Healthcare NHS Trust, London, UK
Gerard Boyle ¹, St James's Hospital, Dublin, Ireland
David Bradley ¹, University of Surrey, Guildford, UK
Paola Bregant ^{1,2}, Azienda Sanitaria Universitaria Giuliano Isontina, Trieste, Italy,
Sara Brockstedt ¹, Lund University, Lund, Sweden
Luca Brombal ², University of Trieste, Trieste, Italy
Francesco Brun ², University of Trieste, Trieste, Italy
Markus Buchgeister ¹, Beuth University of Applied Sciences, Berlin, Germany
Justine Calvert ¹, King's College Hospital NHS Foundation Trust London, London, UK
Carmel J. Caruana ², University of Malta, Malta
Elizabeth Chaloner ^{1,2}, King's College Hospital NHS Foundation Trust London, London, UK
Kin-yin Cheung ¹, Hong Kong Sanatorium and Hospital, Hong-Kong, PR China
Joan Chick ¹, King's College London, London, UK
Arun Chougule ², SMS Medical College & Hospital, Jaipur, India

- Stelios Christofides**¹, Nicosia General Hospital, Nicosia, Cyprus
- Gillian Clarke**¹, King's College Hospital NHS Foundation Trust, London, UK
- James Clinch**¹, King's College Hospital NHS Foundation Trust, London, UK
- Patrick Conaghan**¹, King's College Hospital NHS Foundation Trust, London, UK
- Asen Cvetkov**^{1,2}, AM Studio Ltd, Plovdiv, Bulgaria
- Thomas Davies**², Brighton and Sussex University Hospitals NHS Trust, Brighton, UK
- Colin Deane**^{1,2}, King's College Hospital NHS Foundation Trust, London, UK
- De Denaro Mario**^{1,2}, Azienda Sanitaria Universitaria Giuliano Isontina, Trieste, Italy,
- De Stefano Antonio**², Queen Alexandra Hospital, Portsmouth, UK
- Charles Deehan**^{1,2}, King's College London, London, UK
- Harry Delis**², University of Patras, Patras, Greece
- Navneet Dulai**¹, King's College Hospital NHS Foundation Trust, London, UK
- Alex Dunlop**¹, King's College Hospital NHS Foundation Trust, London, UK
- Hannu Eskola**¹, Tampere Technical University, Tampere, Finland
- Anthony Evans**¹, University of Leeds, Leeds UK
- Phil Evans**¹, Institute of Cancer Research and Royal Marsden Hospital, Sutton, UK
- Fedele Fiammetta**², Guy's and St Thomas' NHS Foundation Trust, London, UK
- Michelle Footman**¹, King's College Hospital NHS Foundation Trust, London, UK
- George D Frey**¹, Medical University of South Carolina, SC, USA
- Callum Gillies**², University College London Hospitals NHS Foundation Trust, UK
- Jean-Yves Giraud**¹, Grenoble University Hospital, Grenoble, France
- David Goss**¹, King's College Hospital NHS Foundation Trust, London, UK
- Mark Grattan**¹, Northern Ireland Cancer Centre, Belfast City Hospital Trust, Belfast, UK
- Kristina Hakansson**¹, King's College Hospital NHS Foundation Trust, London, UK
- Nicola Harris**¹, King's College Hospital NHS Foundation Trust, London, UK
- Glafkos Havariyoun**², King's College Hospital NHS Foundation Trust, London, UK
- Gunter Helms**¹, University Clinic Göttingen, Germany
- William Hendee**¹, Medical College of Wisconsin, Milwaukee, WI, USA
- Ignacio Hernando**¹, University Hospital Río Hortega, Valladolid, Spain
- Naomi Hogg**¹, King's College Hospital NHS Foundation Trust, London, UK
- Ivana Horakova**¹, National Radiation Protection Institute, Prague, Czech Republic
- Ernesto Iadanza**², University of Florence, Florence, Italy
- Samuel Ingram**², University of Manchester, Manchester, UK
- Tomas Jansson**¹, Lund University Hospital, Lund, Sweden
- Emily Joel**¹, King's College Hospital NHS Foundation Trust, London, UK
- Bo-Anders Jonsson**¹, Lund University, Lund, Sweden
- Lena Jonsson**¹, Lund University, Lund, Sweden
- Stephen Keevil**¹, King's College London, London, UK
- Kalle Kepler**¹, University of Tartu, Tartu, Estonia
- Linda Knutsson**¹, Lund University, Lund, Sweden
- Anchali Krisanachinda**¹, Chulalongkorn University, Bangkok, Thailand
- Inger-Lena Lamm**¹, Lund University Hospital, Lund, Sweden
- Jimmy Latt**¹, Lund University, Lund, Sweden
- Martin Leach**¹, Institute of Cancer Research and Royal Marsden Hospital, London, UK
- Lorenzo Leogrande**², Fondazione IRCCS Policlinico A. Gemelli di Roma, Rome, Italy
- Cornelius Lewis**¹, King's College Hospital NHS Foundation Trust, London, UK
- Maria Lewis**¹, St George's Hospital, London, UK
- Kang Ping Lin**², Chung Yuan Christian University, Taipei
- Lefteris Livieratos**², Guy's and St Thomas' NHS Foundation Trust, London, UK
- Michael Ljungberg**¹, Lund University, Lund, Sweden
- Renata Longo**², University of Trieste, Trieste, Italy
- Ratko Magjarevic**¹, University of Zagreb, Zagreb, Croatia
- Peter Mannfolk**¹, Lund University, Lund, Sweden
- Paul Marsden**¹, King's College London, London, UK
- Kosuke Matsubara**², Kanazawa University, Kanazawa, Japan
- George Mawko**¹, Queen Elizabeth II Health Sciences Centre, Halifax, Canada
- Brendan McClean**¹, St Luke's Hospital, Dublin 6, Ireland
- Ruth McLauchlan**¹, Charing Cross Hospital, London, UK
- Siddharth Mehta**², Mount Vernon Cancer Hospital, East and North Hertfordshire Trust, London, UK
- Franco Milano**^{1,2}, University of Florence, Florence, Italy
- Ana Millan**¹, Radiophysics Techniques Inc, Zaragoza, Spain
- Angelo Filippo Monti**², ASST GOM Niguarda, Milano, Italy
- Elizabeth Morris**¹, King's College London, UK
- Ewald Moser**¹, Medical University of Vienna, Vienna, Austria
- Ben Newman**², Guy's and St Thomas' NHS Foundation Trust, London, UK
- Kwan Hoong Ng**^{1,2}, University of Malaya, Kuala Lumpur, Malaysia
- Mattias Nickel**¹, Lund University, Lund, Sweden
- Markus Nilsson**¹, Lund University, Lund, Sweden
- Anders Nilsson**¹, Lund University, Lund, Sweden
- Jonathan Noble**¹, King's College Hospital NHS Foundation Trust, London, UK
- Alain Noel**¹, Centre Alexis Vautrin, Vandœuvre-les-Nancy, Nancy, France
- Emil Nordh (Lindholm)**¹, Lund University, Lund, Sweden
- Fridtjof Nuesslin**¹, Technical University München, Munich, Germany
- Crispian Oates**¹, Newcastle Hospitals NHS Foundation Trust, Newcastle-upon-Tyne, UK
- Kjeld Olsen**¹, University Hospital Herlev, Denmark
- Johan Olsrud**¹, Lund University, Lund, Sweden
- John Oshinski**², Emory University, Atlanta, USA
- Renato Padovani**², ICTP, Trieste, Italy
- Nikolas Pallikarakis**¹, University of Patras, Patras, Greece
- Silvia Pani**², University of Surrey, Guildford, UK
- Leandro Pecchia**², University of Warwick, Coventry, UK
- Mikael Peterson**¹, Lund University, Lund, Sweden
- Jonathan Phillips**¹, King's College Hospital NHS Foundation Trust, London, UK
- Davide Piaggio**², University of Warwick, Coventry, UK

David Platten¹, Northampton General Hospital, Northampton, UK

Ervin Podgorsak¹, McGill University, Montreal, Canada

Marta Radwanska¹, AGH University of Science and Technology, Krakow, Poland

Hamish Richardson¹, King's College Hospital NHS Foundation Trust, London, UK

Luigi Rigon², University of Trieste, Trieste, Italy

Anna Rydhog¹, Lund University, Lund, Sweden

Tobias Schaeffter¹, King's College London, London, UK

Fernando Schlindwein¹, University of Leicester, Leicester UK

Mario Secca¹, New University of Lisbon, Lisbon, Portugal

Christopher Sibley-Allen¹, King's College Hospital NHS Foundation Trust, London, UK

Jonathan Siikanen¹, Lund University, Lund, Sweden

Andy Simmons¹, King's College London, London, UK

Edward AK Smith², University of Manchester, Manchester, UK

Peter Smith¹, Northern Ireland Regional Medical Physics Agency - Belfast, UK

Perry Sprawls^{1,2}, Emory University, Atlanta, GA, USA

Freddy Stahlberg¹, Lund University, Lund, Sweden

Magdalena Stoeva^{1,2}, Medical University Plovdiv, Plovdiv, Bulgaria

Sven-Erik Strand¹, Lund University, Lund, Sweden

Slavik Tabakov^{1,2}, King's College London, London, UK

Vassilka Tabakova^{1,2}, King's College London, London, UK

Jan Taprogge², Royal Marsden Hospital NHS Foundation Trust, Sutton, UK

Graeme Taylor¹, Guy's and St Thomas's NHS Foundation Trust, London, UK

Heikki Terio¹, Karolinska University Hospital, Stockholm, Sweden

Jim Thurston^{1,2}, Royal Marsden Hospital NHS Foundation Trust, London UK

Sameer Tipnis², Medical University of South Carolina, Charleston, SC, USA

Tracy Underwood^{1,2}, University of Manchester, Manchester, UK

Emil Valcinov¹, University of Patras, Patras, Greece

Bruce Walmsley¹, Guy's and St Thomas's NHS Foundation Trust, London, UK

Mark Wanklyn², GenesisCare, Sydney, Australia

Stephen Wastling¹, King's College, London, London, UK

Carla Winterhalter², University of Manchester, Manchester, UK

Ronnie Wirestam¹, Lund University, Lund, Sweden

Xia Yunzhou², University of Manchester, Manchester, UK

Paul Zarand¹, Uzsoki Hospital Medical Physics Lab. Budapest, Hungary

WORKING GROUP COORDINATORS

ENCYCLOPAEDIA 2ND EDITION:

- **Diagnostic Radiology (X-ray):** Slavik Tabakov, Perry Sprawls, Paola Bregant

- **Magnetic Resonance:** John Oshinski, Renata Longo, Antonio de Stefano

- **Non-Ionising Radiation Safety:** Fiammetta Fedele, Elizabeth Chaloner

- **Nuclear Medicine:** Sameer Tipnis

- **Radiation Protection:** Magdalena Stoeva, Jim Thurston

- **Radiotherapy:** Tracy Underwood, Franco Milano, Eva Bezak

- **Ultrasound:** Sameer Tipnis, Kwan Ng

- **General terms:** Slavik Tabakov, Magdalena Stoeva, Franco Milano, Ernesto Iadanza

WORKING GROUP COORDINATORS

ENCYCLOPAEDIA 1ST EDITION:

- **Diagnostic Radiology (X-ray):** Slavik Tabakov, Perry Sprawls, Maria Lewis

- **Magnetic Resonance:** Andrew Simmons, Stephen Keevil, Freddy Stahlberg

- **Nuclear Medicine:** Sven-Erik Strand, Bo-Anders Jonson, Mikael Peterson

- **Radiation Protection:** Cornelius Lewis, Peter Smith, Jim Thurston

- **Radiotherapy:** Franco Milano, Inger-Lena Lamm, Charles Deehan, Joan Chick

- **Ultrasound:** David Goss, Tomas Janson

- General terms: Graeme Taylor, William Hendee

EMITEL Web Software: AM Studio Ltd. - Magdalena Stoeva, Asen Cvetkov

Editorial Assistant: Vassilka Tabakova

VI. REFERENCES

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Contacts of the corresponding author: Prof. Slavik Tabakov, Vice-President IUPESM, Past President IOMP, King's College London, UK

E-mail: slavik.tabakov@emerald2.co.uk