King's College Hospital NHS Foundation Trust

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EDUCATION AND TRAINING
IN MEDICL PHYSICS AND CLINICAL ENGINEERING
25 YEARS OF EXCELLENCE

Awards: IPEM Trainee Presentation: 2001, 2004, 2006, 2007, 2011;
Other IPEM Awards: 2010, 2017, 2018; Young Healthcare Scientist of the Year 2005;
Rising Star category of the Healthcare Science Awards: 2014, 2016, 2017;
UK Mercia Award for Medical Engineering: 2010, 2013, 2015, 2017;
DoH Chief Scientific Officer Prize: 2012; National Conferences Prizes: 2011, 2018;
International Conferences Prizes: 2009, 2013, 2016; EU Leonardo da Vinci Award: 2004;

Developing the e-Learning, e-Dictionary and e-Encyclopaedia of Medical Physics
International collaboration with 44 countries

KING'S HEALTH PARTNERS

INTRODUCTION

Contemporary healthcare is impossible without medical technology – the professional subject of medical physicists and biomedical/clinical engineers. The importance of these professions was the reason for their classification in 2012 as separate professional units in the International Standard Classification of Occupations (ISCO-08), published by the International Labour Organisation (ILO). King's College London, and its partner NHS Trusts (forming now the Academic Health Centre King's Health Partners - KHP), has a significant role in the global development and establishment of these professions – pioneering: the PET-MR modality, the interventional MR techniques, the e-Learning in Medical Physics, among various other achievements. Over the past 25 years the Education and Training in Medical Physics and Clinical Engineering in King's College London and KHP established itself as an international leader and produced many highly qualified and respected young professionals. Over this period of time these colleagues have received an unprecedented number of external awards and set examples for others to follow.

EARLY YEARS

The MSc Programme in Medical Engineering and Physics (MEP) was introduced at King's College London (KCL) in 1993 by a large team of distinguished academics from King's College London (School of Medicine) and The Institute of Cancer Research (ICR). The Programme was initially an inter-collegiate course of the University of London (UL), including partners from the ICR and Imperial College (based on a similar MSc programme transferred to KCL from Birkbeck College). It was hosted by Dept. Medical Engineering and Physics – then a joint Department of KCL and King's College Hospital NHS Trust (KCH). The Department Director Prof Colin Roberts (the first Professor in Biomedical Engineering in KCL) served as Chair of the MSc Examination Board and Mr John Lee as MSc Programme Director. The MSc Programme was organised according to the requirements of the UK Institute of Physics & Engineering in Medicine (IPEM) for academic background to support the practical training in Medical Physics and Clinical Engineering. The Programme was one of the first in the UK to enrol student-trainees and one of the first to be accredited by the IPEM. The first training was organised at KCH with Coordinator Dr Scott Bowring. The first MSc Administrators were Mrs Evelyn Langford and later Ms Kersty Radmall.

The programme developed rapidly and during 1995 produced its first graduates. With the support of the whole MEP Department, King's College Hospital and KCL-School of Medicine the Programme became very popular. During 1998 the results of project EVETSIN (an independent study commissioned by the Department of Health), ranked this MSc/PgDip Programme in Medical Engineering and Physics as the best in the UK. By that time the training specialties increased to cover the majority of the IPEM professional topics.

Prof. Colin Roberts
Head MSc Exam Board

Mr John Lee
Director MSc MEP

Dr Scott Bowring
Training Coordinator

Dr Graeme Taylor, doyen lecturer in MSc MEP

FIRST RE-ORGANISATIONS AND INTRODUCTION OF E-LEARNING

Following the merger of King's College London with the United Medical and Dental Schools (UMDS) in 1999, the MSc MEP Programme developed close links with the colleagues from the campuses in Guys and St Thomas's Hospitals. During 2002-2003 the Programme was transferred directly under KCL, but continued its close collaboration with the ICR.

Until 2001 the Programme and associated training were based at the Dulwich Hospital campus. After this time it was transferred, together with the whole MEP Department, in the new premises of the Faraday building at Denmark Hill campus. From 2001 MSc Programme Director was Dr Slavik Tabakov (following the retirement of Mr John Lee) and from 2002 Training Coordinator was Mrs Gillian Clarke (following the retirement of Mr Scott Bowring). From 2003 Chair of the MSc Examination Board was Dr Cornelius Lewis, the new Head of MEP Department (after the retirement of Prof. Colin Roberts). From 2002 the MSc Programme was re-organised to accept more Full time students alongside the student-trainees and soon doubled its intake. The MSc Administrators included Mrs Teresa Flett (2005-2012), Dr Vassilka Tabakova (2008-2018) and Mrs Irene Brockwell (2013-present).

From mid-2000 the KCL Medical School gradually associated the MSc MEP Programme with the Division of Imaging Sciences, headed initially by Prof D Hawkes, later expanded to Division of Imaging Sciences and Biomedical Engineering (founded by Prof. Reza Razavi). Following the establishment of the KCL Medical Engineering Centre, the MSc MEP and later MSc Clinical Sciences were placed under the new Dept. of Biomedical Engineering, headed in different periods by Prof. T Schaeffter, Prof. R Botnar and Prof. J Schnabel.

In parallel with the above, the Department of Medical Engineering and Physics was leading a number of international projects, which pioneered e-learning in the profession (these will be described later). Thus the MSc Programme was the first in the world to introduce e-learning in Medical Physics. All these developments included many of the staff of the Department, students and colleagues from the KCL Medical School/Faculty and Guys and St Thomas's NHS Trust. A number of specialists from various countries used this MSc Programme as a model and it is now considered international leader in Medical Physics and Clinical Engineering Education&Training. During 2004 the Department received the inaugural EU Award for Vocational Education – the Leonardo da Vinci Award. Following this in 2006 the Programme Director was awarded the IOMP Harold Johns Medal for Excellence in Teaching and International Education Leadership.

From 2002 the MSc Programme has dedicated teaching room and offices in Faraday building at KCH, and following its expansion from 2006 it took the first floor of the building. The Programme and the associated training are now firmly established leading academic activities

Dr Cornelius Lewis
Head MSc Exam Board

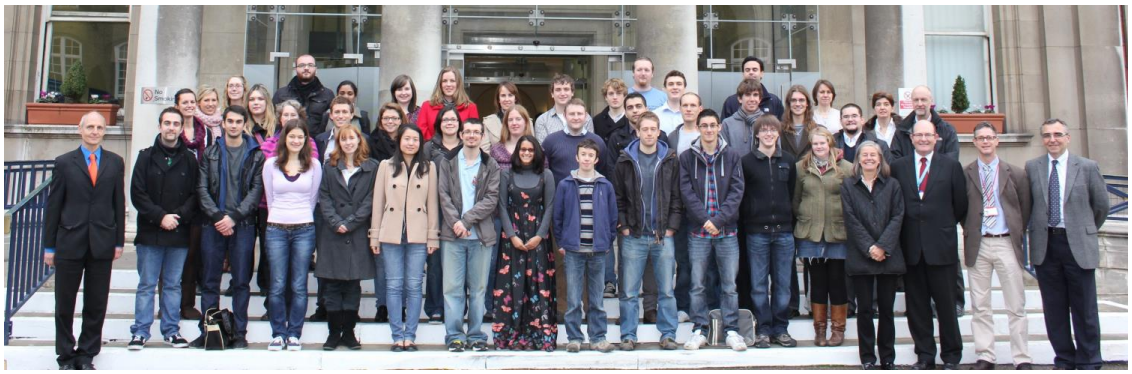
Dr Slavik Tabakov
Director MSc MEP/Cl.Sc

Mrs Gillian Clarke
Training Coordinator

Dr V Tabakova, admin, e-learning coordinator

SECOND RE-ORGANISATION AS PER NHS MODERNISING SCIENTIFIC CAREERS

During 2011 the MSc programme passed through another re-organisation following the requirements of the NHS Modernising Scientific Careers. Following an open tender the programme was selected and accredited to deliver one of the 3 NHS accredited MSc Programmes in Medical Physics and the only MSc programme in Clinical Engineering in England. As a result the MSc programme Medical Engineering and Physics supported the development of two new MSc Programmes – MSc Clinical Sciences (Medical Physics) and MSc Clinical Sciences (Clinical Engineering), both linked with MSc MEP. This led to many fold increase of students. The students-trainees to the programme are coming from more than 20 UK Training Centres. The increased number of students were educated without significant staff increase by introducing of the Moodle e-learning by Dr V Tabakova. Later this platform was merged into the KCL KEATS e-learning. From 2014 the overall number of students in these 3 programmes (most studying 3 years) is always over 110. From these the Medical Physics students are over 80, making it the largest such programme in the UK and in Europe.



Students from MSc MEP and the new MSc Clinical Sciences (Sept 2011) photo with the Head of Medical School Prof. Anne Greenough, PGT Sub-Dean Dr Jonathan Koffman, and IPEM Past-President Dr Keith Ison

THIRD PERIOD (FROM 2018) OF THE MSc PROGRAMMES IN MEDICAL PHYSICS AND CLINICAL ENGINEERING

Following the retirement of Dr S Tabakov at the end of 2017 the three MSc programmes are in a closer link with the KCL Department of Biomedical Engineering under the newly formed School of Biomedical Engineering and Imaging Sciences (headed by Prof. S Ourselin, with teaching under Prof. K Rhode). The strong MSc links remained with the KHP and the King's College Hospital NHS Foundation Trust (KCH, Dept. Medical Engineering and Physics, headed by Dr C Deane, following the retirement of Dr C Lewis) and the Guy's and St Thomas' NHS Foundation Trust (GSTT, Dept. Medical Physics headed by Prof. S Keevil, following the retirement of Dr K Ison) – both Departments being the employers of most of MSc lecturers. The academic links with the ICR were also preserved. The new Educational Leads are: Chair of the combined MSc Board of Examiners is Prof. Stephen Keevil; the MSc MEP Programme is led by Dr Enrico De Vita; the MSc Clinical Sciences (Medical Physics) is led by Dr Lefteris Livieratos; the MSc Clinical Sciences (Clinical Engineering) is led by Dr Adam Shortland. The MSc Administrators include Mrs Irene Brockwell and Dr Calum Wright. Mrs Gillian Clarke continues its activities as Training Coordinator. A number of previous (some retired) lectures continue to teach at the MSc.

A significant introduction in the MSc third period is the increased use of Internet teaching and tutoring, also using patient experience in some of the teaching processes.

Prof. Stephen Keevil
Head MSc Exam Board

Dr Enrico De Vita
Director MSc MEP

Dr Lefteris Livieratos
Director MSc Clin Sc MP

Dr Adam Shortland
Director MSc Clin Sc CE

GRADUATES IN THE HEALTHCARE WORKFORCE

From 1993 to 2002 the majority of students in the MSc MEP course were NHS Trainees. 41 students have graduated in this period. After 2002 the programme included more full-time students and an increased number of NHS trainees (all linked to the KCH Training Scheme). A total of 105 students have graduated in the period 2003 to 2012. 90 NHS trainees graduated the MSc MEP from 1993 to 2012. At least 84% of them continue to work in NHS.

Another 235 students have graduated in the period 2013-2019 (221 MSc, 1 PgDip, 13 PgCert). 95% of these are NHS trainees and almost all work in the field of healthcare in the UK. In the past 5 years these graduates form the majority of young medical physicists and almost all young clinical engineers in NHS England.

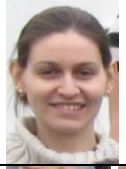
A total of 381 graduates in have been produced by the MSc MEP and MSc Clinical Sciences for these 25 years. More than half of those have graduated with Distinction. The majority of the graduates are from the UK (some are already senior specialists and Heads of Departments). The other graduates are from 25 countries and some of them take responsible positions (one of our students, E Akinluyi, was in the Barclays List of Future Leaders 2010).

EXTERNAL AWARDS AND STUDENTS' ACHIEVEMENTS

The success of these MSc programme (the first in KCL in the subject) is evident from the achievements of its graduates. One of the important indicators of the success of a Master-level student is the MSc Research project. Approximately 80% of all MSc MEP projects have been directly related to clinical practice (and many continue to be used in various Hospitals). Also a number of peer-reviewed publications have been based on our MSc projects. During the period 2002-2018 the average mark of the MSc projects has consistently been in the Distinction zone.

The high research level of these projects was reflected in the comment of one of the External Examiners: "*The projects were outstanding – the topics were relevant, in some cases already altering clinical practice. … Many of the projects were appropriate for, and of standard comparable to, a thesis for a taught doctorate.*"

This high level research activity and professionalism of our MSc students can also be seen in the unprecedented number of external awards, received by them:

1 2	2001 – 1st prize for student/trainee, IPEM Annual Conf. (MSc MEP student Nicola Fry); 2005 – UK Young Healthcare Scientist of the Year (MSc MEP student Nicola Fry)	
3	2004 - 1st prize for student/trainee, IPEM Annual Conference (MSc MEP student Gemma Davies);	
4	2006 - 1st prize for student/trainee, IPEM Annual Conf. (MSc MEP student Joan Coward-Chick)	
5	2007 - 1st prize for student/trainee, IPEM Annual Conf. (MSc MEP student Helen Grimes)	
6	2009 – Poster Award at SPIE Conference, USA (MSc MEP student Ferihan Ertan)	
7	2010 – UK Mercia Award for Medical Engineering (MSc MEP student Jonathan Noble)	
8	2010 – IPEM Award for Outreach (MSc MEP student Stephen Wastling)	
9 10	2011 - 1st prize for student/trainee, IPEM Annual Conf. with European Conf. (MSc MEP student Delphine Darios) 2011 – UK BNMS Poster Prize (MSc MEP student Delphine Darios)	
11 12	2012 – Two Prizes of the DoH Chief Scientific Officer (MSc Clinical Sciences students Katherine Kenny and Georgios Ntentas);	 
13	2013 - UK Mercia Award for Medical Engineering (MSc Clinical Sciences student Megan Duffy).	
14	2013 – International Conference ICMP2013, Poster Prize (MSc Clinical Sciences student Michael Ayers)	

15	2014 - Rising Star category of the Healthcare Science Awards (MSc Clinical Sciences student Megan Duffy).	
16	2015 – Young Professional Award of the UK Society for Radiation Protection, SRP (MSc Clinical Sciences student Anthony Higgins).	
17	2015 - UK Mercia Award for Medical Engineering (MSc Clinical Sciences student Rebecca East).	
18	2016 – KCL Global Experience Award MSc Clinical Sciences graduate Glafkos Havriyoun).	
19	2016 - Rising Star category of the Healthcare Science Awards (MSc Clinical Sciences graduate Antony Higgins).	
20	2017 - Rising Star category of the Healthcare Science Awards (MSc Clinical Sciences graduate Glafkos Havriyoun) the Award presented by DoH Chief Scientific Officer Prof. Sue Hill.	
21	2017 - UK Mercia Award for Medical Engineering (MSc Clinical Sciences student Aisling Barry), the Award presented by HRH Princess Anne	
22	2017 IPEM Early Career Award (MSc MEP past graduate Tracy Underwood)	
23	2018 – IPEM President's Prize (MSc Clinical Sciences past graduate Anna Gardiner)	
24	2018 – British Nuclear Medicine Society (BNMS) – Student Prize 1st place (MSc Clinical Sciences student Jan Taprogge).	

COMMENTS FROM EXTERNAL EXAMINERS AND ASSESSORS

The high quality of these MSc programme is also reflected in the following citations from various External Examiners and External Assessors (2003-2018):

"The standard of this MSc is higher than that of many comparable courses, so students emerging with this qualifications are at a distinct advantage over students from other institutions and are in a better position to make an excellent contribution to the profession and to the health care of patients" (MSc MEP 2003, Ext. Examiner);

"A particular strength of the team at King's is the broad coverage of a wide range of subjects in both medical engineering and physics disciplines. Students benefit from the depth of study available in individual methods." (MSc MEP 2004, Ext. Examiner)

"The course is one of the leading courses of its type in the UK, with commensurate high standard" (MSc MEP 2005, Ext. Examiner);

"The King's MSc course is one of the leading MSc courses in the fields of medical physics and engineering." (MSc MEP 2006, Ext. Examiner)

"The standards achieved this year were extremely and, in fact, the highest I have ever witnessed. The calibre of the students that I examined at the project oral examinations were all of distinction level, which was mirrored by those examined by the second External Examiner… This is an excellent programme, run by excellent staff and particularly this year with excellent students." (MSc MEP 2007, Ext. Examiner)

"Top quality degree. Excellent documentation. Excellent breadth and depth. Consistent responses from the coordinator, staff and students. The facilities are excellent. We recommend full maximum accreditation for this excellent MSc degree" (2008, IPEM Report)

"The standards achieved are high and this clearly reflects not only the excellence of the student body but also the teaching and the learning environment provided for this course…. students were able to present and discuss their project work very clearly and to place it in the context of the wider field. This can often take even PhD students a considerable time to develop." (MSc MEP 2009, Ext. Examiner)

"The degree programme has an excellent balance of content. I have seen ample evidence that the students benefit from the excellent teaching…The course sets a standard against which others should be judged. It is outstanding, nationally and internationally." (2010, Ext. Exam.)

"I have always been very well impressed with this MSc course. The running of the programme is smooth and the examination process is fair." (MSc MEP 2011, Ext. Examiner)

"The team of scientists and engineers who provide this programme set an excellent standard; this is undoubtedly one of the best courses in the field in the world." (MEP 2012, Ext. Exam).

"The Panel was satisfied from the student feedback, external examiners reports and statistical data that the academic standards were rigorously set… The Panel felt the Programme provided substantial support and an excellent learning environment to encourage the high success rate that was evident from the statistics." (2013, KCL Programme Review Panel)

"Their academic standards are correspondingly significantly higher than might be expected for a typical MSc course in this field." (MSc Clin. Sc. and MSc MEP 2014, Ext. Examiner)

"The students represent the largest single cohort of Trainee Clinical Scientists in the NHS funded programme (across all HEIs and all specialisms) and this indicates the confidence that employers have in this course." (MSc Clin. Sc. and MSc MEP 2015, Ext. Examiner)

"Given the clear strengths of the programme highlighted throughout the report the Kings team are commended on the success of the programmes and the enthusiasm, hard work and commitment required to develop and sustain this programme." (MSc Clin. Sc. 2016, NHS Health Education England Re-Accreditation)

"As in previous years the academic standard on the course was very high which demonstrates a consistent level of teaching and assessment. The students on the programme are clearly motivated and well supported in their learning." (MSc Clin. Sc. 2017, Ext. Examiner)

"Overall the assessors were impressed by the organisation and structure of this long standing programme" (MSc Clin. Sc. and MSc MEP 2018, IPEM Re-Accreditation)

MSc PROGRAMME MODULES, FACULTY AND CONTRIBUTORS

The breadth and the complexity of medical physics and clinical engineering are enormous. These interdisciplinary professions are in the interface of medicine, physics and various engineering fields. Due to this reason from the beginning the Programme was modularised allowing students to take, in addition to the Core modules, a number of Specialised modules. By 2011 the MSc MEP Programme was offering 9 single modules, two double modules and an MSc Research module. Following the association with the Modernising Scientific Careers project the modules were distributes in the linked MSc Clinical Sciences Programmes. The modules offered at present include: 5 Core modules (three of which – double), 7 single Specialist modules, 7 double Further Specialist modules (3 of which in collaboration with the Institute of Cancer Research) and an MSc Research module. The modules are now delivered by a faculty including many leading specialists from KCL, KHP, KCL, GSTT, ICR. Special mentioning deserves the fact that from its beginning the MSc Programmes have the support of the KCH Department of Medical Engineering and Physics (Faraday Building), many of its staff teach, train and supervise the studies and the professional development of the students.

KCH Department Medical Engineering and Physics, Faraday building

MSc MEP Teaching facilities: e-Learning (video lecture from USA by Prof P Sprawls) and meeting of the Training Supervisors Forum

Most of the MSc Faculty members are specialists from the NHS Hospitals associated with King's Health Partners. Many of them are full Members and Fellows of the UK Institute of

Physics and Engineering in Medicine (IPEM). The Faculty is greatly helped by students, who take part in all Programme Board meetings and provide feedback and suggestions, thus including them in the team. The main lecturers (past and present) in various modules and sub-modules over the years are listed here below:

Basis of Human Anatomy and Physiology: Dr Alistair Hunter, Dr Nick Boyadjiev, Dr Victoria Aitken, Dr Janet Taylor, Dr C Chatapathy, Dr Gerald Greil, Dr T Hussain, Dr N Dedieu, Dr E Heathfield, Dr W Edwards, Dr A Chiribiri, Mr S Franey, Dr M Charakida.

Introductory modules (Medical Physics and Clinical Engineering): Dr Graeme Taylor, Mr John Lee, Mr James Trotter, Dr Sid Leeman, Dr Slavik Tabakov, Dr Cornelius Lewis, Mrs Gillian Clarke, Mrs Navneet Dulai, Ms Elizabeth Challoner, Mr Jonathan Cole, Mr Benjamin Corcoran, Ms Eleni Kalogianni, Ms Claire Hooker, Mrs Tessa Arscott, Mrs Ros Tibbles, Dr Elaine Gill, Mr Louis Blache, Mr Jim Thurston, Mr Alistair Mackenzie, Dr Nora Donaldson, Dr Derek Cooper, Dr Antonio De Stefano, Dr Keith Ison, Dr Colin Deane, Dr David Goss, Prof Stephen Keevil, Dr Charles Deehan, Dr Gill Vivian, Dr Harry Tsoumpas, Mr Jim Weston, Mr Hamish Richardson, Dr Andrew King, Mr Richard Arscott, Mr Peter Cook, Mrs Joanne Young, Mr Keith Douglas, Ms Gursharan Kalsi, Ms Clare Crowley, Dr Adam Shortland, Mr Andrew Lewis, Mr Mayur Patel, Mr Eskinder Solomon, Mr Jonathan Noble, Mr James Clinch, Dr D De Tournier, Dr A King, Mr P Cook, Mr G Havariyoun, and others.
Rehabilitation Engineering modules: Dr Alan Turner-Smith, Dr Adam Shortland, Prof Colin Roberts, Dr Ruth Mayagoitia-Hill, Dr Dona Cowan, Mr Richard Arscott, Dr Nicola Fry, Mr Jonathan Noble, Dr Sanjucta Deb and others.

Medical Equipment Management, Governance and Risk Management modules: Dr Keith Ison, Prof Colin Roberts, Mr Keith Willson, Dr Slavik Tabakov, Mr Arafat Aligawesa, Mr Mayur Patel, Mr Emmanuel Akinluyi, Mr Prabodh Patel, Mrs Bahar Ragazzi, Mr Rashid Brora and others.

Clinical Measurement and Development modules: Dr Andrew King, Dr Keith Ison, Mr Emmanuel Akinluyi, Mr Richard Arscott, Dr Sanjucta Deb, Dr Adam Shortland and others.

Radiation safety modules: Dr Cornelius Lewis, Dr Stan Batchelor, Dr M Rosenbloom, Mr Stephen Evans, Ms Elisabeth Moore, Mrs Navneet Dulai, Ms Elizabeth Challoner, Mr Jonathan Cole, Mr Benjamin Corcoran, Mr Jim Thurston, Mrs Patricia Clinch, Ms Amy Rose, Mr Ian Honey, Mr Jonathan Cole, Mrs Sharmila Franks, Ms Claire Jerrom, Mr David Gallacher, Ms Susan Chadwick, Mr James Clinch, Mrs Tessa Arscott, Mr Adam Jones, Ms Julie Robinson, Dr Fiametta Fedele, Dr Andrew Coleman, Mr Jonathan Ashmore, Dr Ana Pascoal, Dr L Livieratos and others.

Radiotherapy modules: Dr Charles Deehan, Mr Tony Greener, Mrs Sarah Aldridge, Mr David Convery, Ms Margaret Bidmead, Mr Jim Warrington, Dr Frank Verhaegen, Dr Jean-Claude Rosenwald, Dr Ivan Rosenberg, Dr Alan Nahum, Prof Phil Evans, Prof Steve Webb and other specialists related to the Institute of Cancer Research (ICR) Radiotherapy courses.

Imaging with Ionising Radiation modules: Prof Paul Marsden, Prof Steve Webb, Dr Slavik Tabakov, Dr David Dance, Dr Elly Castellano, Dr Lefteris Levieratos, Mrs Maria Lewis, Dr Ana Pascoal, Dr Joel Dunn, Mr Bruce Walmsley, Mr Richard Fernandez, Dr Jane Mackewn, Dr Lynne Martinez, Dr Maggie Flower, Dr Dimitra Darambara, Dr Glenn Flux, Dr Adrian Hall, Dr Salem Sassi, Dr Iain Murray and other specialists related to the ICR Imaging courses

Imaging with Non-ionising Radiation modules: Prof Stephen Keevil, Prof Tobias Schaeffter, Dr Colin Deane, Dr David Goss, Prof Stephen Williams, Dr Geoff Charles-Edwards, Dr Claudia Prieto, Dr Sarah Peel, Dr Andrew Simmons, Dr Robert Eckersley, Prof Gary Cook, Dr David Lurie, Prof Martin Leach, Dr Geoffrey Payne, Dr Jeffrey Bamber, Mrs Elisabeth Moore, Dr Naomi Miller and other specialists related to the ICR Imaging courses.

The work of the MSc Faculty has been helped by the External Examiners – over the years these include: Prof Alan Beddoe, Dr R Collier, Dr Peter Smith, Prof Robert Allen, Dr Noirin Sheahan, Dr Robert Shields, Dr Fernando Schlindwein, Dr Chris Gibson, Mr David Long, Dr Simon Ryde, Dr Caroline Stewart.

MSc Examination Board meeting 2017

The MSc programme has been also supported by the central and local administration and IT teams, including: Mr Keith Newton, Mr Ian Sanderson, Ms Sarah Page, Mr Christopher Medcalf, Ms Debora Bell, Ms Sarah Brooke, Mr Michael Fendick, Mr Andrew Reive, Mrs Kim Kocayigit, Mr Stephen Skinner, Mr Andrew Cavers, Dr David Byrne, Mrs Morokoth Fournier des Corats, Ms Verity Birch, Mr S Qureshi, Patient Representative Dr S Rouve and other colleagues from the KCL Central Services.

The re-organisation and introduction of the MSc MEP Programme according to the NHS Modernising Scientific Careers was greatly helped by the KCL Medical School/Faculty, notably the Head of School Prof. Anne Greenough, the PGT Sub-Dean Dr Jonathan Koffman, the Director of Administration Mr Keith Newton, the KHP Administration Manager Mrs Rachael Jarvis, the Heads of Imaging Sciences and Biomedical Engineering Division/School Prof Reza Razavi, Prof. Rene Botnar and Prof. Sebastien Ourselin, the School Teaching lead Prof. Kawal Rhode, and the Directors of MEP Department in the same Trust Dr Cornelius Lewis and Dr Colin Deane, the Directors of Medical Physics Department of Guys's and St Thomas's Hospital NHS Foundation Trust Dr Keith Ison and Prof. Stephen Keevil.

CLINICAL TRAINING AND ITS CONTRIBUTORS

From the beginning of the education and training activities in Medical Physics and Clinical Engineering, a Consortium of Hospitals was formed, headed by a dedicated Coordinator in King's College Hospital. This South London Training Consortium included: King's College

Hospital (KCH); Guy's & St Thomas' Hospital (GST); Charing Cross Hospital (CCH); Royal Brompton Hospital and Royal Marsden, London (RMH). The Consortium was accredited by the IPEM to deliver training on most of its specialisations:
Radiotherapy Physics; Radiation Protection; Diagnostic Radiology; Nuclear Medicine; Magnetic Resonance Imaging; Ultrasound Imaging; Medical Electronics and Instrumentation; Rehabilitation Engineering; Medical Engineering Design and Development; Biomechanical Engineering.

With the transition to the NHS Modernising Scientific Careers activities the Consortium delivers all of its specialisations in Medical Physics and Clinical Engineering:
Radiotherapy Physics; Radiation Safety; Imaging with Ionising Radiation; Imaging with Non-Ionising Radiation; Rehabilitation Engineering; Clinical Measurement and Development Device Risk Management and Governance.

The delivery of training is synced with the MSc programme and is greatly facilitated by the support of all Training Coordinators. For this a Forum of Training Supervisors was established in 2013, which has regular annual meetings. The members of the Forum provide an additional layer of feedback, which is vital for the quality of the education and training.

The Training Supervisors are from: King's College Hospital NHS Foundation Trust; St George's Healthcare NHS Trust (London North Consortium); St George's Healthcare NHS Trust (London South Consortium); Cambridgeshire University Hospitals NHS Foundation Trust; Royal Sussex County Hospital; Leeds Teaching Hospitals NHS Trust; United Lincolnshire Hospitals; Royal Marsden Hospital; Nottingham City Hospital; Newcastle Hospitals Foundation Trust; Oxford University Hospitals NHS Foundation Trust; Brighton and Sussex University Hospitals NHS Trust; Royal Surrey County Hospital NHS Foundation Trust; East Kent Hospitals University NHS Foundation Trust; Maidstone and Tunbridge Wells NHS Trust; Leicester Royal Infirmary; University Hospitals Leicester; East & North Hertfordshire NHS Trust; Royal Liverpool and Broadgreen University Hospitals NHS Trust; South West Salisbury NHS Foundation Trust; United Lincolnshire Hospitals NHS Trust; Northampton General Hospital NHS Trust; Nottingham University Hospitals NHS Trust; Cwm Taf University Health Board; Royal Glamorgan Hospital; ABM University Health Board; Morriston Hospital and other Hospitals from England and Wales.

Training Supervisors Forum meeting 2015

THE PIONEERING OF E-LEARNING IN THE PROFESSION

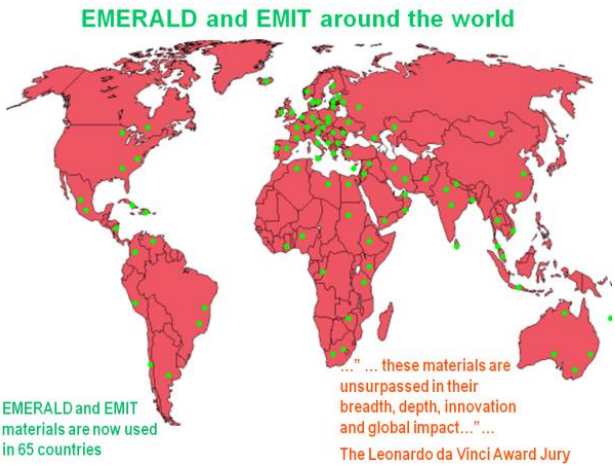
The term e-learning covers a range of activities in which "electronic" and digital technology is used in the learning and teaching process. It is perhaps the most significant area of development in education in recent years. Medical Physics and Engineering education and training requires the use of extensive imaging material and specific explanations. These requirements provide an excellent background for application of e-Learning. The EU projects Consortia EMERALD and EMIT (led by the team of Dept. Medical Engineering and Physics, KCL and KCH) pioneered the e-Learning in the profession. These projects (which started in 1995, before the existing of the term e-learning) developed 5 volumes of such materials, now used in 65 countries. EMERALD developed e-Learning materials in 3 areas of Medical Physics (X-ray Diagnostic Radiology, Nuclear Medicine and Radiotherapy). EMIT developed e-Learning materials in 2 further areas - Ultrasound and Magnetic Resonance Imaging. This way Medical Engineering and Physics was one of the first professions in the world to develop and apply e-Learning (e-L). An indicator of this is the first international prize in the field (EU Leonardo da Vinci Award) presented to the EMIT Consortium in 2004. The teams led by us included partners from Sweden, Italy, Portugal, France, Ireland, Bulgaria, Czech Republic, the International Centre for Theoretical Physics (ICTP) and the European Federation of Organisations for Medical Physics (EFOMP).

The EMERALD II Consortium, developed the first educational web site in the profession (partners from UK, Sweden, Italy, France, Ireland, Czech Republic, Portugal, Bulgaria ICTP and EFOMP)

The UK EMIT team with the Leonardo da Vinci Award: L>R: L Blache, C Lewis, S Tabakov, A Simmons, C Deane, D Goss, V Tabakova, G Clarke, V Aitken (missing: C Roberts, S Keevil)

These materials included the development of the first e-books and educational image databases (IDB) in the profession (and one of the world first such education/training material on CD with ISBN number, launched in 1997). The five IDB include thousands of images of equipment; block diagrams and graphs; QA procedures and test objects; image quality examples; artefacts, etc. The e-books include tasks supporting the study of various equipment and methods. The text of these PDF e-books is hyperlinked with respective images. This simplicity allows for the users to learn directly through their existing computer and its Internet browser and Adobe Acrobat Reader. These materials formed the first Educational Web site of the profession, developed by project EMERALD II (Internet Issue) – available for free use from: http://emerald2.eu/cd/Emerald2/ . This web site is currently used by more than 2000 colleagues per month worldwide. The materials are translated into French and Portuguese and are also used in various IAEA documents and projects, and activities of the International Organisation for Medical Physics (IOMP).

www.emerald2.eu - the first Teaching web site in medical physics



Map showing the global use of our e-Learning materials

To assess the usability of these the Consortia organised two International Conferences on Medical Physics Training with e-Learning materials (1998 and 2003, ICTP, Trieste, Italy) and 5 international Seminars. These attracted specialists from 26 countries and resulted in very useful feedback and ideas for the application of e-Learning in Medical Physics and Engineering. In all these projects we included students from our MSc programme, both for educational feedback and as full team members.

OTHER INTERNATIONAL EDUCATIONAL PROJECTS

EMERALD and EMIT e-Learning materials were quickly disseminated all over the world. To facilitate the international use of these a new EU project was developed to prepare a Multilingual Dictionary of Medical Physics. To do this the project (EMITEL, led by us) had to develop the first Thesaurus of Medical Physics Terms (in English), which was later translated into 29 languages (in 9 alphabets), forming a Multilingual Professional Dictionary.

The Thesaurus was used as background for the development of the first e-Encyclopaedia of Medical Physics – the largest international project in the profession, which spanned from 2001 to 2013 and included 320 leading specialists from 38 countries. The results of this project are uploaded to a dedicated educational web site www.emitel2.eu which is now used by some 6000 colleagues per month worldwide. We are now involved in the planning of a similar e-Encyclopaedia for Biomedical Engineering.

Part of the team of EMITEL project at its Development and Assessment Conference, 2008 (the team includes past and present Presidents of national societies from 21 countries, plus the Presidents of the IOMP and IFMBE)

Apart from the above pioneering projects we organised the first International Conference on Medical Physics Education (Budapest, 1994), the first International Conference on Medical Physics Training (Italy, 1998) and the first International Conferences on Medical Physics e-Learning (Italy, 2003, 2008). These were complemented by other EU and IAEA educational projects, which led to the development of similar MSc Programmes in: Plovdiv (Bulgaria), Riga (Latvia), Prague (Czech Republic), Bangkok and Chiang Mai (Thailand), Penang (Malaysia), Kingston (Jamaica). Additional projects of our Department helped the establishment of similar Medical Physics activities in: Armenia, Belarus, Brazil, Bulgaria, Costa Rica, Estonia, France, India, Malta, Lithuania, Sudan, Zimbabwe, UAE and others.

Our expertise was also pivotal for the establishment of the new BEng degree on Biomedical Engineering at King's College London, which started in 2011 and is now an established programme.

Through our leading involvement in the Summer College in Medical Physics at the International Centre for Theoretical Physics (ICTP, Trieste, Italy, operating under UNESCO and IAEA) we helped many developing countries to train their workforce in Medical Physics. As a result our activities triggered more than 20 Master-level educational courses worldwide.

International Medical Physics College, ICTP, Trieste, currently with attendees from 40+ developing countries

Our international partners in these education/training activities were from 44 countries. These activities were the background for the awarding in 2006 of the IOMP Harold Johns Medal for Excellence in Teaching and International Education Leadership to Dr S Tabakov, who was elected in 2012 President of the International Organization for Medical Physics (IOMP). Since 2000 colleagues from our team have led 50 Education and Training Workshops in various countries. Our activities for the development and dissemination of professional education and training were pivotal for the professional growth in many countries (especially developing countries). Alongside the development of our original e-Learning materials, we published two books on the subject: "Medical Radiation Physics A European Perspective" and "Medical Physics and Engineering – Education and Training". Our "Encyclopaedia of Medical Physics" was published by CRC Press, as well as the book "Management of Medical Equipment" based on our MSc module. We also initiated the new IOMP Journal *Medical Physics International*, dedicated to education, training and professional issues.

Starting from a small Master programme with 5 students in 1993, our education, training and other academic activities in Medical Physics and Biomedical/Clinical Engineering are now considered world leading. We are grateful to all colleagues and students who joined us during these 25 years of excellence – years of dedicated, innovative and very successful team work.

LIST OF GRADUATES FROM MSc MEDICAL ENGINEERING AND PHYSICS (MEP)

1995	**2002 (cont.)**
Stephanie Deverson	Claire Beckwith (PgDip)
Peter Grainger	**2003**
Elizabeth Moore	Richard Arscott
Lara Povey	Maria Boutros
Eli Steiner	Regina Gonzalez
Tracy Sullivan	Alexandra Jensen
1996	Christine Kong
Mary Smail	Fady Wakil
James Wood	Tessa Wehrle
Konstantinos Papapaschalis (PgDip)	Charalampos Athanasiou
1997	**2004**
Sally Griffin	David Brogan
Deborah Smith	Benjamin Corcoran
Linda Toru	Gemma Davies
1998	Rachel Hodgskin
Angela Darekar	Reshma Patel
David Evans	Sophie Riches
Sarah Hails	Bernard Siow
Linda Mortimer	**2005**
Julia Nevinson	James Currell
John Pettingell	Amanjeet Dahaley
AzadehPeyman	Pedro Ferreira
John McNeill (PgDip)	Christopher Golby
1999	Rhiannon Gostick
Ashraf Aseyed Bagher	Benjamin Johnson
Christopher Bragg	Mark McGovern
Laura Conway	Stephen Moloney
Stephen Hodgson	Marium Naeem
Dominic Withers	Cathleen O'Neill
2000	**2006**
Susan Austin-Smith	Karen Chalmers
Charlotte Harris	Joan Chick
Anita Jefferies	Hsuan-Yi Chu
2001	Ian Claydon
Ashraf Elhusseiny	Demetra Constantinou
Nicola Fry	Zahra Hirji
Jane Mackewn	John Kemeny
Patrick Maw	Catherine Mallik
Nicola Wilcox	Andrew Scott
2002	Mary Simon
Mark Bamber	Felicia Thiagaraj
Deborah Cooper	Jason Wong (PgDip)
Ian Honey	
Dimitry Laptev	
Catherine Merry	
Campbell Reid	
Michael Thomas	

2007
Jonathan Cole
Michael Germuska
Helen Grimes
Caroline Jones
Elizabeth R Morris
Georgios Skikos
Eskinder Solomon
Rachel Trimble

2008
David Bernstein
Elizabeth Chaloner
Hannah Dodgson
Hannah Urbanczyk
Laura Wherity
Peter Faulkner
York Tsai
Joy Vijayan

2009
Nicola Harris
Mahshid Bozorgizadeh
Justine Calvert
Ferihan Ertan
Michelle Footman
Mostafa Hussein
William Huynh
Gursharan Kalsi
Maria Kazantzi
Andrew Lewis
Irene Polycarpou
Tracy Underwood
Stephen Wastling

2010
James Clinch
Sue Hayward
Anna-Maria Strongylou
Mazen Alhrishy
Kirsty Blythe
Jedrzej Burakiewicz
Patrick Conaghan
Pravindhya Gajadeera
Maria Georgiou
Kristina Hakansson
Emily Joel
Jonathan Noble
Christopher Sibley-Allen
Hamizah Yunos

2011
Andrew Aitken
Emmanuel Akinluyi
Pablo Cerro Salido
Delphine Darios
Emily Hogg
Naomi Hogg
Denis Mostafa
Philippa Sturt
Stella Synefia (PgCert)

2012
Chloe Bowen
Alberto Caenazzo
Alex Dunlop
Aarthi Ganesan
Rachael Hall
Konstantinos Karaoglanis
Emilia Leech
Elizabeth H Morris
Ola Obisesan
Jonathan Phillips
Leanne Price
Danielle Ruiz
Sabu Shahdatullah
Sven Sund
Johnny Tang
Ilyas Zatout

2013
Serena Cameirano
Vincenzo Galgano
Marielena Kossyva
Karina Lopez-Gonzalez
Joely Smith
Callum Smith (PgCert)
Melissa Brittle (PgCert)
Rupert Larkin (PgCert)

2014
Rachael Andrews
Michael Ayers
Sarah Bailey
Adam Baker
Roberts Bauld
Patrick Begley
Kristina Bolsakova
Thomas Burrows
Nicholas Byrne
Sam Campaigne

2014 (cont.)
Louise Councell
Sam Davies (PgCert)
Jonathon Delve
Megan Duffy
Hannah Eyles
Daniel Fakhry-Darian
Matthew Galloway
Liam Godden
Simon Goodall
Sarah-May Gould
Lisa Hallett
James Hubber
Fiona Keathing
Katharine Kenny
Katherine Lane
Yun Miao
Robert Mitchell
Georgios Ntentas
Nasreen Parkar
Catherine Scott
Jonathan Silver
Stephen Skett
Louise Way
Yi Wah Eva Cheung
Hoi Kin Kenneth Kwan
Nicoletta Vitale

2015
Agraja Dimunge
Denis Duignan
Rebecca East
Matthew Elt
John Green
Thomas Hague
Paul Harrington
Victoria Kidgell
Robert Laflin
Lumbani Muthali
James Nasrat
Christopher Reay
Sarah Ward
Leo Whiteman
Beat Billson
David Bird
Andrew Blackmore
Daniel Butler
Anna Chilcott
Paul Clarke
Anne Gasnier
Callum Gillies
Anthony Higgins
Robert Julian
Philip Mannering
Ellis Marshall
Laura Moran
Jonathan Nelson
Elizabeth Powell
Matthew Rowlandson
Philip San
Thomas Snderson
Anna Stephenson
Nicholas Tassell
Mustafa Tumen
Emma Walker
Mark Wanklyn
Samantha West
Thomas Williams
Glenn Woolley
Emma Wroe

2016
Michael Agyei
David Carnegie
Alison Cole
Graham Cornish
Harpreet Dhiraj
Alex Dunford
Holly Anne Farnham
Alex Gromwood
Glafkos Havariyoun
Jessica Johnson
Sarah McElroy
Siddharth Mehta
Stephen Milner
Thomas Richardson (PgCert)
Victoria Rowse
Matthieu Ruthven
Jodie Schultz
Haris Shuaib
Joely Smith
Stephen Stibbs
Jon Sutton
Anna Tonino Baldion
Tom Woolcot
Belinda Ball
Aisling Barry
Jenny Bramley
Emily Churscikowski
Jonathan Hosking
Bunsi Keshav
Rumi Khor

2016 (cont.)	**2017 (cont.)**
Richard Miles	Matthew Walker (PgDip)
Tristan Payne	Samantha Wright
Garry Ramsay	Habiba Yasmin
Nathan Robson	Phoebe Yeomans (PgCert)
Sarah Taylor	Naomi Clayton
2017	**2018**
Amany Amin	Theo Barfoot
Sam Barnes	Heidi Barnett
Niall Bolger	Christian Brunet
Robin Cole	Olivia Channon
Thomas Davies	Sorcha Curry
Isabel Dodson	Nicole Dunkerley
Elliot Dodson (PgCert)	Kate Elliott
Lucy Evans	Claire Frye
Andrea Fischer	Rosie Goodburn
Eleanor Holden	James Gray
Anna Hughes	Sarah Helps
Ryan Hulley	Neil Heraghty
Saba Humayudin (PgCert)	Lucca Kalafatis (PgCert)
Ioanna Katsiolidou	Joe Maryin
Virginia Marin Anaya	Isabel Palmer
Charlie Martin	Emma Parker
Michael Mills	Nathaniel Scott
Anil Mistry	Ben Shaw
Christopher Naish	Matt Sparks
Ailbhe Porter	Belinda Stiles
Charlotte Porter	Coral Stockley
Thomas Quinn	Jan Taprogge
Sasha Rai	Esther Uwannah
Natalie Sizer	Nixa Vekaria (PgCert)
Edward Smith	Dika Vilic
Matthew Tedder	Callum Walker
Tamar Willson	Carly Booker
Mihaela Bardan	Leila Brown
Alexandra Callaway	Hannah Carruth
Jessica Chiu	Georgina De Vries
Lewis Crown	Sarah Greasley
Stephanie Graham	Tom Jenkins
Maighread Ireland	Ben Marshall
Gunvor Koldste (PgCert)	Karla Small
Benjamin Lee	Sarah Booth
Simon Marchant	**2019**
Ben Newman	David Adams
Kalp Patel	Ewan Almond
Piotr Rymaszewski	Cameron Anderson
Anna Stec	Maedeh Borhani
Abigail Shaylor (PgCert)	Joel Brown
Thomas Taylor	Laura Brown
Maria Thommyppillai	

2019 (cont.)
Hinesh Chardva
Steven Court
Bernadette Deere
Jacob Eltherington
Benjamin Fongenie
Miranda Frizzelle
Paul Gape
Sarah Green
Claudia Hill
Jonathan Howard
Ruairidh Howes
Benjamin Inglis-Smith
Priten Khagram
Daniel Lansdowne
Victoria Moore
Qurratul Ain Munnee
Myurah Nathan
Thomas O'Brien
Christopher Pagett
Joseph Perry
Hannah Scott
Joanna Sillars
David Stell
Daniel Sutcliffe
Laura Tonks
Angelos Vasilopoulos

Enrolled 2017 (to graduate 2020)
Diego Aparicio
John Armstrong
Eric Barton
Matt Bothwell
Ruby Callister
Lily Carnegie-Peake
Richard Eames
Ryan Fullarton
Rosemary Gallant
Christopher Habgood
Rebecca Hammond
Callum Hartley
Eleanor Ivy
Monika Jakimowicz
Jack Miskell
Ionna Mone
Victoria Newton
Amelia Perry
Juliet Polkey
Ellen Punter
Paul Sail

Enrolled 2017 (to graduate 2020) cont.
Sofia Sherwood
Andrew Simcox
Oliver Steel
Jessica Tait
Samsara Terparia
William Turner
William Van den Berg
Elizabet Verdeny Colominas
Owen White
Michael Woodward
Imran Asif
Brett Cohen
Saul Harris
Timothy Hicks
Catherine Howse
Reginald Idika
Olivia Lala
Tarah McAteer
Stephen McCormack
Sinead Mottishaw
Christopher Pearce
Claire Pinington
Jacob Redwood-Thomas
Fiona Ritchie
Emily Rowe
Robert Ruddiforth
Raveen Saigal
Ross Stephens
BenjaminTomlinson
Louise Whitehead
Yogeeta Hirani

Enrolled 2018
Jane Ansell
Yassine Azma
Kayleigh Brook
Victoria Butterworth
Adnan Chowdhry
Anna Chown
Lewis Davies
Meagan De La Bastide
Tom Finerty
Elizabeth Gabriel
Angharad Ganguli
Kamil Gierasimczyk
Kyah Howard
Sebastian Janner
Sheera Lakshman
Victoria Lindsay

Enrolled 2018 (cont.) James O'Sullivan Jay Patel Jessica Patel James Penna Agnieszka Peplinski Dominic Rafferty Timothy Rice Cameron Starling Liam Stubbington Sam Townrow Anna Veronese Lydia Vye Sam Wheeler Robert Williams Daniyal Abdul Latif Moton Chloe Black Philani Dube James Endersby	Michael Jeffryes Liam Johnston Man Him Law Ryan Longley Samuel Oliver Charlotte Orledge Jack Patterson James Perry Tasnima Rahman Pearl Read Charlotte Robinson Billy Woods Afnan Al-Gethami Maram Alqarni Ivna Branquinho Olla Eltiraifi Gyula Geszti Dominyka Ivanova

PHOTOS FROM VARIOUS STUDENT COHORTS

MSc MEP early photos

MSc MEP entry 2003

MSc MEP entry 2004

MSc MEP entry 2005

MSc MEP entry 2006

MSc MEP entry 2007

MSc MEP entry 2008

MSc MEP entry 2009

MSc MEP entry 2010

10 Alumnae meeting 1995-2006 – past and present lecturers and students

- The photo of MSc Clinical Sciences and MSc MEP entry 2011 is on page 3.


MSc Clinical Sciences and MSc MEP entry 2012


MSc Clinical Sciences and MSc MEP entry 2013

MSc Clinical Sciences and MSc MEP entry 2014

MSc Clinical Sciences and MSc MEP entry 2015

MSc Clinical Sciences and MSc MEP entry 2016

MSc Clinical Sciences and MSc MEP entry 2017

MSc Clinical Sciences and MSc MEP entry 2018

Students and Staff at the celebrations of 20th anniversary of medical physics and engineering MSc in KCL

Slavik Tabakov, 2018


Education and Culture
Leonardo da Vinci
EU2004.NL
Leonardo da Vinci Awards 2004
MAASTRICHT, 15 December 2004
Awarded to
"E-learning develops medical-imaging skills"
developed by EMIT Consortium - King's College London and King's College Hospital NHS Trust - Dept. of Medical Engineering and Physics (UK)
in partnership with University of Lund and Lund University Hospital (S), University of Florence (I), King's College London - GKTSM and King's College Hospital NHS Trust (UK), Hôpital Albert Michallon, Grenoble (F), European Federation of Organisations for Medical Physics - EFOMP (F).
for quality and innovation in Vocational and Educational Training.
Ján Figeľ,
Member of the European Commission responsible for Education, Training, Culture and Multilingualism.