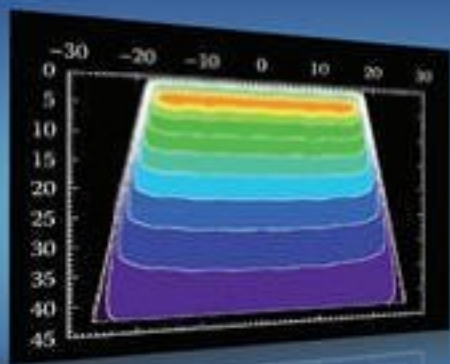


Encyclopaedia of
**MEDICAL
PHYSICS**

Volume I and II



Ebooks for Radiographers

Edited by

Slavik Tabakov • Franco Milano
Sven-Erik Strand • Cornelius Lewis
and Perry Sprawls

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Preface

INTRODUCTION

The field of medical physics and related technologies is developing rapidly. The last several decades have witnessed the introduction of pioneering methods such as computed tomography, magnetic resonance and molecular imaging, to name just a few. Usually such new methods are applied with relative ease in health care and are further modified according to their field of application. This is a dynamic development process and often the available information about the new medical equipment and methods is rather limited. The present Encyclopaedia of Medical Physics is a link in a series of collaborative projects addressing this issue.

Two of the preceding steps in this process were the EMERALD and EMIT projects (www.emerald2.co.uk), which developed training materials (e-books and image databases) to address the initial training of medical physicists. These included specific training tasks covering the fields of x-ray diagnostic radiology, nuclear medicine, radiotherapy, ultrasound imaging and MR imaging. These materials include the first ever e-books with image databases and paved the way for e-learning in the profession. These are now used in more than 60 countries around the world (the EMIT project received the inaugural award for education of the European Union – the Leonardo da Vinci Award at Maastricht, 2004).

Both EMERALD and EMIT held conferences, which assessed the materials and revealed the need for a free professional reference source linked to a multilingual dictionary of terms. This web tool was expected to quickly provide information for new, existing and old methods and equipment in medical physics. The tool (EMITEL) was specially made to support the education, training and CPD process in the profession.

EMITEL PROJECT

The initial idea for this project was developed during the period 2001–2005 and was further prepared for submission to the EU. At this stage, the project partnership included the core of the previous project partners – King’s College London (KCL) (contractor) and King’s College Hospital, University of Lund and Lund University Hospital, University of Florence, AM Studio Plovdiv and the International Organization for Medical Physics (IOMP). This was the first EU project of IOMP as an institution and paved the way for further international projects and funding. At the middle of the project, a new partner joined the partnership – the Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste), which later held the EMITEL Conference in 2008.

The objective of the new pilot project, EMITEL (European Medical Imaging Technology e-Encyclopaedia for Lifelong Learning), was to develop an original e-learning tool, which will be used for lifelong learning of a wide spectrum of specialists in medical physics. In addition to the e-encyclopaedia a multilingual digital dictionary of terms was planned to be developed to cross-translate the terms in any of its languages.

Medical imaging was emphasized in the name of the project, as this technology expands rapidly. However, radiotherapy and radiation protection were also included, together with a number of general terms associated with medical physics.

The EMITEL project (2006–2009) was funded by the EU programme, Leonardo da Vinci, as well as by the project partners. The EMITEL consortium has an agreement to continue its function after the end of the project, assuring the update of the project results.

EMITEL DICTIONARY

The EMITEL Dictionary used as a base the previous EMIT dictionary (initially available from www.emitdictionary.co.uk). The list of medical physics terms in this early dictionary was further refined and expanded. Currently, nearly 3400 terms are included. These terms were translated into 29 languages by colleagues from these countries. Thus, the original 7 languages – English, Swedish, Italian, French, German, Portuguese, Spanish – were supplemented by 22 new languages: Arabic, Bengali, Bulgarian, Chinese, Croatian, Czech, Estonian, Finnish, Greek, Hungarian, Iranian, Japanese, Korean, Latvian, Lithuanian, Malaysian, Polish, Romanian, Russian, Slovenian, Thai and Turkish.

The medical physics dictionary uses synchronized lists of terms, allowing cross-translation of terms between each two of its languages. The dictionary database is expandable and can include additional languages. The dictionary immediately became popular and currently has more than 2000 users every month (many from the developing countries, where limited professional literature is available in the specific languages).

The preparation of the dictionary was coordinated by S. Tabakov, and its software was developed by AM Studio (M Stoeva and A Cvetkov). The EMITEL consortium extends special gratitude to all translators (listed further below), who performed this task voluntarily.

EMITEL ENCYCLOPAEDIA

Each term from the dictionary is explained through an article (entry) in English. The entries, which vary from 50 to 500 words, aim at MSc level and above. The model of the encyclopaedia is built around a large number of specific entries (rather than a small number of multi-page articles), which allows for quick search and easy update. However, most of the EMITEL entries include further reading and information about other related entries in EMITEL, thus forming information strings.

Many of the entries include images, graphs, examples and other additional information. Very often this additional information is related to the images from the previous projects, EMERALD and EMIT. The consortium expresses its gratitude to all colleagues and companies who provided images and diagrams.

The encyclopaedic entries are grouped in seven categories – Physics of X-ray Diagnostic Radiology, Nuclear Medicine, Radiotherapy, Magnetic Resonance Imaging, Ultrasound Imaging, Radiation Protection and General Terms. Most entries include contributions from three specialists – author, referee and group coordinator.

A number of entries were written in parallel by several groups (e.g. Absorption) aiming to explain the entry from different perspectives. Some repetitions were allowed in order to facilitate the reader of a particular article. Where possible, abbreviations of terms (e.g. AEC) were included in the text as links to the respective full entries.

An original EMITEL website was created by AM Studio. The website uses the ability of the current Internet browsers to operate in all languages and combines the dictionary and the encyclopaedia. In this way, each translated term comes with a hyperlink displaying the corresponding entry. A multilingual search engine works with all languages of the dictionary.

The rapid development of medical physics has led to the existence of a number of acronyms and synonyms (included in the text). To deal with this problem, a second search engine was added to the website, which looks inside the full text of the entries (in English) and displays those entries where a particular synonym/acronym is mentioned. Care was taken, where possible, to include term modifications and variations.

The EMITEL website (www.emitel2.eu) is hosted by a web company. Alongside the database of terms, it has an additional internal website with content management system (CMS, also developed by AM Studio). The function of the CMS is to allow updates to existing entries and to add new information, images and diagrams. The CMS also allows for new terms to be added with new entries. In this way, EMITEL will act as the professional wikipedia of medical physics, with the difference being that only accepted entries and text will be uploaded (i.e. with editorial control). Currently, the EMITEL e-encyclopaedia has approximately 8000 users every month.

The present two volumes include the printout of all EMITEL entries (as in the website in 2012).

EMITEL REFEREEING

All entries of the encyclopaedia were refereed by specialists, who later became members of the team. To ensure that the entries are suitable for postgraduate-level usage, these were re-checked by MSc students from the MSc Medical Engineering and Physics, King's College London and King's College Hospital. Further text and images were included after this stage. The multistage refereeing of all entries was coordinated by the EMITEL administrator V. Tabakova, from the Division Imaging Sciences and Biomedical Engineering, KCL. This process took place in parallel with the completion of the encyclopaedia (2008) and continued until the end of 2011. All EMITEL referees are included in the list of contributors.

The intention of EMITEL is to continue the updates of the online material. In this way, contributors and referees are welcome to submit new articles, or to update existing articles.

EMITEL NETWORK

EMITEL is the largest international project in the profession. To develop and maintain the large volume of information in the encyclopaedia and dictionary, an international network was created. Currently it includes approximately 320 colleagues from 36 countries, more than half being translators. The network includes many senior professionals – officers and committee chairs of IOMP, EFOMP, AFOMP, AAPM, IPEM, IFMBE and current and past presidents of over 20 national medical physics societies.

The network was first discussed and agreed during the EMITEL International Conference on Medical Physics, held at ICTP, Trieste, 24–26 October 2008 (ICTP – The Abdus Salam International Centre for Theoretical Physics). The conference was attended by colleagues from 22 countries, who evaluated the materials and decided on the way forward.

The conference delegates included the current IOMP president, secretary general, treasurer, chair of ETC, chair of AHC, IFMBE secretary general, IUPESM secretary general, EFOMP president-elect, AFOMP president, AAPM president, IPEM vice-president and many distinguished colleagues from Europe and the rest of the world.

Currently, the internal links of the network are maintained through an administrator in KCL. This function will gradually transfer to the IOMP. It is expected that the number of network members will increase, as in the future colleagues who contribute new articles and materials to EMITEL will also be included. In this way, the network will assure the future support and expansion of the EMITEL encyclopaedia and dictionary as a website free to use by all colleagues.

ACKNOWLEDGEMENTS

EMITEL gratefully acknowledges the financial support from the EU Leonardo Programme and the support from the partner institutions. EMITEL is most grateful for the professional input and materials delivered by its many contributors, forming the EMITEL network. EMITEL gratefully acknowledges all materials of companies and colleagues used to enhance the articles.

Slavik Tabakov
EMITEL Coordinator
President-Elect of IOMP



How to Use EMITEL Website (www.emitel2.eu)

Select Encyclopaedia > write the term you want to see at the window > click Enter. A list with terms is displayed – against each one is a blue hyperlink related to the area of the term > click the hyperlink to read the article. EMITEL can also search inside the text of the articles. To do this, select Search in Full Text; after this, specify the area and proceed as mentioned earlier. In case of UK or American English differences (i.e. colour>color; optimise>optimize) try both spellings or search only part of the term (e.g. colo, optim).

To use the Dictionary select Dictionary > choose the input and output languages > write the term you want to see at the window > click Enter. A list with terms is displayed, where the terms are found either single, or in combination with other words (the e-Dictionary assumes that the user's Internet browser already supports the input and output languages).

To use both the encyclopaedia + dictionary select combined and proceed as mentioned earlier (this search is limited only to the title of the article, not inside its text).

The image displays two screenshots of the EMITEL website interface. The left screenshot shows the 'Encyclopaedia' search results for the term 'Dose' in the 'Diagnostic Radiology' area. It features a search bar, a 'Search' button, and a list of terms with checkboxes. The main article for 'CTDI' is displayed, including a definition and a mathematical formula:
$$CTDI = \frac{1}{nT} \int_{-\infty}^{\infty} D(z) dz$$

The right screenshot shows the 'Dictionary' search interface. It includes a search bar, a 'Search' button, and language selection options for both input and output languages. A list of terms is displayed, including 'Dose', 'Implant dose distribution', 'Incident dose', 'Inhomogeneous dose distribution', 'Integral dose', 'Lateral dose distribution', 'Lethal dose', 'Linear dose response curve', and 'Linear nonthreshold dose response'.

The website also includes new entries, updates, errata and other corrections, which have been submitted by colleagues and approved by the Editorial Board.

DISCLAIMER

The EMITEL Encyclopaedia and Dictionary include text, images and diagrams. These have been checked for viruses. EMITEL can be read with any Internet browser. The e-Dictionary assumes that the Internet browser already supports the input language and output languages.

All efforts were made for the correct translation of terms in the dictionary. Similarly, the articles in the EMITEL encyclopaedia

have been subject to internal and external refereeing. However, the EMITEL Consortium would welcome additional suggestions for their improvement.

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Contributors

LEAD EDITORS

Slavik Tabakov
EMITEL Coordinator
and
Editor (Editorial Board)
King's College London
London, United Kingdom

Franco Milano
Editor (Editorial Board)
University of Florence
Florence, Italy

Sven-Erik Strand
Editor (Editorial Board)
Lund University
Lund, Sweden

Cornelius Lewis
Editor (Editorial Board)
King's College Hospital London
London, United Kingdom

Perry Sprawls
Editor (Editorial Board)
Emory University
Atlanta, Georgia

ENCYCLOPAEDIA CONTRIBUTORS

Barry Allen
St George Hospital
Sydney, New South Wales, Australia

Monica Almqvist
Editor (Editorial Board)
Lund University Hospital
Lund, Sweden

Philip Batchelor
King's College London
London, United Kingdom

Anna Benini
Ringshospitalet
Copenhagen, Denmark

Adnan Bibic
Lund University
Lund, Sweden

Jacques Bittoun
Centre Inter-Etablissements de
Résonance Magnétique-Hôpital de
Bicêtre
Le Kremlin-Bicêtre, France

Karin Bloch
Lund University
Lund, Sweden

Kirsty Blythe
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Cari Borras
University of Pernambuco
Recife, Brazil

Gerard Boyle
St James's Hospital
Dublin, Ireland

David Bradley
University of Surrey
Guildford, United Kingdom

Paola Bregant
University Hospital "Ospedali Riuniti"
Trieste, Italy

Sara Brockstedt
Lund University
Lund, Sweden

Markus Buchgeister
Beuth University of Applied Sciences
Berlin, Germany

Justine Calvert
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Elizabeth Chaloner
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Kin-yin Cheung
Hong Kong Sanatorium and Hospital
Hong-Kong, China

Joan Chick
Editor (Editorial Board)
King's College London
London, United Kingdom

Stelios Christofides
Nicosia General Hospital
Nicosia, Cyprus

Gillian Clarke
Editor (Editorial Board)
King's College Hospital NHS
Foundation Trust
London, United Kingdom

James Clinch
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Patrick Conaghan
King's College London
London, United Kingdom

Asen Cvetkov
Editor (Editorial Board)
AM Studio Limited
Plovdiv, Bulgaria

Colin Deane
Editor (Editorial Board)
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Mario Dedenaro
University Hospital "Ospedali Riuniti"
Triest, Italy

Charles Deehan
Editor (Editorial Board)
Guy's and St Thomas's NHS
Foundation Trust
London, United Kingdom

Navneet Dulai

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Alex Dunlop

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Hannu Eskola

Tampere Technical University
Tampere, Finland

Anthony Evans

University of Leeds
Leeds, United Kingdom

Phil Evans

Institute of Cancer Research
and
Royal Marsden Hospital
London, United Kingdom

Michelle Footman

King's College Hospital NHS
Foundation Trust
London, United Kingdom

George D. Frey

Medical University of South Carolina
Charleston, South Carolina

Jean-Yves Giraud

Grenoble University Hospital
Grenoble, France

David Goss

Editor (Editorial Board)
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Mark Grattan

Northern Ireland Cancer Centre
Belfast City Hospital Trust
Belfast, United Kingdom

Kristina Hakansson

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Nicola Harris

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Gunter Helms

University Clinic Göttingen
Göttingen, Germany

William Hendee

Medical College of Wisconsin
Milwaukee, Wisconsin

Ignacio Hernando

University Hospital Río Hortega
Valladolid, Spain

Naomi Hogg

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Ivana Horakova

National Radiation Protection Institute
Prague, Czech Republic

Tomas Jansson

Editor (Editorial Board)
Lund University Hospital
Lund, Sweden

Emily Joel

King's College Hospital NHS
Foundation Trust
London, United Kingdom

Bo-Anders Jonsson

Editor (Editorial Board)
Lund University
Lund, Sweden

Lena Jonsson

Lund University
Lund, Sweden

Stephen Keevil

Editor (Editorial Board)
King's College London
London, United Kingdom

Kalle Kepler

University of Tartu
Tartu, Estonia

Linda Knutsson

Lund University
Lund, Sweden

Anchali Krisanachinda

Chulalongkorn University
Bangkok, Thailand

Inger-Lena Lamm

Editor (Editorial Board)
Lund University Hospital
Lund, Sweden

Jimmy Latt

Lund University
Lund, Sweden

Martin Leach

Institute of Cancer Research
and
Royal Marsden Hospital
London, United Kingdom

Cornelius Lewis

Editor (Editorial Board)
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Maria Lewis

St George's Hospital
London, United Kingdom

Michael Ljungberg

Editor (Editorial Board)
Lund University
Lund, Sweden

Ratko Magjarevic

University of Zagreb
Zagreb, Croatia

Peter Mannfolk

Lund University
Lund, Sweden

Paul Marsden

King's College London
London, United Kingdom

George Mawko

Queen Elizabeth II Health Sciences
Centre
Halifax, Nova Scotia, Canada

Brendan McClean

St Luke's Hospital
Dublin, Ireland

Ruth McLauchlan

Charing Cross Hospital
London, United Kingdom

Franco Milano

Editor (Editorial Board)
University of Florence
Florence, Italy

Ana Millan

Radiophysics Techniques, Inc.
Zaragoza, Spain

Elizabeth Morris
King's College London
London, United Kingdom

Ewald Moser
Medical University of Vienna
Vienna, Austria

Kwan Hoong Ng
University of Malaya
Kuala Lumpur, Malaysia

Mattias Nickel
Lund University
Lund, Sweden

Markus Nillson
Lund University
Lund, Sweden

Anders Nilsson
Lund University
Lund, Sweden

Jonathan Noble
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Alain Noel
Centre Alexis Vautrin
Vandeuvre-les-Nancy, France

Emil Nordh (Lindholm)
Editor (Editorial Board)
Lund University
Lund, Sweden

Fridtjof Nuesslin
Editor (Editorial Board)
Technical University Munich
Munich, Germany

Crispian Oates
Newcastle Hospitals NHS Foundation
Trust
Newcastle-upon-Tyne, United Kingdom

Kjeld Olsen
University Hospital Herlev
Herlev, Denmark

Johan Olsrud
Lund University
Lund, Sweden

Nikolas Pallikarakis
University of Patras
Patras, Greece

Mikael Peterson
Editor (Editorial Board)
Lund University
Lund, Sweden

Jonathan Phillips
King's College Hospital NHS
Foundation Trust
London, United Kingdom

David Platten
Northampton General Hospital
Northampton, United Kingdom

Ervin Podgoršak
McGill University
Montreal, Quebec, Canada

Marta Radwanska
AGH University of Science
and Technology
Krakow, Poland

Hamish Richardson
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Anna Rydhog
Lund University
Lund, Sweden

Tobias Schaeffter
King's College London
London, United Kingdom

Fernando Schlindwein
University of Leicester
Leicester, United Kingdom

Mario Secca
New University of Lisbon
Lisbon, Portugal

Christopher Sibley-Allen
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Jonathan Siikanen
Lund University
Lund, Sweden

Andy Simmons
Editor (Editorial Board)
King's College London
London, United Kingdom

Peter Smith
Editor (Editorial Board)
International Organization for Medical
Physics
York, England

Perry Sprawls
Editor (Editorial Board)
Emory University
Atlanta, Georgia

Freddy Stahlberg
Editor (Editorial Board)
Lund University
Lund, Sweden

Magdalena Stoeva
Editor (Editorial Board)
Medical University
Plovdiv, Bulgaria

Sven-Erik Strand
Editor (Editorial Board)
Lund University
Lund, Sweden

Slavik Tabakov
EMITEL Coordinator; Editor
(Editorial Board)
King's College London
London, United Kingdom

Vassilka Tabakova
King's College London
London, United Kingdom

Graeme Taylor
Guy's and St Thomas's NHS
Foundation Trust
London, United Kingdom

Heikki Terio
Karolinska University Hospital
Stockholm, Sweden

Jim Thurston
Editor (Editorial Board)
Royal Marsden Hospital
London, United Kingdom

Tracy Underwood
King's College Hospital NHS
Foundation Trust
London, United Kingdom

Emil Valcinov
University of Patras
Patras, Greece

Bruce Walmsley
Guy's and St Thomas's NHS
Foundation Trust
London, United Kingdom

Stephen Wastling
King's College London
London, United Kingdom

Ronnie Wirestam
Editor (Editorial Board)
Lund University
Lund, Sweden

Paul Zarand
Uzsoki Hospital Medical Physics
Laboratory
Budapest, Hungary

WORKING GROUP COORDINATORS

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, Tracy Underwood, William Hendee

EMITEL Web software: AM Studio Ltd. - Asen Cvetkov, Magdalena Stoeva
Network Administrator and Editorial Assistant: Vassilka Tabakova

EMITEL Dictionary Contributors
(All translation coordinators "in italics")
EMITEL Dictionary Coordinator: *Slavik Tabakov*

Arabic: *Farida Bentayeb*; Rachida El Meliani; Nagi Hussein; Ibrahim Elyasseery; Salem Sassi;

Bengali: *Hasin Azhari Anupama*; Golam Abu Zakaria; Md Akhtaruzzaman; Safayet Zaman;

Bulgarian: *Jenia Vassileva*; Venceslav Todorov; Petar Trindev; Slavik Tabakov; Borislav Konstantinov; Anastas Litchev; Magdalena Stoeva;

Chinese: *Andy Zhu*; Wu Wenkai; Bao Shanglian; Dai Liyan; Geng Jianhua; Dai Xiangkun; Fu Guishan; Geng Hui; Wang Jianhua; Wang Yunlai; He Zhengzhong; Xu Xiao; Xu Zhiyong; Yin Yong; Zhang Jiutang; Zhang Yue; Hu Yimin; Dai Jianrong

Croatian: *Mario Medvedec*; Jurica Bibic; Ana Buinac; Hrvoje Hrsak; Sandra Kos; Nenad Kovacevic; Srecko Loncaric; Tomislav Bokulic; Iva Mrcela; Zeljka Knezevic; Saveta Miljanic; Dario Faj; Slaven Jurkovic; Deni Smilovic Radojcic; Igor Lackovic; Branko Breyer; Milica Mihaljevic;

Czech: *Ivana Horakova*; Anna Kindlova; Simona Trampotova; Daniela Kotalova; Vaclav Husak; Jaroslav Ptacek; Josef Pacholik; Pavel Dvorak, Libor Judas, Irena Novotna;

Estonian: *Kalle Kepler*; Sigrid Kivimae; Kalju Meigas; Juri Vedru; Eduard Gerskevitch;

Finnish: *Hannu Eskola*; Paivi Laarne;

French: *Alain Noel*; Jean-Yves Giraud; Helene Bouscayrol; Louis Blache;

German: *Markus Buchgeister*; Gunther Helms; Stefan Delorme;

Greek: *Stelios Christofides*; Prodromos Kaplanis; George Christodoulides; Charalambos Yiannakkaras; Nicolaos Papadopoulos; Demetrios Kaolis; Georgiana Kokona; Georgios Menikou; Christos Papaefstathiou; Yiannis Gerogiannis; Demetra Constantinou; Spyros Spyrou; Andreas Mikelides; Anastasia Sissou; Christodoulos Christodoulou;

Hungarian: *Pal Zarand*; Istvan Polgar; Tamas Porubszky; Janos Martos; Geza Safrany; Tamas Daboczi; Jozsef Varga;

Italian: *Franco Milano*;

Japanese: *Koichi Ogawa*; Katsuyuki Nishimura; Kanae Nishizawa; Suoh Sakata; Hidetoshi Saitoh; Keiko Imamura; Kiyonari Inamura;

Korean: *Chang-Hoon Choi*; Wee-Saing Kang; Tae Suk Suh

Latvian: *Yuri Dekhtyar*; Alexei Katashev; Marite Chaikovska; Emzinsh Dzintars; Sergei Popov; Lada Bumbure; Juris Rauzins; Plaude Sandija;

Lithuanian: *Diana Adliene*; Arunas Lukosevicius; Algidas Basevicius; Dovile Serenaite;

Malay: *David Bradley*; *Suhairul Hashim*;

Persian: *Alireza Binesh*; Ali Asghar Mowlavi; Azam Niroomand-Rad;

Polish: *Marta Wasilewska-Radwanska*; Zenon Matuszak; Katarzyna Matusiak; Aleksandra Jung;

Portuguese: *Ana Pascoal*; Nuno Teixeira; Paulo Ferreira; Nuno Machado;

Romanian: *Daniela Andrei*; Cristina Petroiu; Aurel Popescu ; Octavian Dului; Raducu Popa; Constantin Milu;

Russian: *Valery Kostylev*; Nina Lutova, Boris Narkevich, Tatiana Ratner, Marina Kislyakova;

Slovenian: *Ervin Podgoršak*; Bozidar Casar; Vili Kovac; Damijan Skrk; Petra Tomse; Urban Simoncic; Urban Zdesar; Boris Sekeres

Spanish: *Ana Millan*; Ignacio Hernando; Alejandro García Romero;

Swedish: *Inger-Lena Lamm*; Monica Almquist; Ronnie Wirestam; Sven-Erik Strand; Bo-Anders Jonsson; Michael Ljungberg; Freddy Stahlberg; Thomas Jansson;

Thai: *Anchali Krisanachinda*; Sivalee Suriyapee; Tanawat Sontrapornpol; Panya Pasawang; Chotika Jumpangern; Taweap Sanghangthum; Isra Na Ayuthaya; Sorn-jarod Oonsiri;

Turkish: *Perihan Unak*; Turgay Karali; Serap Teksoz; Zumrut Biber Muftuler; Fatma Yurt Lambrecht;

Other Contributors:

Colin Roberts; Luciano Bertocchi; Victoria Aitken, Hakan Goranson; Peter Charie; Andrew Webb; Teresa Flett; Fauzia Farook; Nigel Brooks; Paul Labbett; Reza Razavi; Stephen Williams; Margaret Bidmead; Geoff Pinkstone; Rowenna Hoy; Kursat Egriboz; Charlotte John; Fumie Izaki; Karine Jacques; Thelma Lewis; James Weston, Keith Ison, Jonathan Cole, John Navas; Suganthi Thirunavukarasu