International Organization for Medical Physics

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Hans Svensson

With great sadness we record that the former IOMP Secretary General Professor Hans Svensson passed away on the 6th December 2011.

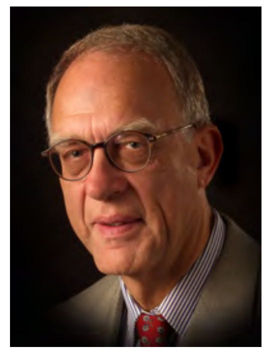
Hans Svensson, born 1935 in Växjö, South-Sweden, graduated in Medical Physics at Lund University and after moving to Umea as a postgraduate started his extraordinary career to become one of the world's leading medical physicists. In the eighties he was appointed a full professor in Medical Radiation Physics and chaired the Medical Physics Department of the University Hospital of Umea. For a seven year break Hans left Umea to take office as Head of the Dosimetry Section at the IAEA in Vienna. From 1994 onwards Hans was back to his home university in Umea again. I see three priorities of his professional life; radiation dosimetry and quality assurance, radiation protection and education of medical physicists, with particular emphasis on the developing countries. Hans served as a WHO consultant in many countries in Africa and Asia.

Hans` most important activities have been in ESTRO where he was the first medical physicist to serve on the Board and later served as chair of the ESTRO physics committee.

During the presidentship of Keith Boddy (1994-1997) he was Secretary General of the IOMP.

Both, Keith and Hans, formed an inspiring team and contributed significantly to the development and international reputation of the IOMP.

I remember the many discussions I had with him wherever we met, at ICRU report committees and at meetings of ESTRO, EFOMP, IOMP, BIPM, IAEA - sometimes tough but always fair discussions, often interrupted by joking and laughing. I remember his sense of humour and his professional seriousness. I will certainly miss him; all of us in the IOMP are missing him. The medical physics community has lost an outstanding colleague.



Munich, January 2012

Fridtjof Nüsslin

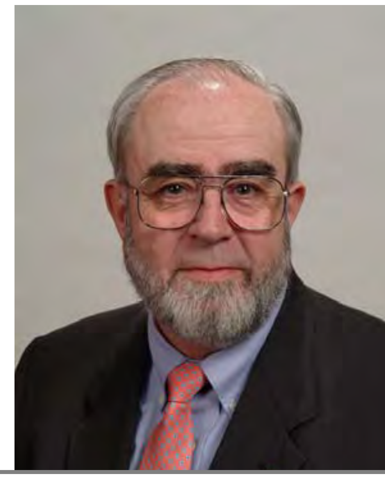
A New Associate Editor

eMPW is proud to announce that Dr Bashar Issa, Associate Professor in Medical Physics, Department of Physics, University of UAE has joined the staff of eMPW as an associate editor.

eMPW Still Needs Material

The eMPW focuses on medical physics education. Medical physicists have to educate many people about medical physics

- Medical Physicists
- Physicians
- Ancillary Personnel
- Government Regulators
- Members of the Public



We have to do this with limitations on our time and resources. eMPW hopes to serve as a way to communicate about our success and failures. It will touch the wide spectrum of education around the world and especially innovations of importance. I invite each and every one of you to send me brief articles about education and announcements about conferences about education.

- How do you educate individuals in your country?
- What innovations have you come up with?
- What changes have been made in the educational requirements?

We are interested in everyone's perspective. This issue of eMPW has a report from Chip Jackson, a medical physics student, in Australia. We would welcome brief reports from medical physics students through out the world

G. Donald Frey
Editor

Ethical Considerations in Medical Physics Education

We are looking for case studies of ethical issues in Medical Physics Education. If you are examples please send them to the editor.

Freyd@musc.edu

Patient Safety and the Medical Physicist

Over the past 18 months several articles have appeared in the *New York Times* and other newspapers describing overexposures of patients to radiation used for medical purposes. These articles have revealed problems in the medical use of radiation that must be addressed by medical physicists working with physicians and technologists.

Overexposures in computed tomography: In several institutions, overexposures have occurred during use of x-ray computed tomography (CT) for brain perfusion studies to identify the neurological consequences of strokes and other events. In some cases, patients received exposures that were several times greater than necessary. The overexposures were caused by use of inappropriate CT protocols for brain perfusion studies, and by the desire to achieve appealing low-noise images rather than images acquired at the lowest dose consistent with adequate diagnostic information. Another contributing factor was the cacophony of terms used to describe CT parameters across makes and models of CT scanners.

To resolve these problems, the AAPM hosted a meeting in April, 2010 entitled "CT Dose Summit: Optimization of Protocols." One outcome of the meeting was establishment of a working group with two charges. The first charge was to standardize parameter terminology across different makes and models of CT scanners. The second charge was to develop consensus protocols for CT procedures, beginning with brain perfusion studies, and make these protocols available wherever CT procedures are performed. Consensus protocols for adult brain perfusion studies are now posted on the AAPM website, and protocols for other conditions are under development. Discussions are underway with industry about terminology standardization, and guidelines for use of the NEMA XR-25 CT dose-check standard are also posted on the AAPM website.

Although recent media attention has targeted computed tomography, other areas of medical imaging also require constant vigilance. In particular, interventional, cardiovascular and neurointerventional imaging procedures use prolonged fluoroscopy together with digital spot acquisitions, resulting often in relatively high radiation dose to patients. As facilities transition to new, more sophisticated imaging equipment, traditional imaging protocols may become obsolete and cause suboptimal images and unnecessary patient exposures if used.

Major campaigns to reduce exposures in medical imaging have been launched by professional organizations, including the AAPM. The Image Gently campaign addresses exposures to pediatric patients, and the Image Wisely campaign focuses on adult patients.

Overexposures in radiation therapy: The *New York Times* also reported patient overexposures caused by mistakes in the calibration and application of therapeutic x ray beams from linear accelerators. Two patients died from overexposures caused by mistakes during radiation delivery, and several other cases have been cited where calibration errors caused patient overexposures.

Stimulated in part by the *New York Times* articles, the AAPM convened a meeting in Miami in June, 2010 entitled "Safety in Radiation Therapy: A Call to Action." The purpose of the meeting was to identify the causes of radiation therapy errors, establish approaches to reducing these errors, and protect patients from disastrous consequences if errors do occur. Twenty recommendations from the meeting were described in an article published simultaneously in the January 2011 issues of *Medical Physics* and *Practical Radiation* Oncology. Follow-up to the recommendations is currently under discussion within the AAPM, and will in part be the responsibility of the Institute for the Assessment of Medical Devices, a collaboration between the AAPM and the Morgridge Institute of Research based in Madison WI.

Some of the recommendations from the Miami meeting can be highlighted. They include (1) reduce distractions and traffic at the accelerator console so that the operator can focus exclusively on patient treatment; (2) simplify the treatment console so that the operator has fewer computer screens to monitor and fewer parameters to track; (3) reduce reliance on computer-control of the treatment and return control of the treatment to the operator; (4) provide early warning systems to indicate when a treatment exceeds defined parameters, or an equipment malfunction or operator mistake occurs; (5) use check lists and implement a double-check verification process to ensure before treatment that patient and machine set-ups are proper; (6) apply statistical tools to the treatment process to identify potential problems and to analyze the cause of problems when they occur; (7) establish a national reporting system of errors and malfunctions so that everyone can learn from problems at other institutions; (8) encourage external audits and accreditation of treatment facilities to ensure periodic peer- review; (9) reinforce reliance on written policies and procedures to guide the treatment process with individual patients; and (10) empower all members of the treatment team to call "time out" when a treatment design seems inadequate or a treatment process encounters a problem.

Conclusion: Recent reports of overexposures have

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prompted several initiatives to improve the use of medical radiation so that patient risks are minimized. These initiatives should be led by medical physicists working collaboratively with physicians, technologists, regulators and industrial representatives.

Acknowledgements: The author thanks Drs. Andrew Karellas, David Rogers and Anthony Wolbarst for their helpful comments.

William R. Hendee, PhD
Editorial
Med. Phys. 38 (6), June 2011

Editor

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Simulation Packages or Programming as Teaching Tools in Medical Physics

Introduction: Medical physics is a multidisciplinary field where both students and instructors have to acquaint themselves with a wide range of scientific subjects and skills in addition to physics and mathematics, such as computing, biology, chemistry, and safety-related issues. However, due to the applied nature of the field medical physicists have to also keep up with new technological development that are taking place at a fast pace.

Designing an undergraduate medical physics curriculum has to take into account the mounting pressures on students who have to fulfill many requirements within a short span of time of 3-4 years. Students are expected to cover the physics core subjects (mechanics, thermodynamics, electrodynamics, and quantum physics) in addition to mastering the fundamental concepts related to medical physics areas from radiation physics to diagnostic imaging and perhaps radiation therapy, along with the requisite mathematical and computing requirements. For such a program to be successful in preparing the graduate for the employment environment it has to equip the student with practical and adaptive skills and strategies in addition to adequate knowledge of the background subject. Furthermore, subject coverage has to mean the ability to solve detailed quantitative problems and not just to master a descriptive knowledge of the subject, often general and superficial.

Computers and Programming in Teaching Physics: The use of computers in medical physics teaching and learning has contributed positively, for a long period, in many areas but particularly in simulating radiation interaction in matter and indeed in image processing. For example, students have found Monte Carlo (MC) simulation as both a tool to answer questions related to the concept and nature of the probability of interaction itself and also to do useful numerical calculation related to the intensity attenuation, shielding thickness, etc. and also to stimulate thinking about more difficult problems. The latter is perhaps the first step towards indulging into research. Image enhancement and Filter Applications have been at the core of Digital image Processing courses and modules leading to Diagnostic Imaging courses.

Many instructors resort to practical sessions, hospital visits, and laboratory demonstration right at the start of the courses hoping it would alleviate the fear of complicated topics such as Magnetic Resonance Imaging, Radiation Therapy, etc. Computer Simulation Packages offer cheap, no need for supervision, and all time availability practicing tools for students especially when access to expensive imaging equipment are not available in nearby hospitals for a variety of reasons, or experienced medical physicists cannot supervise students due to time constraints.

Black Box Package or the Student as Programmer: Our experience with undergraduate medical physics students has convinced us that readily written simulation programs that require the student to only supply input quantities have a limited appeal life time. Furthermore, its impact on enhancing conceptual thinking and stimulating questioning more difficult modeling problems is limited. These are black box or plug in interfacing layer with limited ability to expand or change the physical model on which it is based, however, with ever increasing range of applications especially in Newtonian mechanics and statistical mechanics in introductory physics courses.

The other approach to using computers and simulation in teaching physics is to involve the students in developing the simulation code itself, at least partially. Modern programming environments (e.g. MATLAB) offer the programmer the essential tools and building blocks for assembling a larger structured task. These tools include many mathematical operations that constitute an integral part of the mathematics/skills required in a medical physics curriculum. For example, Fourier transforms, integrators (both numeric and symbolic), and many types of filters. The beauty about such approach is that students can use individual language commands (e.g. C-language) or built-in functions. Furthermore, they can continually compare between the two written units and enhance their programming experience. In fact we are changing our approach to teaching programming itself from devoting a whole course into another method of learning by example and imitating. For example, students found it useful to use the built-in Fourier transform routine and later on and to their surprise they could actually look at the few lines of code generating the function. This had encouraged students to tackle programming tasks. This teaching approach is becoming possible in recent years because current student generations are becoming more acquainted with many IT tools, software packages, and programming in general. For example, we no longer have to teach students about “search and rank” operations because these concepts have become available in even word processing packages.

The above approach of using sophisticated programming environments such as MATLAB has the advantage of powerful yet simple to use plotting and visualization routines. After all, it was animation and visualization that made black box simulation tools successful in softening the impact of difficult and abstract physics problems. It is now a simple task to develop animation to your computer program by implementing a single timing loop through which updating a graph or an image is performed.

Solving Bloch’s Equations in MRI as an Example: Magnetic Resonance Imaging (MRI) is regarded as a difficult topic to both teach and learn. This may be due to the fact that it combines both Classical and Quantum physics topics, and also the use of Fourier Transform is essential for a thorough understanding of the subject. The solution of Bloch’s equations details the magnetization behavior in response to a radio frequency (RF) magnetic field excitation pulse. In a trial of new approach to use programming in teaching the students were asked to use MATLAB to solve these coupled differential equations using both numerical and symbolic techniques. The students had to refresh their mathematical skills and were later able to generate magnetization components along the three axes as functions of time, RF pulse amplitude and duration. Furthermore they were able to investigate the effect of relaxation processes (T1 and T2) on the magnetization decay during the excitation pulse itself for the first time. The benefits for the students and instructor were enormous. For me as an instructor it has been worth all the effort! For the first time I had a group of students full of energy and excitement, helping each other, and wanting to know more about the subject. The students experienced research in a structured manner and kept asking about MRI for a long time afterwards. They were exposed to a variety of tasks and had to resort to many skills and strategies in order to survive this project (this was a project within a traditional course not a graduation project by itself). Certainly, students' reaction to simulation results was different to any previous response that I witnessed for a long time in my previous years of "traditional" lectures – i.e. merely displaying the analytic solution i.e. exponential growth and decay of magnetization components obtained by students or looked up in books. The ability to add further terms into the equations, investigate relaxation within excitation, study the effect of different pulse shapes were all added bonuses thoroughly enjoyed by the students.

In summary, while readily available simulation packages are useful at attracting students to some topics and encouraging them to tackle problems (particularly at introductory levels) they probably offer limited benefits at advanced courses. In our view asking students to write simulation code has more benefits not only to understanding the material but also to encourage students to perform research and therefore question more deeply the modeling process. For students to witness the building stage by stage of a structured solution to a complex problem has the magical and convincing effect of changing their pre-conceived set of ideas and believes that they often use, reconnect in new ways, and generalize in order to generate answers to new questions. This means that pre-conceived models that students use to provide explanations and answers have been challenged by the students themselves which many people constitute as the first stage of learning. We think that encouraging students to tackle physics and medical physics problems through programming offers benefits to the learners and also new avenues to be used by instructors.

Dr Bashar Issa
Associate Professor in Medical Physics
Department of Physics
University of UAE

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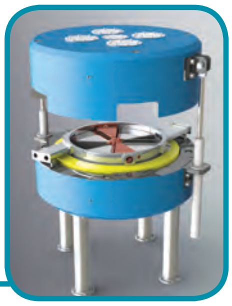

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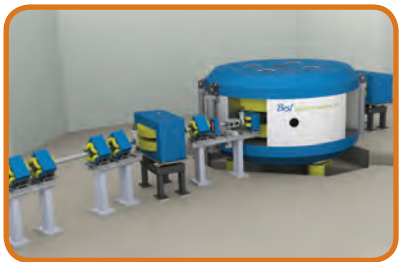

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Radiation Concerns and the Medical Physicist

The use of radiation has increased dramatically since CT has become a common technology. We, as medical physicists, should be proud of our accomplishments in bringing this technology to bear as a weapon in the fight against disease. However the concern about possible low level effects of the radiation persist. Science has not yet answered the question as to if there are effects below 50 mSv . Thus it is important for medical physicists to be aware that radiation effects should only be considered in their relationship to benefits. We are the experts in radiation effects and should constantly make this important point. It is truly tragic if patients decide against a needed procedure that needs radiation because they fear the effects of the radiation. The AAPM has recently addressed this issue by issuing a statement on the subject.

G. Donald Frey, Ph.D.
Editor

AAPM Position Statement on Radiation Risks from Medical Imaging Procedures 12/13/2011

The American Association of Physicists in Medicine (AAPM) acknowledges that medical imaging procedures should be appropriate and conducted at the lowest radiation dose consistent with acquisition of the desired information. Discussion of risks related to radiation dose from medical imaging procedures should be accompanied by acknowledgement of the benefits of the procedures. Risks of medical imaging at effective doses below 50 mSv for single procedures or 100 mSv for multiple procedures over short time periods are too low to be detectable and may be nonexistent. Predictions of hypothetical cancer incidence and deaths in patient populations exposed to such low doses are highly speculative and should be discouraged. These predictions are harmful because they lead to sensationalistic articles in the public media that cause some patients and parents to refuse medical imaging procedures, placing them at substantial risk by not receiving the clinical benefits of the prescribed procedures.

AAPM members continually strive to improve medical imaging by lowering radiation levels and maximizing benefits of imaging procedures involving ionizing radiation.

International Medical Physics Certification Board

Raymond K. Wu, PhD, Chairman, IOMP Professional Relations Committee

The medical physics profession is relatively young compared with other fields of physics. The International Labor Organization (ILO) did not have medical physicist on its list of professions until 2010. Even now, it lists medical physicist with physicists and astronomers instead of under the health profession category. The levels of recognition among professionals in many countries are determined by the ILO classification systems. Many countries often regard medical physicists working in clinical environments as technicians and afford few professional opportunities to keep current their professional knowledge. Medical physicists working in academic environments may find it easier to achieve the level of recognition consistent with the skills and knowledge required by a medical physicist. Those working in non-academic environments are not very satisfied with their employment status. Therefore in many countries there is a shortage of clinically qualified medical physicists. At many international meetings of medical physicists, such problems have drawn attention. In hope of improving the quality of patient care given by clinical medical physicists, a group of medical physics organizations formed the International Medical Physics Certification Board recently.

This recent action actually started on May 6, 2008, when the American College of Medical Physics (ACMP) and the International Affairs Committee of the American Association of Physicists in Medicine (AAPM) co-sponsored an International Medical Physicists Symposium during the ACMP Annual Meeting in Seattle, Washington. The goal of the Symposium was to explore means of improving the quality of medical physics practice. After the Symposium, some participants requested the ACMP to explore the possibility of assisting with the formation of an International Certification Board since ACMP was the original sponsor of the American Board of Medical Physics. In December 2008, the IBMP Constituting Panel was created by the ACMP Board of Chancellors. Dr. Edward Sternick of Rhode Island Hospital/Brown Medical Center was appointed the Chairman. Other members of the Constituting Panel are Maria-Ester Brandan, PhD, of Mexico, K Y Cheung, PhD, of Hong Kong, Ibrahim Duhaini, MS, of Lebanon, Prof. Yimin Hu of China, Siyong Kim, PhD, of USA, Anchali Krisanachinda, PhD, of Thailand, Josef Novotny, PhD, of Czech Republic, Ervin B. Podgorsak, PhD, of Canada, Timothy Solberg, PhD, of USA, Tae Suk Suh, PhD, of South Korea, Arun Chougule, PhD, of India, N. Suntharalingam, PhD, and Raymond Wu, PhD, both of USA. In the following year, the Constituting Panel held two meetings and a symposium entitled "Creating an International Medical Physics Credentialing Board" in May in Virginia USA.

The Constituting Panel will work on guidelines and standards but will not be involved with the creation or the operation of the certification board. In early 2009, the IOMP Professional Relations Committee, chaired by K.Y. Cheung, established a Task Group to take on this task. The Chairman of the Task Group is the author of this article. One

of the first jobs of the Task Group was to identify member countries interested in creating such a certification process at the international level. In the World Congress 2009 in Munich, the progress of the IOMP Task Group was the topic of a report to the Executive Committee and the Council. Two meetings of the Task Group attracted a large number of delegates. Between the two meetings, the presentation "Creating an Independent International Medical Physics Board" was given in the "Education & Training in AFOMP Region Special Session". Delegates interested in the initiative were asked to involve their national medical physics organizations and discuss in depth if such an international body is really needed, and if the organization will be willing to contribute a one-time fee of $100 to $500 to become a Charter Member. It was suggested to limit the number of Charter Members to ten, and to include large and small national medical physics organizations.

The certification initiative was discussed within the IOMP Executive Committee (EXCOM) in subsequent Virtual Meetings through May 2010. The IOMP leadership supports the initiative in principle because of the potential of improving the quality of clinical medical physicists and the profession. It recognizes that creating a certification system is a difficult endeavor which will take long time and careful planning, and that it is more practical to work with countries which already have their own certification programs at the beginning. It also recommends the Board to avoid legal liabilities for work performed by the certified individuals. IOMP is working on establishing policy statements on the roles and responsibilities of medical physicists, and the education and training requirements. The guidelines for certification should be consistent with the policy statements. The IOMP EXCOM clarified that the Education and Training Committee will task itself to accredit education and training programs, but not certification programs. The EXCOM devoted some time in Virtual Meetings to highlight the three existing methods to identify qualified medical physicists. In some countries there are directives in force defining precisely the kind of professional work which is restricted to medical physicists qualified to be listed in registries of government authorities. In other countries the certification systems are created by professional organizations and recognized voluntarily by professional organizations and hospitals only. In between is the third method which is to encourage government authorities to consider all medical physicists when certified are qualified to perform certain categories of professional work.

In May 2010, the following eleven organizations resolved to be Charter Members – ABFM, ACMP, ACPSEM, CSMP, CSMPT, FMOFM, HKAMP, IMPS, KSMP, LAMP, and NAMP[1]. The voting persons and alternates were identified. All except two attended the 3rd International Medical Physics Symposium jointly sponsored by ACMP, AAPM, and IOMP, held in San Antonio, USA in May 25, 2010. Six persons participated in the Symposium online using Webex. Before the Symposium, the voting persons met two times, and made the following resolutions – adopt the name International Medical Physics Certification Board (IMPCB), consider May 23rd 2010 to be the date the organization was formed, designate Secretary/Treasurer Ti-Chuang Chiang to lead a committee to incorporate the organization, and open a bank account, and designate Edward Sternick, PhD, to form a committee to draft the guidelines for certification. The resolutions were later ratified unanimously by email votes by all eleven organizations

During the 10th Asia-Oceania Congress of Medical Physics, a meeting was organized by AFOMP to explore the various models of clinical medical physicist accreditation in different countries and regions. The title of the meeting was "Symposium on Certification and Licensing of Medical Physicists". It was held on October 17, 2010 in Taiwan. The Symposium organizer was Howell Round, PhD, of Hamilton, New Zealand, Chairman of the Professional Development Committee of AFOMP. Eleven speakers presented the various stages of the development of certification process in their respective regions and countries. Their presentations are available online at www.impcb.org.

The International Conference on Medical Physics (ICMP 2011) was the next major conference of medical physicists after the World Congress in Munich. The 18th ICMP was held in Brazil in April 2011. The author was invited to be a Plenary Session speaker to present the talk on "Medical Physicists Board Certification: Looking Ahead". Prior to the ICMP 2011, the basic guidelines prepared by Dr. Sternick and the IBMP Constituting Panel had been reviewed by the IOMP Executive Committee, the IOMP Professional Relations Committee, and the Voting Members of IMPCB. The guidelines were covered in detail in the Plenary Session, and in the Round Table Discussion session that followed immediately.

At the time of writing, the IMPCB is in the process of preparing the Constitution and Bylaws that define the governing structure and rules of operation. It is prudent to first work with the existing national systems of certification, and design a well documented process to validate if the standards described in the guidelines are fully met by the national system. The Board will then be able to vote and approve if all medical physicists certified by the national system should be receiving certificates from the IMPCB. The next step is to use the experience to help other countries to create their own certification boards.

To follow the work-in-progress, please visit the website www.IMPCB.org

Footnote:

1. The acronyms stand for Associação Brasileira de Fisica Medica, American College of Medical Physics, Australasian College of Physical Scientists and Engineers in Medicine, Chinese Society of Medical Physics, Chinese Society of Medical Physics – Taipei, Federación Mexicana de Organizaciones de Física Médica, Hong Kong Association of Medical Physics, Iraqi Medical Physics Society, Korean society of Medical Physics, Lebanese Association Of Medical Physics, and Nepalese