International Organization for Medical Physics

IOMP

eMPW

Volume 33 Number 2 July, 2017

# 150th birthday of Marie Curie. Celebrating a lifetime of achievements!

**1867** — Born in Warsaw, Poland on November 7 1867, as Maria Salomea Skłodowska. The youngest of 5 siblings, had a difficult childhood


**1891** — Became the first woman faculty member at the École Normale Supérieure

**1895** — Married Pierre Curie. Together they had two daughters, Irene and Eve

**1898** — Enrolled at the University of Paris proceeding with her studies of physics, chemistry, and mathematics

**1900** — Founded the Radium Institute in Warsaw

**1903** — Awarded the NOBEL Prize in Physics along with Pierre Curie and Henri Bequerel

**1911** — Discovered Thorium, Polonium and Radium

| 90 | 84 | 88 |
|---|---|---|
| Th | Po | Ra |
| 232.038 | 209 | 226 |

**1932** — Awarded the NOBEL Prize in Chemistry for the discovery of radium and polonium, isolation of radium and study of its nature and compounds

**1934** — Died at Sancellemoz sanatorium in Passy from aplastic anemia on 4 July 1934

**2013** — IOMP establishes the IDMP

**2017** — IOMP celebrates Marie Curie's 150th birthday and the 5th IDMP on 7 November 2017

# Medical Physics World


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# Medical Physics World

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*Marie Curie timeline infographic designed by Theocharis Berris.*



## MPW/eMPW

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# IOMP in 2017 – our special IDMP, marking the 150th birthday of Marie Curie

## President's Address

**Slavik Tabakov, PhD, FIPEM, FHEA, FIOMP, Hon. Prof., IOMP President**

Dear Colleagues,

Our March issue of the eMPW opened the preparations for the special International Day of Medical Physics (IDMP), marking the 150th birthday of Maria Sklodowska Curie. The IOMP Women Sub-Committee is very active in these preparations and I am sure we shall have a remarkable celebration on 7 November 2017. On this day there will be web broadcastings, together with IAEA and WHO, so please tune in. Increasing the number of women medical physicists is a priority for us and we plan to start preparations for forming a full IOMP Women Committee.
There will be a number of large medical physics conferences and congresses this year, one of the largest being the 17th Asia Oceania Congress of Medical Physics (AOCMP 2017), combined with the 38th Annual Conference of Association of Medical Physicists of India (AMPICON 2017) - to be held in Jaipur, India just over the IDMP period. I am sure we shall see many colleagues there and IOMP already plans to organise a new IOMP School during AOCMP (as the one at ICMP2016, Bangkok).
An important task ahead of IOMP is the work on providing incorporating status of the Organisation. This status will be very important for our future activities, including taking direct official part in projects. We are working on the subject and this year we aim to present the Council with the view and proposal of the IOMP ExCom on the issue. This task will be related to many more IOMP projects, as the Accreditation for Educational courses and CPD. This activity also moved steadily ahead during the spring with the development of the new Accreditation Manual.
Another important task announced this year is the IOMP project History of Medical Physics. The project results will be a Compendium of various independent Volumes, as per the different branches of the profession. We expect that the project will be

## IOMP NMOs

### National Member Organisations

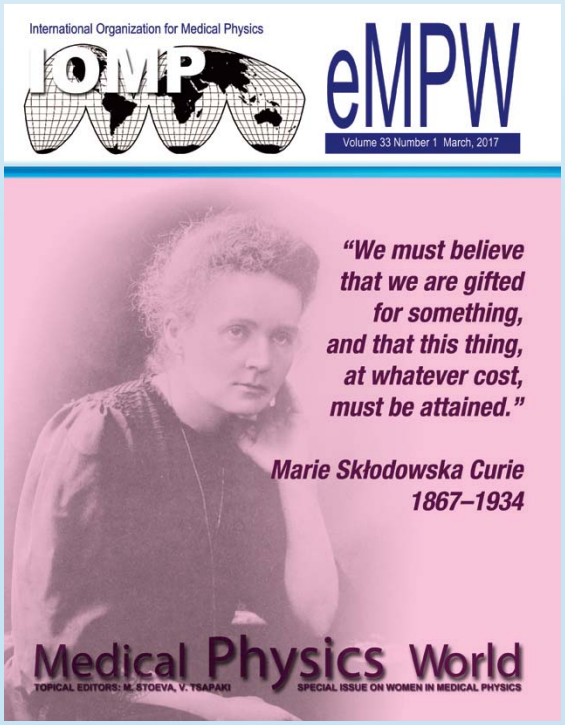
Algeria
Argentina
Australia & New Zealand
Austria
Bangladesh
Belgium
Brazil
Bulgaria
Cameroon
Canada
Chile
Colombia
Croatia
Cuba
Cyprus
Czech Republic
Denmark
Ecuador
Egypt
Estonia
Finland
France
Georgia
Germany
Ghana
Greece
Hong Kong
Hungary
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Japan
Jordan
Korea
Kuwait
Lebanon
Lithuania
Malaysia
Mexico
Mongolia
Morocco
Myanmar
Nepal
Netherlands
New Zealand
Nigeria
Norway
Pakistan
Panama
Peoples Rep. of China
Peru
Philippines
Poland
Portugal
Qatar
Rep. of China - Taiwan
Rep. of Macedonia
Rep. of Moldova
Romania
Russia
Saudi Arabia
Singapore
Slovenia
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Tanzania
Thailand
Trinidad & Tobago
Turkey
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Venezuela
Vietnam
Zambia
Zimbabwe
Bangladesh - AFFILIATE

developed over several years and many colleagues will volunteer in it. The project will be very useful to a broad audience and will create an excellent visibility for our profession. More details about the project are in the latest issue of the IOMP Journal Medical Physics International (www.mpijournal.org) During this period IOMP increased its links with other related international organisations and started exchange of papers in our respective Journals and Newsletters. This included an agreement with the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) for cooperation in collecting data on the usage of radiation in medicine and on reviewing the scientific literature related to this topic. Our links with WHO were also strengthened – both in the fields of Medical Devices and Radiation Safety. Our traditional links with IAEA also resulted in support for a number of projects, in particular for the development of Training and Educational activities in the African region.

Finally I would like to remind that this year marks not only our 5th IDMP, but also 5 years from the recognition of our profession by the International Labour Organisation and its inclusion in the International Standard Classification of Occupations (ISCO-08) - a milestone in the development of the profession. It is appropriate here to note that it took nearly 20 years for many IOMP Officers and Chairs to achieve this.

I wish to all of you a very successful period ahead and excellent celebrations of the IDMP 2017 under the theme "Providing a Holistic Approach to Women Patients and Women Staff Safety in Radiation Medicine", which IOMP will announce at its web site: http://www.iomp.org/idmp/

Prof Slavik Tabakov, PhD, Dr h.c., FIPEM, FHEA, FIOMP, President IOMP




*IOMP MPW Special Issue March 2017*

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**www.IOMP.org**

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# From the Desk of the IOMP Secretary General

Virginia Tsapaki, PhD, IOMP Secretary General

We are approaching to the middle of the year 2017; a year which is already marked by interesting and exciting events for the International Organization for Medical Physics (IOMP).

February and March were busy months for the Organization. In early February, there was a busy one week consultancy meeting at the International Atomic Energy Agency (IAEA) headquarters in which IOMP was represented by the Secretary General and the President. The objective of the meeting was to continue on the drafting of the IAEA Safety Report on Radiation Protection in Dental Radiology as well as the development of related training material. The team of invited experts included representatives of the World Dental Federation (FDI), the International Association of Dento-Maxillofacial Radiology (IADMFR) and the Alliance for Radiation Safety in Pediatric Imaging (the Image Gently Alliance).

The European Conference of Radiology, 1-5 March 2017 in Vienna, was an important scientific event that IOMP took part again this year. Thanks to Prof Magdalena Stoeva who did all the necessary arrangements, the IOMP booth was present in a prominent place within the scientific societies' section. This enabled not only the promotion of IOMP, but also the networking with other scientific societies of the world. During ECR, the SG represented IOMP in a leadership meeting with the International Society of Radiology (ISR) which resulted in a closer collaboration. This included joint celebrations of International Day of Medical Physics (IDMP) and International Day of Radiology (IDR), joint statements in future conferences, joint sessions in congresses and events, etc.

Just after ECR, IOMP took part in the IAEA Technical Meeting on Preventing Unintended and Accidental Medical Exposures in Radiology held at the IAEA's Headquarters in Vienna, Austria, from 6 to 8 March 2017 (https://rpop.iaea.org/RPOP/RPoP/Content/News/2017-3-tm-radiology.htm). The meeting gave Member States, international organizations and professional societies an opportunity to exchange information on methods for investigation, reporting and prevention of unintended and accidental exposure in diagnostic radiology and interventional procedures. The meeting was attended by 52 participants from 25 countries including radiologists, medical physicists, radiation technologists, and regulators as well as equipment manufacturers. It was attended by representatives from WHO, UNSCEAR, ISR, ISRRT, Image Gently Alliance, DITTA, HERCA, CRCPD, ESR, EFOMP, EFRS, as well as a range of national organizations and regulatory authorities.

Although still early in the year 2017, a number of applications for various scientific events and/or conferences around the globe have already been processed. The request from national or regional organizations was either for endorsement or/and financial support. Examples are the endorsement of events in countries such as Bangladesh (http://pmcn2017.info/), South Africa (http://www.saapmb2017.co.za/) and India (http://aocmp-ampicon2017.org).

IOMP is proud to announce the formalization of a cooperation between the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) through the exchange of letters for the evaluation of the usage of radiation in medicine.

There were a number of requests from National Member Organizations (NMOs) to update the latest IOMP survey related to the number of medical physicists (MP) and specifically on the percentages of men and women MP. The results of the IOMP initial survey can be found in the European Journal of Medical Physics: https://www.ncbi.nlm.nih.gov/pubmed/25790723 . For this reason, the survey is currently being updated at the following link: https://goo.gl/forms/8ofpGsRg6UtS7lt H3

Finally, IOMP is continuously trying to update all NMOs information you are kindly asked to update your information at the following link: https://docs.google.com/forms/d/e/1FAIpQLSc6aOY5O5vNxq08yD9ynfJE_k6dHY51nO2Xs2XZdPnIaBAszg/viewform?c=0&w=1

# Vice President's Report

**Madan M Rehani**

**Vice President, IOMP**

**Massachusetts General Hospital & Harvard Medical School, Boston, MA, USA**

One of the important roles that international professional societies play is the cooperation with international organizations. In this respect, this issue provides a glimpse of the cooperation with international organizations and international professional bodies. IOMP has been very active in working with International Atomic Energy Agency (IAEA) and the World Health Organization (WHO). There is official recognition of IOMP with these two organizations. IOMP has been among list of international professional organizations as recognized NGO of IAEA ever since early 2000's. IOMP is invited to the General Conference (GC) of IAEA every year. GC is the event that attracts all Member States of the IAEA (168 as of Feb 2016) in which Heads of official liaison bodies of the respective government participate. Typically, there are as much as 1000 participants. However, invitation to GC is more of a status symbol with possibility to make impact in policy matters. More important is the participation of IOMP in development of radiation safety standards called Basic Safety Standards (BSS). BSS provides requirements that get translated into regulatory systems of the country. IOMP plays significant role in giving definition of medical physicist in BSS and mentioning the role medical physicists play in clinical settings to achieve protection of patients and staff. It is in this respect that it must be remembered that BSS defines medical physics as a "health professional". Since ILO is a signatory and official co-sponsor of IAEA BSS, this takes official form. The IOMP was recognized as NGO with official relationship with WHO in Jan 2015. By virtue of that, IOMP is invited to World Health Assembly of WHO every year. Again, this provides possibility to present views at highest level of policy making at the IAEA. For example, last year an official statement was presented as: Statement by the International Organization for Medical Physics (IOMP), an NGO in official relation with WHO, 69th World Health Assembly: Agenda Item 16.1 Health Workforce and services Strengthening human resource.

The statement pertains to effective and optimal cancer control in low and middle income countries (LMIC) as a component of universal health coverage Thank you for the opportunity to deliver this statement on behalf of the International Organization for Medical Physics (IOMP) – representing over 24,000 medical physicists in over 80 countries Medical Physicists have an indispensable role in cancer diagnosis and treatment as well as in cancer research. It is estimated that 22,000 Medical Physicists will be required in LMICs by 2035 to provide equal access to radiation therapy. The total number of medical physicists in 2016 is around this number, of which approximately only 1/3rd are in LMICs. There is an urgent need to strengthen actions to address this demand.
The figures have been drawn from an article in Lancet Oncology in September 2015.

IOMP contributed in a publication of WHO released in 2017 "WHO List of Priority Medical Devices for Cancer Management".

The IOMP has been working closely with International Radiation Protection Association (IRPA), particular on the subject of Radiation Safety Culture in Healthcare as a joint IOMP-IRPA-WHO activity. So far 4 joint events have been held (at Buenos Aires, Geneva, Stellenbosch South Africa, Doha Qatar). Further information at >>>

# It is time to talk about specificities of women health

**Simone Kodlulovich Renha, PhD, Chair of Awards & Honours Committee**

One survey carried out by the group of the Women's College Hospital in Canada ("A thousand voices for women's health. A pioneering study") presents the expectative, priorities and necessities of a representative group of 1,000 women taking account: racial, cultural and religious communities, demographic and socio-economic backgrounds, diverse sexual orientations and vulnerable life circumstances. This study also showed that women believe in the ancient holistic idea that healing is most effective when you consider the whole person, rather than focusing on specific illnesses, body parts or symptoms. As Socrates said in the 4th century B.C., "the part can never be well unless the whole is well." For them, the holistic approach is to focus on prevention rather than treatment, to focus on wellness, not illness, to deliver care in the context of women's lives, to enable women to be the co-creators of their own health. They also understand that women need more information, education and resources to manage their own health. But most of all, women want to be treated with dignity and respect, without judgment, categorization, or preconceptions.

Women want health-care professionals who acknowledge the connection between mind and body and tailor the health-care to their specific needs considering religion, family status, care giving responsibilities, concurrent illnesses, medication interactions, and domestic and economic realities. The majority want a hospital that specializes in women's health, that acts as a hub of women's health and that includes testing, diagnosis, treatment, follow-up and support. Due to cultural and religious reasons, some women also requires to be treat only by female health professionals, especially in case of disorders affecting their genitals or breasts. The World Health Organization (WHO) has also pointed out some specific concerns about women health, expressed in the following 10 areas (http://www.who.int/features/factfiles/women_health/en): 1) Tobacco: the use of tobacco among younger women increased. Women generally have less success in quitting the habit, have more relapses than men, and nicotine replacement therapy may be less effective among women. 2) HIV epidemic in women is increasingly: Of all adults living with HIV in sub-Saharan Africa 61% are women and the proportion in the Caribbean is 43% and the numbers of women living with HIV in Latin America, Asia and Eastern Europe are also growing. 3) Consequences in women health due to violence: between 15% and 71% of women around the world have suffered physical or sexual violence committed by an intimate male partner at some point in their lives. The main consequences from for women health include injuries, unwanted pregnancies, sexually transmitted infections, depression and chronic diseases. 4) Violence against women is widespread around the world: Some studies show that up to 1 in 5 women reports being sexually abused before the age of 15. 5) Early marriage: approximately 100 million girls will marry before their 18th birthday over the next 10 years. Young married girls often lack knowledge about sex and the risks of sexually transmitted infections and HIV/AIDS. 6) Motherhood in adolescence: about 14 million adolescent girls become mothers every year. 7) Maternal deaths: Every day, 1600 women and more than 10 000 newborns die from preventable complications during pregnancy and childbirth. Almost 99% of maternal and 90% of neonatal mortalities occur in the developing world. 8) Women with her own income: when women earn an income, they are more likely than men to buy the nets for their households. 9) Indoor smoke is responsible for half a million of the 1.3 million annual deaths due to ▸

chronic obstructive pulmonary disease (COPD) among women worldwide. In comparison, only about 12% of COPD deaths among men each year are related to indoor smoke. During pregnancy, exposure of the developing embryo to such harmful pollutants may cause low birth weight or even stillbirth. 10) Higher risk of becoming visually impaired - Across the world and at all ages, women have a significantly higher risk of becoming visually impaired than men. Even so, women do not have equal access to health care to treat eye diseases often due to their inability to travel unaccompanied to health facilities and cultural differences in the perceived value of surgery or treatment for women.
In the report of Taskforce 3 on Gender Equality of the UN Millennium Project (Final Report to the WHO Commission on Social Determinants of Health September 2007) we can also see another challenger faced by women: the gender inequality. Gender relations of power constitute the root causes of gender inequality and are among the most influential of the social determinants of health. They operate across many dimensions of life affecting how people live, work, and relate to each other. They determine whether people's needs are acknowledged, whether they have voice or a modicum of control over their lives and health, whether they can realize their rights.
The report also point out seven approaches that can make a difference: 1. Address the essential structural dimensions of gender inequality; 2) Challenge gender stereotypes and adopt multilevel strategies to change the norms and practices that directly harm women's health; 3) Reduce the health risks of being women and men by tackling gendered exposures and vulnerabilities; 4)Transform the gendered politics of health systems by improving their awareness and handling of women's problems as both producers and consumers of health care, improving women's access to health care, and making health systems more accountable to women; 5) Take action to improve the evidence base for policies by changing gender imbalances in both the content and the processes of health research; 6)Take action to make organisations at all levels function more effectively to mainstream gender equality and equity and empower women for health by creating supportive structures, incentives, and accountability mechanisms.
This report also shows that addressing the problem of gender inequality requires actions both outside and within the health sector because gender power relations operate across such a wide spectrum of human life and in such inter-related ways.
The health sector may take leadership but it must also act in collaboration with other sectors if these goals are to be achieved.

IOMP is attentive to all these particularities regarding to women health and has been working continually with many international organizations to contribute to the improvement of health care offered to the all population, taking in account the women special needs. The IOMP women group also believes that we can give a substantial contribution to women health care. So, we will continue to encourage more and more women to follow the profession of medical physics.
In the IDMP 2017, dedicated to women patient and professional, in the occasion of the 150o Madame Curie anniversary, let's celebrate discussing the women health problems, actions and solutions.

Medical Physics: Providing a Holistic Approach to Women Patients and Women Staff Safety in Radiation Medicine

# Medical Physics Enables Healthier Lives for Women

John Damilakis, PhD, Chair IOMP Education and Training Committee

There are health problems that are more prevalent in women than in men such as breast cancer and osteoporosis. In this article, I'll focus on 2 diagnostic imaging methods developed by medical physicists that have increased women's length of life and quality of life: X-ray mammography and dual-energy X-ray absorptiometry (DXA). Medical physicists not only developed these methods but also play a fundamental role in their application ensuring the quality of procedures while minimizing radiation risks to women patients.

Several imaging techniques have been developed for breast cancer diagnosis. X–ray mammography is the most widely used modality for early detection and follow-up of lesions. Ultrasound examination, magnetic resonance imaging, magnetic resonance spectroscopy and positron emission tomography can provide additional information for the early diagnosis and characterization of breast tumors. Dedicated CT systems have been developed for the three-dimensional high-resolution imaging of the breast. However, X-ray mammography has been considered as a 'gold standard' for screening of asymptomatic women. X-ray mammography was developed in the 60s. In 1965, Charles Gros, a French medical physicist developed the first X-ray unit dedicated to mammography called 'Sonographe'.

Screening mammograms are associated with low radiation dose and are capable of reducing breast cancer mortality considerably (1,2). The female breast is a radiation sensitive organ. The lifetime attributable risk of fatal radiation-induced cancer is from 1.3 to 1.7 cases per 100000 women. Medical physicists assess radiation doses from mammography and associated risks and contribute considerably to the development and implementation of quality assurance programs.

Although mammography is a low-dose technique, optimization of protection i.e. reduction of radiation dose without loss of diagnostic information is of paramount importance. Important factors determining both radiation dose and image quality are the energy spectrum of the x-ray beam, breast composition and thickness and the characteristics of the x-ray detector. Glandular dose increases with decreasing tube potential and increasing breast thickness. Scattered photons degrade image quality considerably. The use of an anti-scatter grid reduces scatter, however patient dose is increased. The use of automatic exposure control and proper breast compression are also important measures to reduce dose and improve image quality. Although patient radiation doses associated with most X-ray mammography are low in comparison with those from other X-ray examinations, every facility should take its own action to avoid unnecessary patient exposure to radiation. Medical physicists optimize mammography examinations maximizing the expected benefit against the potential radiogenic risks.

The new European Basic Safety Standards (3) advocate the establishment and use of diagnostic reference levels (DRLs). In mammography DRLs are expressed in tems of Entrance Surface Air Kerma (ESAK) free-in-air or Entrance Skin Dose (ESD) or in terms of Mean Glandular Dose (MGD) estimated using a standard PMMA phantom. There is no much information on DRLs for mammography. National DRLs set by an authoritative body in European countries were reviewed in 2010-11 in the Dose Datamed 2 (DDM2) project (4). There is a need to establish DRLs for mammography, consolidate available information and provide guidance on what actions are needed in using DRLs to further enhance radiation protection of female patients. Medical physicists play a vital role in establishing and using DRLs and, for this reason, the new European legislation (3) states that members states shall ensure that

medical physics experts contribute to 'optimization of the radiation protection of patients and other individuals subjected to radiation exposure, including the application and use of diagnostic reference levels'.

In 1963, J. Cameron and James Sorenson, medical physicists from the USA developed the first non-invasive technique to assess bone mineral in the early 60s. They introduced single photon absorptiometry to measure peripheral bone mineral density. This had tremendous implications in healthcare, especially for the early diagnosis of osteoporosis. It is well known that the assessment of vertebral fractures is possible today using computational techniques applied to x-ray absorptiometry (DXA) thoracic and lumbar spine images. Moreover, DXA is widely used for 'areal' bone mineral density assessment of lumbar spine, proximal femur and forearm. Use of DXA has increased considerably during recent years. For this reason, application of radiation protection principles i.e. justification and dose optimization is necessary. Scanning length of all DXA should be minimal. Patient's body size should be considered and use of proper acquisition protocols is of great importance, especially for young patients and adolescents. Medical physicists ensure that regulatory requirements relating to radiation protection are fulfilled, define the technical specifications of new DXA equipment and ensure that the equipment operates as specified throughout its life.

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# Report of Science Committee

## Geoffrey S. Ibbott, PhD, Science Committee Chair

The IOMP Science Committee is responsible for disseminating current information to medical physicists; assisting in the planning and conduct of regional meetings on medical physics; contributing to and reviewing scientific documents prepared by organizations such as the International Commission on Radiation Units and Measurements, the International Commission on Radiological Protection, the World Health Organization, and the National Council on Radiation Protection and Measurements; and participating in various forums for the generation of scientific information in medical physics.

The current Committee membership is shown below, with each member's country and regional organization.

Geoffrey Ibbott , Chair, USA
Facundo Ballester, Spain/EFOMP
Sha Chang, USA
Lawrence Dauer, USA
XiaoWu Deng, China
Benedick Fraass, USA
George Kagadis, Greece/EFOMP
Reinhard Loose, Germany/EFOMP
Malcolm McEwen, Canada
Hossein Mozdarani, Iran/MEFOMP
Wilbroad E. Muhogora, Tanzania/FAMPO
Hugo Palmans, United Kingdom
Mark Rivard, USA
Maria Elisa Rostelato, Brazil/ALFIM
Ferid Shannoun, Austria
Vellaiyan Subramani, India
Yoshiharu Yonekura, Japan

In recent months, the Science Committee has continued to review and comment on the proposed program for the WC 2018 in Prague. Dr. Ibbott has been nominated to be a co-chair of the Scientific Committee of the WC and will work together with the chairs and other co-chairs to develop the program. The SC has contributed numerous suggestions for session chairs and plenary speakers. We also reviewed and commented on an application for support of an educational program in Lima, Peru sponsored by AAPM, IOMP and ISEP.

The Science Committee contributed to the activities of the World Health Organization (WHO) through the "Consultation to Define Priority Medical Devices for Cancer Management – Targeting Low and Middle Income Settings". This effort was based in part on the IAEA Publication "Setting up a Radiotherapy Programme: Clinical, Medical Physics, Radiation Protection and Safety Aspects" and other reports, and had as its goal to identify the essential medical equipment for radiation therapy treatment of the six cancers that the WHO has prioritized in LMI countries: cervical, breast, lung, prostate, colorectal and leukemia. The project culminated recently in the publication of a massive report as part of the WHO medical devices technical series called "WHO list of priority medical devices for cancer management". The report itself is available at http://www.who.int/medical_devices/publications/priority_med_dev_cancer_management/en/.

Several members of the Science Committee continue to contribute to the Expert Group on Medical Exposures; a project of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). The subcommittee has identified publications that describe issues regarding access to radiation therapy throughout the world, and aspects of quality of radiation therapy, with particular interest in the dose delivered to organs at risk. This is part of a larger project to evaluate radiation therapy worldwide.

Our next projects include finalizing a subcommittee on Emergency Response, contributing to the IAEA's International Conference on Radiation Protection in Medicine (scheduled for December 11-15 in Vienna,) and developing new relationships with the IEEE.

It is an honor to serve as chair of the Science Committee, and I am looking forward to the activities of the committee over the next years.

# Implementation of International Basic Safety Standards (BSS) for the use of radiological medical imaging devices

**ABRAMOWICZ Jacques(1), CONSUL Nikita(2), FRIBERG Eva(3), JIMENEZ Pablo(4,8), KUMAR SHARMA Jitendar(5), MIKHAIL Miriam(6), HOLMBERG Ola(7), PÉREZ María(8), STOEVA Magdalena(9), VAN DEVENTER Emilie(8), WHITLEY Stewart(10)**

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**2 Columbia University College of Physicians & Surgeons, USA**
**3 Norwegian Radiation Protection Authority (NRPA), Norway**
**4 Pan American Health Organization (PAHO)**
**5 Ministry of Health & Family Welfare, India**
**6 RAD-AID International**
**7 International Atomic Energy Agency (IAEA)**
**8 World Health Organization (WHO)**
**9 International Organization for Medical Physics (IOMP)**
**10 International Society of Radiographers and Radiological Technologists (ISRRT)**

Abstract

The "Radiation protection and safety of radiation sources: International basic safety standards" (BSS), are co-sponsored by the IAEA, WHO, PAHO, FAO, ILO, EC, FAO and UNEP.WHO is cooperating with BSS cosponsors to support its implementation in the health sector to improve radiation protection (RP) in medicine. This article summarizes the outcomes of a workshop on BSS implementation held in Geneva on 10th May 2017, as part of the 3rd WHO Global Forum on Medical Devices (Geneva, Switzerland, 10-12 May 2017). During the workshop, presenters from Norway and India shared their experiences indicating that implementation of the BSS requires an administrative framework involving dialogue and cooperation between relevant authorities and professional societies, beyond revising national laws and regulations. The major challenges identified included the justification of radiation exposure for new medical imaging technologies, procedures or devices and for screening programs. There are not enough radiation safety officers in medical facilities to ensure procurement of appropriate and safe devices. There is a need for increased number of medical physicists, for integration of radiation protection into health technology assessment and for promotion of clinical audit programmes to ensure that clinical benefit outweighs radiation detriment. Presenters from the IOMP, ISRRT, RAD-AID International and WFUMB discussed their respective roles as medical physicists, radiographers and radiologists, and the actions conducted to promote the BSS as part of their missions and global outreach programs. It was noted that similar BSS for non-ionizing radiation are lacking and some international organizations are joining efforts to bridge this gap.

## Introduction

Advanced technologies have opened new horizons for the use of radiation medical devices in diagnostic imaging and image-guided interventions, including the use of ionizing radiation (e.g. computed tomography, fluoroscopy) as well as non-ionizing radiation (e.g. ultrasound, magnetic resonance imaging). Although the safety and efficacy of procedures have improved, incorrect or inappropriate handling of these technologies can introduce potential hazards for patients and staff (e.g. unnecessary exposure can arise from procedures that are not indicated and/or not properly performed, accidental exposures can result from unsafe or inappropriate use of radiation technology).

The "Radiation protection and safety of radiation sources: International basic safety standards (BSS), represent a global benchmark for setting national regulations in the field of radiation protection. Co-sponsored by eight international organizations(1), the new BSS have expanded the safety requirements applicable to the use of ionizing radiation in medical imaging equipment and devices [1].

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*(1) European Commission (EC), Food and Agriculture Organization (FAO), International Atomic Energy Agency (IAEA), International Labor Organization (ILO), Nuclear Energy Agency (NEA/OECD), Pan American Health Organization (PAHO), United Nations Environment Program (UNEP), and World Health Organization (WHO).*

In contrast, similar BSS for non-ionizing radiation are lacking, and some international organizations are considering joining efforts to bridge this gap.

This article summarizes the discussions and conclusions of a workshop entitled "Implementation of International Basic Safety Standards (BSS) for the use of radiological medical imaging devices", organized during the 3rd WHO Global Forum on Medical Devices. The aim of the workshop was to collect experience and views about challenges and opportunities in the implementation of the BSS for the use of radiological medical imaging devices. The workshop was co-chaired by Emilie Van Deventer (WHO) and Jitendar Kumar Sharma (India). Nikita Consul (USA) contributed as rapporteur. Several national and international organizations presented their perspectives during this workshop. National experiences were combined with the views from organizations which spoke to its niche contribution toward increasing radiation safety in its global outreach.

**The BSS and the Bonn Call for Action**

In December 2012, the IAEA organized the "International Conference on Radiation Protection in Medicine (ICRPM): Setting the Scene for the Next Decade" in Bonn, Germany, co-sponsored by WHO. This conference, which gathered 536 participants from 77 countries and 16 international organizations, outlined roles and responsibilities for stakeholders regarding radiation protection in medicine, and identified 10 priority actions for the next decade to improve radiation protection in health care, known as the "Bonn Call-for-Action" [2]. The aims of the Bonn Call-for-Action are to:

a) strengthen the radiation protection of patients and health workers overall;

b) attain the highest benefit with the least possible risk to all patients by the safe and appropriate use of ionizing radiation in medicine;

c) aid the full integration of radiation protection into health care systems;

d) help improve the benefit/risk-dialogue with patients and the public; and

e) enhance the safety and quality of radiological procedures in medicine.

The Bonn Call-for-Action was published as a joint position statement by the IAEA and WHO, and it set the stage for a continuing collaboration with stakeholders. As a follow-up of the Bonn Conference, the upcoming "ICRPM: Achieving Change in Practice" will be held at the IAEA Headquarters in Vienna, Austria, 11-15 December 2017, co-sponsored by WHO and PAHO. A pervasive ongoing collaboration between WHO and IAEA to promote the Bonn Call-for-Action includes the encouragement of medical facilities around the world to abide by the BSS within radiology services.

**Setting the scene**

Dr. Maria del Rosario Perez from the WHO presented an overview on the new BSS highlighting several avenues for improving protection and safety regarding radiological medical devices in all modalities, and in particular for radiology. She brought up that several types of stakeholders, ranging from the medical device manufacturers to the clinicians, radiographers and medical physicists have a role to play.

In addition to the clinical considerations linked to the process of justification of radiological procedures, optimization of protection and safety includes considerations about the design of radiological equipment, together with operational considerations about how different members of the healthcare team interact and how the radiological devices are handled in different circumstances (e.g. children, research subjects, health screening, pregnancy, breastfeeding, high-dose procedures). Dosimetry calculations and quality assurance by the medical physicist are essential to optimize radiation protection and safety for the patients. Multiple specific items of the BSS highlight instances of radiation safety requirements for medical exposures.

Several challenges were identified, including the low awareness level among healthcare professionals regarding radiation doses and risks; the lack of integration of radiation safety into healthcare policies in different regions; the limited cooperation and dialogue about radiation safety between health authorities, medical device regulators, and radiation protection regulators; and the immeasurable disparities in access to health services and technologies that exists across different regions of the world. Herein lies an opportunity to bridge the communication gap, educate and engage on radiation safety the different members of the healthcare team.

**National Organizations Involved With Radiation Safety in Medical Imaging**

**Norway**

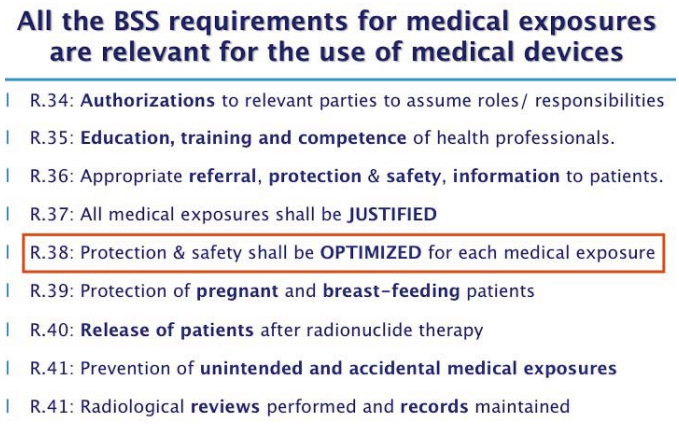


*Figure 1. Slide highlighting the multiple BSS requirements pertinent to medical devices and medical exposures.*

Eva Friberg from the Norwegian Radiation Protection Authority (NRPA) spoke about the need for building a framework to ensure implementation of the BSS. Although Norway is not part of the European Union, they have already adopted the essential parts of the Euratom BSS in their national radiation protection regulation [3]. She stressed that implementation of the BSS required establishing an administrative framework that involved dialogue and cooperation with relevant authorities and professional societies, beyond revising laws and regulations of the nation. Implementing the BSS posed challenges toward justifying medical exposure, especially generic justification of new medical methods, procedures, or devices. To overcome this challenge, radiation detriment was incorporated into the risk/benefit evaluation already performed in Health Technology Assessments. In this way HTA is identified as a tool to ensure that clinical benefit outweighing radiation detriment. Cooperation with relevant authorities and professional societies became necessary to justify screening programs, biomedical research, and other non-medical human imaging procedures requiring the use of medical devices [4]. Implementing requirements for clinical audit emphasized a need for developing a national methodology and to ensure for proper training of the auditors. A national survey revealed lack of education and training in radiation protection for many health professionals involved in medical exposure, highlighting the importance of establishing sustainable educational programs and recognition systems for health professionals and medical physicists. To achieve reliable local dose management, establishing national diagnostic reference levels and estimates of population dose from diagnostic imaging, technical solutions for automatic data collection and reporting are now under development. Overall, she stressed the importance of communication and cooperation between authorities of radiation protection, health authorities, and stakeholders like professional societies in adopting the new International BSS.

*Figure 2. The NRPA has its own personal dosimetry service for patients and other civilians.*

**India**

Jitendar Sharma, the founder director of the WHO Collaborating Centre and head of the Department of Health Technology at India's Ministry of Health, and currently the founder CEO of MedTech Zone in Andhra Pradesh (AMTZ), spoke about the establishment of radiation safety precautions in the design and manufacturing related with radiology projects built in the facilities of MedTech Zone- which is the world's first medical devices manufacturing city. While, in regards to radiation safety compliance, often a country is in the "We Don't Know that We Don't Know" phase, he characterizes the facilities as somewhere between the "We Know We Don't Know" and the "We Know We Know" phases. He shared the experience of bringing together ministers of health from various states of India to map out radiology programs and design a compliance audit for radiation safety. The major challenge was ensuring sufficient radiation safety officers for all of the sites for auditing, and ensuring that compliance is bridged via procurement of appropriate and safe devices. This could take the government in India around 3-5 years, so engagement with third party compliance agencies that are able to do the tendering and procurement independently, for auditing the compliance, is being recommended. Besides, the AMTZ is providing for high end industrial scale radiation testing centre at highly subsidized cost of testing. This approach will not only reduce the cost of manufacturing by 40% for radiological medical devices, but it will also reduce import dependency in India and help to improve access to medical devices that are radiation-safe.

**International Organizations Involved With Radiation Safety in Medical Imaging**

**IOMP**

Magdalena Stoeva, Chair of the IOMP Medical Physics World Board, presented the objectives of IOMP to assure increased radiation safety, as a leader of several educational initiatives and centers in collaboration with the IAEA, WHO and other international organizations. IOMP is a non-governmental organization (NGO) in official relations with the WHO which represents 6 international federations, 86 national societies and more than 24,000 individual members worldwide and has several international publications.

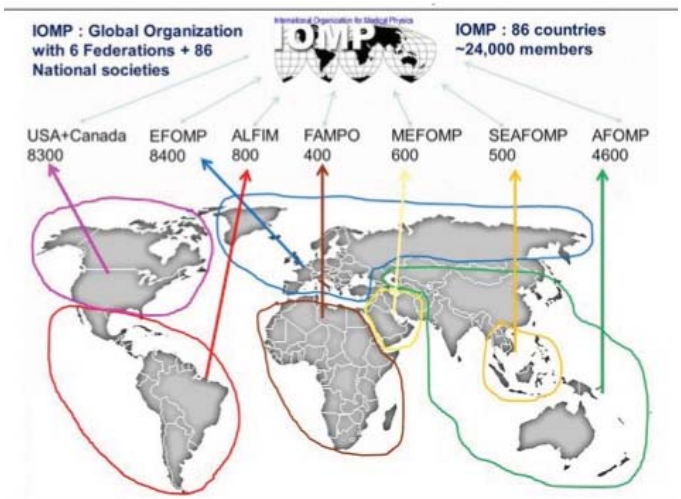


*Figure 4. IOMP member organizations around the globe.*

The first of the stated IOMP objectives is to organize international cooperation in medical physics and allied subjects. The IOMP collaborates with the IAEA and WHO, focusing on the actions proposed in the Bonn Call-for-Action. It will participate at the 2017 ICRPM to review actions taken and results achieved in radiation protection in medicine since the 2012 ICRPM in Bonn, Germany.

*Figure 4. IOMP Regional Coordination Board*

The second objective of the IOMP is to contribute to the advancement of medical physics, especially in developing countries. It has been estimated, based on the global need for increased medical imaging, that the number of medical physicists in the coming two decades will approximately triple. The IOMP recognizes that it will play an essential role, together with the WHO and the IAEA, in implementing the BSS recommendations via the responsibilities and qualifications of medical physicists. The IOMP will lead in this by providing guidance and support to its member organizations on the development of formal infrastructure for education and training, establishment of professional certification, and planning for medical physics manpower requirements. One such example of formal education and training is the "IOMP School", which most recently was held in Bangkok in 2016, with 42 mini symposia.

The third objective of the IOMP is to encourage and advise on the formation of national societies of medical physics in countries without such organizations. The expansion of its member organizations will be essential in channeling educational initiatives and infrastructure required for the training of additional medical physicists in the countries where they are lacking, but essential in the near future as the need for medical imaging in the diagnosis of non-communicable diseases grows.

**International Society of Radiographers and Radiological Technologists (ISRRT)**

Stewart Whitley provided the views from the ISRRT, a NGO in official relations with the WHO that was founded in 1962 with 94 member societies and more than 500,000 individual society members. He presented the aspects of the BSS and Bonn Call-for-Action that the ISRRT can be expected to continue being involved with. The ISRRT holds annual workshops in low- and middle-income countries (LMICs), disseminates information from both the WHO and IAEA, promotes research and best practices including for instance the so-called "Dosewise Radiographer of the year" competition, promotes awareness every 8th of November as the World Radiography Day and awards an annual

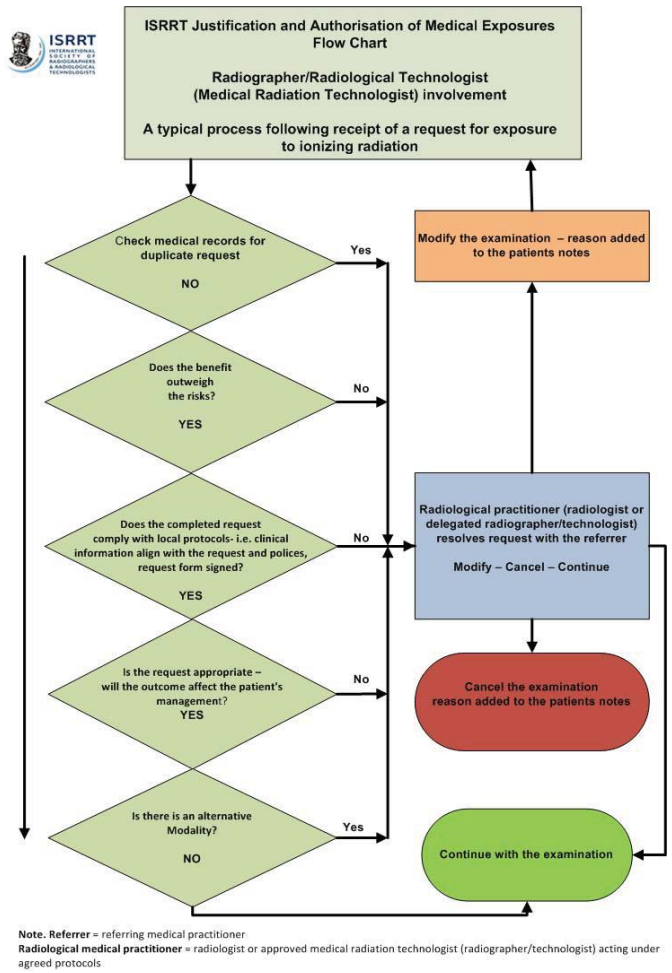


*Figure 6. ISRRT Justification and Authorization of Medical Exposures Flow Chart.*

Research award to the value of £5,000. They are involved with the Image Gently and Image Wisely awareness campaigns, they periodically hold ISRRT World Congresses, produce three Newsletters every year, and are involved with national societies by both sending experts and providing recommendations and advice.

With regards to implementation of the BSS, ISRRT is involved with utilization of all diagnostic equipment based in government-funded hospitals and health clinics, as well as the private sector. They are involved with image-guided radiotherapy procedures and imaging in other medical subspecialties outside of the Diagnostic Imaging departments. They promote their

members to focus on the Bonn Call-for-Action and encourage them to engage in the process of justification of medical exposures and use of imaging referral guidelines, as well as to contribute to the establishment of diagnostic reference levels. One specific example is the design of a flowchart to aid radiographers in decision-making processes related to the Bonn Call-For-Action items on Justification. They have contributed to several IAEA and WHO projects related to the Bonn Call-for-Action. Radiographers are core frontline staff who come into direct contact with patients on a daily basis and so, they can contribute to the decision making process about imaging modality and radiation dose given to the patient.

*Figure 7. RAD-AID has on-site projects in 25 countries, designed to assist the implementation, improvements, and optimization of radiology and radiation therapy.*

The IOMP and ISRRT are similar in their level of engagement with national member societies and educational initiatives in outreach sites, with the exception of the ISRRT workshops in LMICs and various stints for public awareness by the ISRRT, which the IOMP may consider taking up as well.

**RAD-AID**

Miriam Mikhail presented the views and activities of RAD-AID, a NGO in official relations with the WHO and founded in 2008 with programs on site at 25 different countries and thousands of volunteers from 100 different countries. She spoke about the mission of RAD-AID to improve radiological and radiotherapy services in countries with concurrent implementation of BSS. RAD-AID makes use of a trademarked "Radiology Readiness Assessment" to plan an outreach project and get buy-in from local stakeholders; in implementation phases, RAD-AID focuses on sustainable training that includes radiation safety (e.g. dose optimization), while also bringing essential diagnostic modalities to areas of the world that increasingly suffer from underdiagnosed communicable and non-communicable diseases.

Regional campaigns for justification and optimization of radiation exposure due to medical imaging is supported by RAD-AID collaborations with leaders in radiology around the world who are also involved with initiatives such as AFROSAFE, LATINSAFE, EUROSAFE, ARABSAFE, Image Gently, Image Wisely, and Choosing Wisely. Outside of on-site projects, RAD-AID promotes appropriate imaging by teaching via broadly available resources in-country like RadiologyInfo.org, by promoting clinical imaging referral guidelines (RC iRefer, CAR National Practice Guidelines, ACR appropriateness criteria, ACR Select, WA Diagnostic Imaging Pathways, Clinical Decision Support), by strengthening system capacity for the retrieval of outside imaging, and by promoting systems for patient cumulative dose tracking in the medical records.

There are opportunities for collaboration of medical physicists with RAD-AID, given their model of education and training at country level for improving safety and quality of radiology care including both: the radiation safety perspective in addition to the diagnostic perspective.

**The World Federation of Ultrasound in Medicine and Biology (WFUMB)**

Emilie Van Deventer spoke on behalf of Jacques Abramowicz from the WFUMB, a NGO in official relations with the WHO that brings sustainable ultrasound programs to underserved areas of the world with 6 continental member organizations, 89 member countries and more than 50,000 individual members. She spoke about WFUMB's role in promoting ultrasound safety as a form of non-ionizing radiation, with optical light and MRI magnetic fields being other common forms of non-ionizing radiation. The WFUMB is actively involved with global education on ultrasound, runs 13 Centers of Education in all regions of the world across 5 different continents, publishes the Journal of Ultrasound in Medicine and Biology, and has worked with the WHO to publish the Manual of Diagnostic Ultrasound.

The WFUMB works with the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) and they publish policy statements and recommendations on the safe and appropriate use of ultrasound (e.g. Doppler Ultrasound, imaging of the fetus for "souvenir" purposes, as well as ultrasound exposure in the first trimester and autism spectrum disorders). WFUMB has also published recommendations on non-medical use of ultrasound and a clinical safety statement for diagnostic ultrasound. They educate their members, educate trainees, and work directly with ultrasound manufacturers to further their cause of safe implementation of ultrasound as a source of non-ionizing radiation, in medicine and biology.

**Inputs from the audience during the discussion**

Rajiv Ranjan Prasad, from the IAEA Division on Nuclear Application for Human Health (NAHU) presented an overview of the IAEA publications in the field of radiation and health

including the new BSS, and distributed leaflets announcing the new BSS edition among the workshop participants.

Guy Frija, made comments on behalf of the International Society of Radiology (ISR) and European Society of Radiology (ESR), emphasizing that the formal establishment of the ISR Radiological Quality and Safety Alliance (ISRQSA), which will coordinate actions of the continental campaigns (i.e. AFROSAFE, LATINSAFE, EUROSAFE, ARABSAFE, Image Gently, Image Wisely, and Choosing Wisely). The ISRQSA provides another platform for global collaboration with WHO, IAEA and other relevant international organizations to support implementation of the BSS and Bonn Call-for-Action. ISR is a NGO in official relations with WHO and has therefore a collaboration work plan including radiation safety aspects.

Representatives from DITTA, a global alliance of manufacturers of medical imaging equipment which is also a NGO in official relations with WHO, highlighted the role of manufacturers in the implementation of BSS and the Bonn Call for Action.

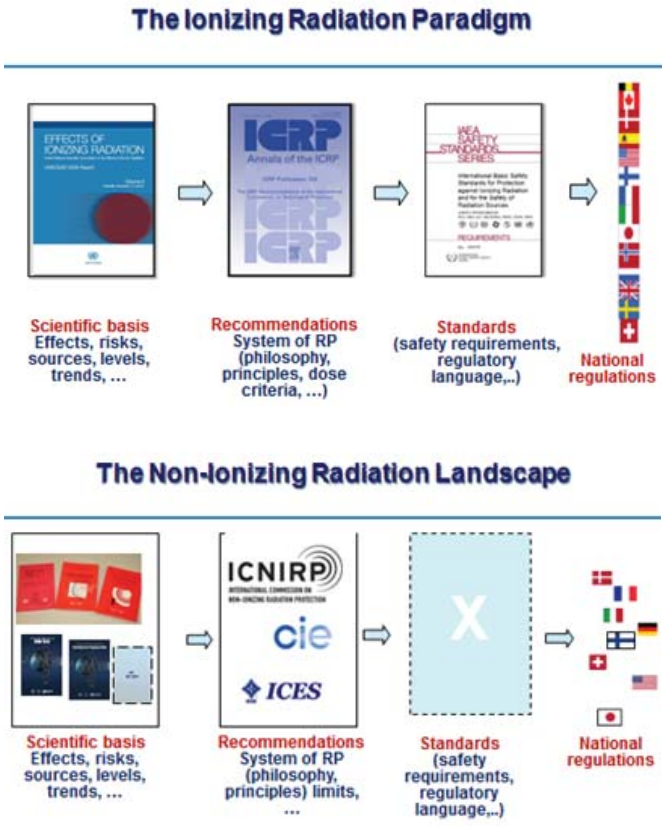


*Figure 8. Radiation basic safety standards (BSS): paradigm for ionizing radiation and current situation with non-ionizing radiation*

**Future Directions**

Collaboration between UN organizations (i.e. IAEA, WHO and PAHO) and professional societies, patient advocates, manufacturers' associations, regulators (i.e. public health, radiation safety and medical devices authorities) and other relevant stakeholders, will be essential in ensuring that all patients at the global level are safe from undue excess amounts of ionizing radiation, and have access to safe medical imaging for diagnostic purposes. The ICRPM in Vienna in December 2017 will be influential in setting the stage for future handlings of radiation safety issues and improving implementation of BSS around the world. It was noted that similar BSS for non-ionizing radiation are lacking and some international organizations are joining efforts to bridge this gap.

**Conclusions**

The BSS Workshop at the WHO 3rd Global Forum on Medical Devices brought together comments from various national and international organizations, on how radiation safety in medical imaging is promoted globally. Continued collaboration leadership by each of these organizations will be essential to furthering the optimization of radiation safety alongside medical imaging for patients around the world.

**References**

[1] European Commission, Food and Agriculture Organization of the United Nations, International Atomic Energy Agency, International Labour Organization, OECD Nuclear Energy Agency, Pan American Health Organization, United Nations Environment Programme, World Health Organization, 2014.. Radiation protection and safety of radiation sources: International basic safety standards (BSS), IAEA Safety Standards Series GSR part 3. Vienna IAEA (2014). http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1578_web--57265295.pdf

[2] Bonn Call-for-Action http://www.who.int/ionizing_radiation/medical_radiation_exposure/BonnCallforAction2014.pdf?ua=1

[3] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom https://ec.europa.eu/energy/sites/ener/files/documents/CELEX-32013L0059-EN-TXT.pdf

[4] IAEA, 2014 Justification of Practices, Including Non-Medical Human Imaging. General Safety Guide, IAEA Safety Standards Series No. GSG-5 http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1650web--23654722.pdf

# Report from the Publication Committee

**Tae Suk Suh, PhD, Chair Publication committee**

CRC physics editor Francesca McGowan informed IOMP of a new publishing initiative called CRC Press Focus, which CRC Press is rolling out across a wide range of subject areas. The format and timeline of the CRC Press Focus are distinctive; each book is longer than a journal article but shorter than a traditional monograph (25,000 to 50,000 words in length). The Focus books will form part of the "Series in Medical Physics and Biomedical Engineering" supported by IOMP. IOMP and CRC are finalizing the plan for the CRC Press Medical Physics Focus regarding potential editors and the role of editors.

IOMP PC proposed the publication of a new book that would promote the IOMP and many key physicists while focusing on the theme of "Medical Physics History Books." IOMP PC and CRC will discuss the possibility of publishing. Slavic Tabakov, president of IOMP and member of IOMP PC, will lead this project.

Paolo Russo, vice chair of IOMP PC and editor-in-chief of Physica Medica, organized the Focus Issue of ICMP 2016 in Physica Medica. The ICMP 2016 Focus Issue will include papers presented at the ICMP 2016 in Bangkok, Thailand, and recommended by guest editors of ICMP 2016 Physica Medica, European Journal of Medical Physics (EJMP, Editor Paolo Russo), will be considered an official journal of IOMP after final endorsement from each related organization. IOMP PC prepared an MOU between IOMP and EJMP, referring to the past two agreements with Medical Physics and JACMP and including the request from EJMP a few months ago.

In accordance with the various ideas suggested during the IOMP PC meeting, a number of action plans were prepared to increase the output of publication on medical physics, as well as make the publication more accessible to practitioners in medical physics worldwide. IOMP PC shall consider a serial publication with major periodic updates in sub-fields in the form of a book or a journal, which could be accepted globally, such as IOMP's official journal (MPI). IOMP PC is also interested in creating an IOMP e-documents repository with the intention of sharing select documents for research and education; such a database can be used as a global and standard platform for e-publication in the future.

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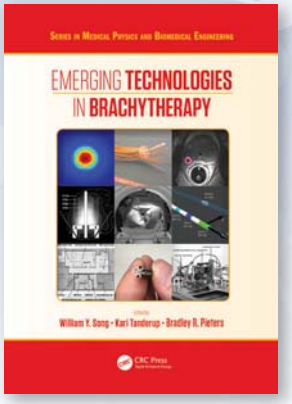


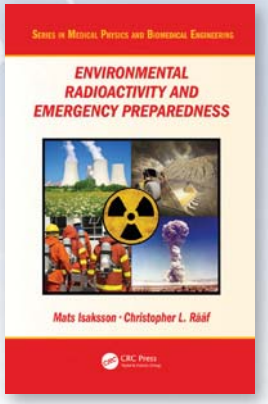


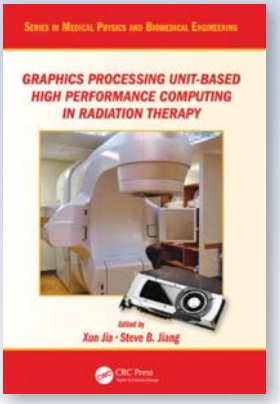


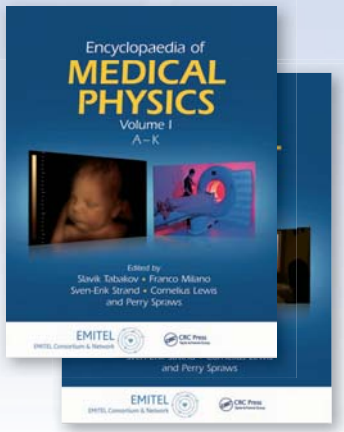


## Emerging Technologies in Brachytherapy

Brachytherapy is continuously advancing. Years of accumulated experience have led to clinical evidence of its benefit in numerous clinical sites such as gynecological, prostate, breast, rectum, ocular, and many other cancers. Brachytherapy continues to expand in its scope of practice and complexity, driven by strong academic and commercial research, by advances in competing modalities, and due to the diversity in the political and economic landscape. It is a true challenge for practicing professionals and students to readily grasp the overarching trends of the field, especially of those technologies and innovative practices that are not yet established but are certainly on the rise.

March 2017 • 978-1-4987-3652-7

## Environmental Radioactivity and Emergency Preparedness

Radioactive sources such as nuclear power installations can pose a great threat to both humans and our environment. How do we measure, model and regulate such threats? *Environmental Radioactivity and Emergency Preparedness* addresses these topical questions and aims to plug the gap in the lack of comprehensive literature in this field.

The book explores how to deal with the threats posed by different radiological sources, including those that are lost or hidden, and the issues posed by the use of such sources. It presents measurement methods and approaches to model and quantify the extent of threat, and also presents strategies for emergency preparedness, such as strategies for first-responders and radiological triage in case an accident should happen.

December 2016 • 978-1-4822-4464-9

## Graphics Processing Unit-Based High Performance Computing in Radiation Therapy

**"*Graphics Processing Unit-Based High Performance Computing in Radiation Therapy* provides comprehensive and timely information on state-of-the-art GPU techniques and is certainly a must-have book for medical physicists, engineers, and students engaged in research and development involving high performance computing."** – *Lei Xing, Jacob Haimson Professor of Medical Physics, Stanford University*

October 2015 • 978-1-4822-4478-6

## Encyclopaedia of Medical Physics

**"The breadth of topics is considerable and the consortium has made significant progress towards satisfying their goal of a global resource. The editors and translators have certainly put much effort into collecting and disseminating information and the global community can be grateful."** – *Joseph Driewer, PhD, University of Nebraska Medical Center, Omaha, USA*

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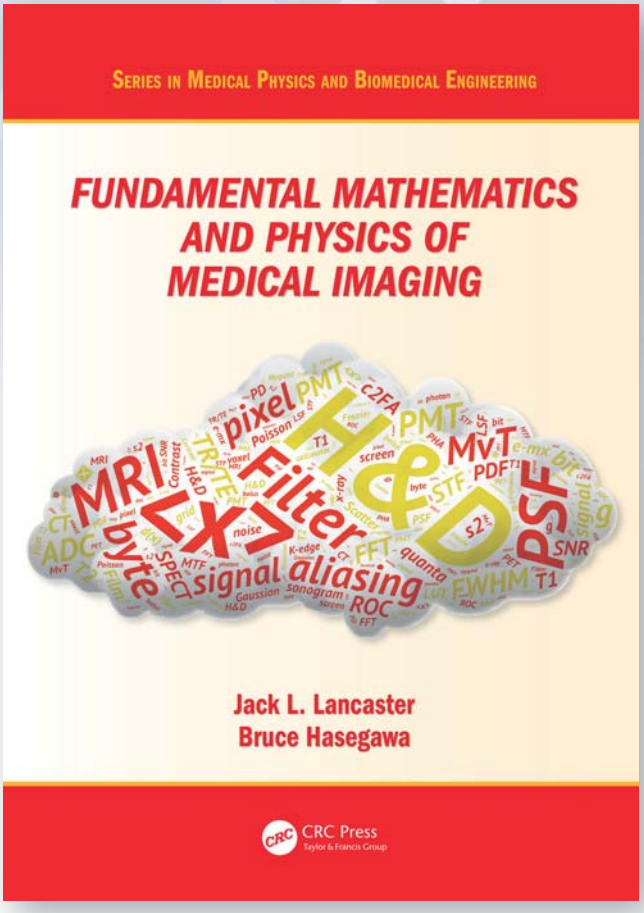


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## Fundamental Mathematics and Physics of Medical Imaging

**Jack Lancaster, Research Imaging Institute, University of Texas Health Science Center at San Antonio, Texas, USA & Bruce Hasegawa**

Authored by a leading educator, this book teaches the fundamental mathematics and physics concepts associated with medical imaging systems. Going beyond mere description of imaging modalities, this book delves into the mechanisms of image formation and image quality common to all imaging systems: contrast mechanisms, noise, and spatial and temporal resolution, making it an important reference for medical physicists and biomedical engineering students. This is an extensively revised new edition of *The Physics of Medical X-Ray Imaging* by Bruce Hasegawa (Medical Physics Publishing, 1991), and includes a wide range of modalities such as X-ray CT, MRI and SPECT.

**Key Features:**

- Covers underlying physics and mathematics at a level appropriate for all medical imaging modalities
- Extensive homework problems within each chapter, with answers in a solutions manual.
- The solutions manual also includes optional homework problems that can be used periodically in lieu of those in the textbook.
- Extensive figures and equations throughout the book.
- Several chapters include example questions and answers.
- Many of the homework problems can be solved using Mango, a freely distributed image processing software found on the author's website at: http://ric.uthscsa.edu/mango/

**Table of Contents:**

**Basic Concepts.** Overview. Medical Imaging Technology & Terminology. Digital Imaging in Diagnostic Radiology. **Intermediate Concepts.** Physical Determinants of Contrast. Mathematics for Linear Systems. Spatial Resolution. Random Processes. Noise and Detective Quantum Efficiency. **Advanced Concepts.** Noise-Resolution Models. The Rose Model. Receiver Operating Characteristics (ROC) Analysis. **Dynamic Imaging.** Digital Subtraction Angiography (DSA). Temporal Filtering. **Tomographic Imaging.** X-Ray Computed Tomography (CT). Single Photon Emission Computed Tomography (SPECT). Magnetic Resonance Imaging (MRI).

September 2016 • 978-1-4987-5161-2

# Middle East Federation of Organizations of Medical Physics

Ibrahim Duhaini, Past President of MEFOMP

Upon demand of students seeking programs in Medical Physics in the MEFOMP region, find below is a table of currently Medical Physics programs in the Middle East Region with the corresponding degrees offered, country and contact persons for more details on the programs. This information was gathered from colleagues in the MEFOMP countries and it might be other programs not listed in this table. If any has additional data to be listed please send an email to Duhaini@yahoo.com.

| N# | University | Degree Offered (BS, MS, PhD) | Website Address | Year Established | City | Country | Contact Person & Email |
|---|---|---|---|---|---|---|---|
| 1. | Damascus University | M. Sc. | none | 2014 | Damascus | Syria | Dr. Osama Anjak. oanjak@yahoo.com |
| 2. | Lebanese University | M. Sc., PhD | www.fsciences.ul.edu.lb | 2014 | Beirut | Lebanon | Dr. Jamal Charara. jcharara@ul.edu.lb |
| 3. | IBB University | BS | | 2012 | Ibb | Yemen | Dr. Abdullah Alqudami alqudami@gmail.com |
| 4. | King Fahd University of Petroleum and Minerals | M.Sc | http://www.kfupm.edu.sa/departments/phys/ | 2002 | Dhahran | Saudi Arabia | Dr. Nabil Maalej. maalej@kfupm.edu.sa |
| 5. | Sultan Qaboos University | M.Sc | www.squ.edu.om/science/Departments/Physics | 2002 | Muscat | Oman | Dr. Zakia AL harbi. z.alra7bi@gmail.com |
| 6. | University of Mustansiriya | M. Sc. | www.uomustansiriyah.edu.iq | 1963 | Baghdad | Iraq | Dr. Nabaa naji nabaaanaji@yahoo.com |
| 7. | University of Baghdad | BS | www.uobaghdad.edu.iq | 1957 | Baghdad | Iraq | nabaaalazawy@ gmail.com |
| 8. | University of Nahrain | M.Sc | www.nahrainuniv.edu.iq | 1987 | Baghdad | Iraq | Dr. Siham Sabah Siham511@yahoo.com |
| 9. | College of Science City | BS | www.mauc.edu.iq | 2005 | Baghdad | Iraq | medicalphysicsmauc@ gmail.com |
| 10. | Yarmouk University | BS | http://www.yu.edu.jo | 2004 | Irbid | Jordan | Physics.dept@yu.edu.jo |
| 11. | University Of Jordan | M.Sc | www.ju.edu.jo | 2007 | Amman | Jordan | phys@ju.edu.jo |

# REPORT ON INTERNATIONAL CONFERENCE ON PHYSICS IN MEDICINE AND CLINICAL NEUROELECTROPHYSIOLOGY IN BANGLADESH-PMCN-2017

An international conference on 'Physics in Medicine and Clinical Neuroelectrophysiology (PMCN2017)' was held during 10-11 March, 2017 at the Nabab Nawab Ali Chowdhury Senate building of the University of Dhaka. The event was organized jointly by the Bangladesh Medical Physics Association (BMPA), Bangladesh Clinical Neuro-Electrophysiologists Society (BCNEPS) and the Department of Biomedical Physics & Technology of Dhaka University (BMPT) in co-operation with Institute of Nuclear Medical Physics Project (INMP), Bangladesh Atomic Energy Commission.

The conference was endorsed by IOMP and AFOMP.

The presence of around 220 participants made the conference a great success. Sixty contributory papers in Nuclear Medicine, Radiotherapy, Radiology, Radiation Oncology, Health physics & Radiation, Clinical neuroelectrophysiology, Biomedical Engineering and Medical Physics were presented from home and abroad. There were 10 Invited presentations in the conference. In the 2 days program, there were 2 parallel sessions.

Professor Dr. Gias uddin Ahmad, Vice Chancellor of Primeasia University was the Chief Guest at the inauguration ceremony while the Special Guests were, Mr. Mahmud Hassan, Managing Director, Tradevision Ltd. Three theme lectures presented in the inauguration ceremony were: Qualified Medical Physicists (QMP): Wheel of Global Health Care presented by Professor Sadiq Malik, President, Bangladesh Medical Physics Association and Chief Medical Physicist of Delta Medical College & Hospital, Clinical Neurophysiology in Bangladesh: 1996 to 2016 presented by Dr. Selina Husna Banu, Founder, Secretary General of BCNEPS & Head of Neurology Unit, ICH and SSF Hospital, and Telemedicine: taking modern healthcare to the doorsteps of the rural people presented by Professor K Siddique-e Rabbani, former President of BMPA and Honorary Professor of BMPT of Dhaka University. At the ceremony, Lifetime Achievement awards were given to Professor Dr. M A Hai for his lifetime contribution to Oncology in Bangladesh and Professor Dr. Giasuddin Ahmad was honoured for Pioneering Medical Physics in Bangladesh.

There was a Plenary Session on Education and Accreditation and 'Open Floor and Panel Discussion'. The following were the speakers: Education and Accreditation K Siddique-e Rabbani, Accreditation, Certification & Recognition issues by Prof. Sadik R Malik, Education & Accreditation of Clinical Neuro Electrophysiology by Dr. S Banu and Accreditation and Certification: International Atomic Energy Agency's Approach by Prof. Kamila A Quadir, Bangladesh. The session was chaired by Professor Dr. M Aminul Islam, former Vice Chancellor of Shahjalal University of Science and Technology, Bangladesh. Lots of suggestions came from the audiences during "Open Floor and Panel Discussion". The session chair gave emphasis that all medical physicists should work together in Bangladesh so that they can achieve a process and program for the accreditation and certification of medical physicists in Bangladesh. The conference ended successfully.

# World Congress on Medical Physics & Biomedical Engineering

**June 3–8, 2018**
**Prague, Czech Republic**
**www.iupesm2018.org**

**IUPESM PRAGUE 2018**

## TOPICS

1 Diagnostic Imaging
2 Image Processing
3 Information Technology in Healthcare
4 Modelling and Simulation
5 BME and MP Education, Training and Professional Development
6 Patient Safety
7 Accreditation and Certification
8 Health Technology Assessment
9 Biosignals Processing
10 Biomechanics, Rehabilitation and Prosthetics
11 Minimum Invasive Surgery, Robotics, Image Guided Therapies, Endoscopy
12 Diagnostic and Therapeutic Instrumentation
13 Micro- and Nanosystems, Active Implants, Biosensors
14 Neuroengineering, Neural Systems
15 Biomaterials, Cellular and Tissue Engineering, Artificial Organs
16 Assistive Technologies
17 Biological Effects of Electromagnetic Fields
18 Clinical Engineering
19 Radiation Oncology Physics and Systems
20 Dosimetry and Radiation Protection
21 Advanced Technologies in Cancer Research and Treatment
22 Biological Effects of Ionizing Radiation
23 Nuclear Medicine and Molecular Imaging

## ORGANISERS

**Czech Society for Biomedical Engineering and Medical Informatics**
**Member of Czech Medical Association JEP**
Prague, Czech Republic

**Czech Association of Medical Physicists**
Prague, Czech Republic

## CONTACTS

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E-mail: coc@iupesm2018.org

**Supporting Agency**
**GUARANT International spol. s r.o.,** Na Pankráci 17, 140 21 Prague, Czech Republic
Tel: +420 284 001 444, fax: +420 284 001 448, e-mail: agency@iupesm2018.org

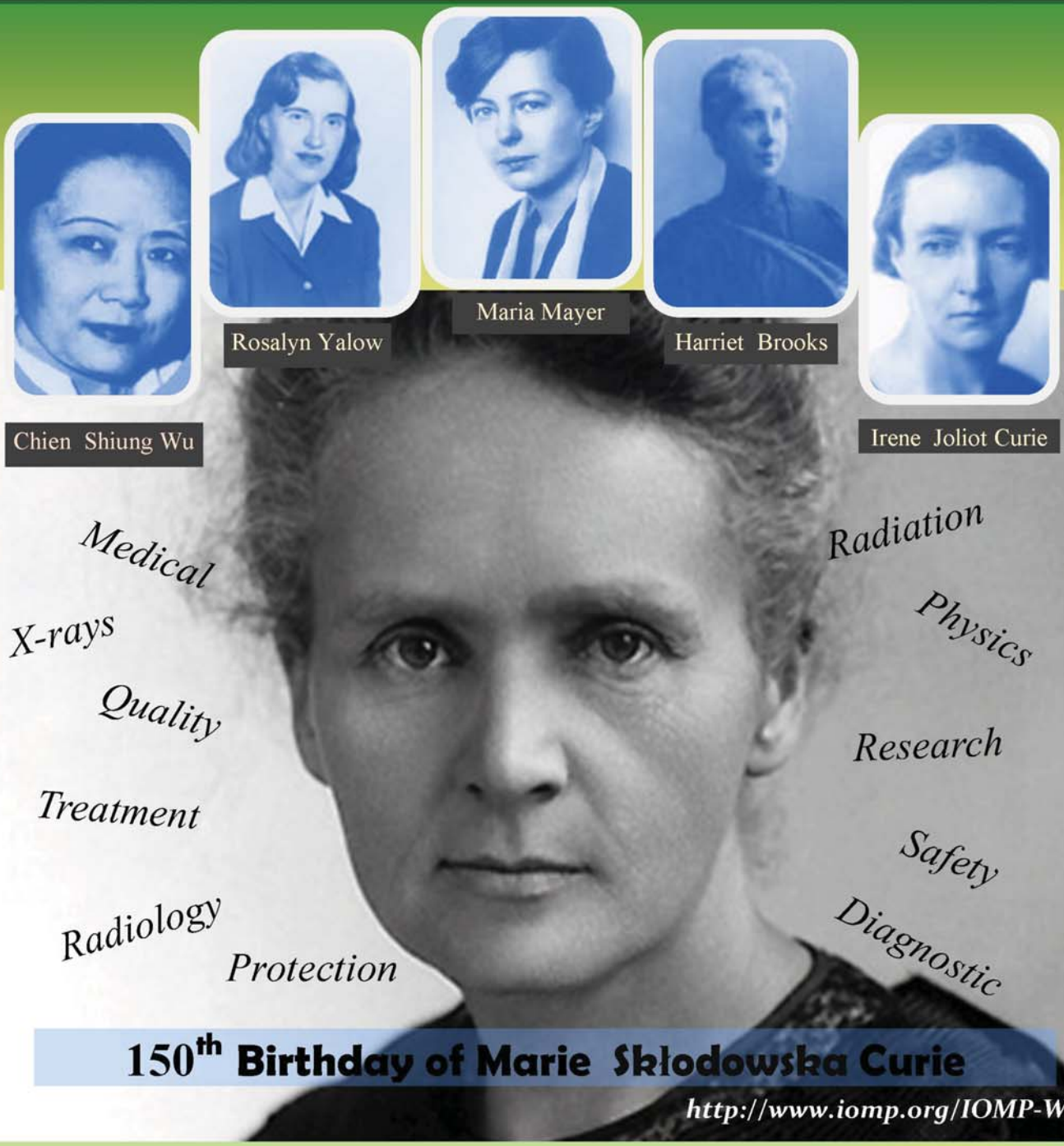
Dear NMO Presidents and NMO delegates

The IUPESM World Congress on Medical Physics and Biomedical Engineering is the triennial event of IOMP and IFMBE. Previous such IUPESM World Congresses have solidified the unifying concepts of the physical and engineering sciences in medicine. The next two World Congresses in Prague 2018 and Singapore 2021 will continue strengthen the cooperation within IUPESM. At the following link you can find all relating information and an invitation to host the IUPESM 2024 World Congress:
http://www.iomp.org/?q=content/invitation-host-iupesm-2024-world-congress

Kind regards
Virginia Tsapaki
IOMP Secretary General

# CALENDAR OF EVENTS - Ibrahim Duhaini, Calendar Editor

- International Conference on Advances in Radiation Oncology (ICARO2)
When: Jun 20 – 23, 2017
Where: Vienna, Austria
http://www-pub.iaea.org/iaeameetings/50815/International-Conference-on-Advances-in-Radiation-Oncology-ICARO2
- ACOMP Workshop on Monte Carlo Simulation of Head LINAC Modelling and Dose Calculation
When: Jul 11 – 14, 2017
Where: Bandung City, West Java, Indonesia
http://medphys.fi.itb.ac.id/wmc2017/
- The 63th COMP Annual Scientific Meeting
When: Jul 12 – 15, 2017
Where: Ottawa, ON, Canada
https://www.comp-ocpm.ca/asm-2017-english/
- Int'l Conference and Exhibition on Medical Physics and Biophysics
When: Jul 27 – 28, 2017
Where: Rome, Italy
http://medicalphysics.conferenceseries.com/
- AAPM 59th Annual Meeting & Exhibition - Denver
When: Jul 30 – Aug 3, 2017
Where: Denver, CO, USA
http://www.aapm.org/meetings
- European Training and Education for Medical Physics Experts Network (EUTEMPE-RX)
When: Throughout the Year 2017
Where: Europe
www.EUTEMPE-net.eu
- 4th International Conference on Medical Physics and Biophysics"
When: June 29-30, 2017
Where: London, UK.
http://medicalphysics2017.blogspot.com/
- 6th Annual Conference of Bangladesh Medical Physics Society (ACBMPS)
When: 25-26 July 2017
Where: Dhaka , Bangladesh
www.bmps-bd.org (organized by: BMPS)
- Annual Meeting of the German Society of Biomed Eng and Joint Conf in Medical Physics
When: Sep 10 – 13, 2017
Where: Dresden, Germany
http://www.dgbmt-dgmp.de
- Joint ICTP-IAEA Workshop on Monte Carlo Radiation Transport and Associated Data Needs for Medical Applications: EGSnrc -- Italy
When: Sep 18 – 29, 2017
Where: Province of Trieste, Italy
http://indico.ictp.it/event/7992/material/poster/0.pdf
- 17th Asia Oceania Congress of Medical Physics (AOCMP) & the 38th Annual Conference of Association of Medical Physicists of India (AMPICON)
When: 4 - 7 November, 2017
Where: JAIPUR, INDIA
www.aocmp-ampicon2017.org
- 9th International Conference on Isotopes & Expo.
When: 12 – 16 November 2017
Where: Doha - Qatar
http://www.9ici.org/
- ASTRO Annual Meeting
When: Sep 24 – 27, 2017
Where: San Diego, CA, USA
https://www.astro.org/2017-ASTRO-Annual-Meeting.aspx
- International Conference on Monte Carlo Techniques for Medical Applications (MCMA2017)
When: Oct 15 – 18, 2017
Where: Naples, Metropolitan City of Naples, Italy
http://agenda.infn.it/event/MCMA2017
- IEEE Nuclear Science Symposium and Medical Imaging Conference 2017
When: Oct 21 – 28, 2017
Where: Atlanta, GA, USA
http://www.nss-mic.org/2017
- 30th Annual Meeting of the European Association of Nuclear Medicine
When: Oct 21 – 25, 2017
Where: Vienna, Austria
http://eanm17.eanm.org/
- the Engineering & Physical Sciences in Medicine Conference 2017
When: Oct 29 – Nov 1, 2017
Where: Hobart, Tasmania , Australia
http://epsm.org.au/
- ICBMP Conference on Biophysics and Medical Physics - Cape Town
When: Nov 5 – 6, 2017
Where: Cape Town, South Africa
https://www.waset.org/conference/2017/11/cape-town/ICBMP
- International Conference on Radiations and Applications - Algiers
When: Nov 20 – 23, 2017
Where: Algiers Province, Algeria
http://www.usthb.dz/ICRA/index.html
- International Conference on Radiation Protection in Medicine: Achieving Change in Practice
When: Dec 11 – 15, 2017
Where: IAEA Headquarters, Vienna, Austria
https://rpop.iaea.org/RPOP/RPoP/Content/UpcomingEvents/2017-3-international-conference.htm
- International Conference on Radiation Medicine (ICRM2018)
Organizer: King Faisal Specialist Hospital and Research Center, IAEA, WHO and Others
When: 11 – 15 February, 8 AM – 5 PM,
Where: Riyadh, Kingdom of Saudi Arabia
www.radmed.org
- Seminars and Workshops
Organizer: Iranian Association of Medical Physicists.
When: Throughout the year
Where: Iran
www.iamp.ir
- 6th Annual Conference of Bangladesh Medical Physics Society (ACBMPS-2017)
When: August 4, 2017
Where: Dhaka Medical College Campus, Dhaka, Bangladesh.
www.bmps-bd.org
- Workshop and Seminars.
Organizer: BMPS and Dept. of Medical Physics and Biomedical Engineering
When: Throughout the year
Where: Bangladesh
www.bmps-bd.org




**150th Birthday of Marie Skłodowska Curie**

*http://www.iomp.org/IOMP-W/*

# Medical Physics: Providing a Holistic Approach to Women Patients and Women Staff Safety in Radiation Medicine

**7 November 2017**

***International Day of Medical Physics***

IOMP


**An Invitation to World Congress on Medical Physics and Biomedical Engineering**
**June 3 – 8, 2018, Prague, Czech Republic**

This triennially organized joint meeting of medical physicists, biomedical engineers and adjoining health care professionals is a unique opportunity to liaise with your professional colleagues from all over the world, learn and share your knowledge, and discuss the latest research outcomes and technological advancements as well as new ideas in both medical physics and biomedical engineering field. Besides the purely scientific and technological topics, the 2018 Congress will also focus on other aspects of our professional involvement in health care, such as the education and training, the accreditation and certification, the health technology assessment or the patient safety.

The city of Prague is one of the most beautiful and romantic cities in the world. You can find here all kinds of historical heritage some of them dating back ten centuries as well as cultural treasuries of our times, worth of exploration in a spare time during the Congress. Prague is also regular destination of most worldwide operating airlines.

For more detailed information and questions please refer to the IUPESM 2018 Congress webpage **www.iupesm2018.org**.

Your active contribution is welcome and we look forward to welcoming you to our beautiful city Prague in 2018.

**Jaromír Cmíral, Ing., PhD., DSc. and Libor Judas, RNDr., PhD**
Co-Chairs of Congress Organizing Committee