THE JOHN CAMERON MEMORIAL LECTURE – CELEBRATING THE LEGACY OF A GREAT PIONEER

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"If anything is worth doing, it is worth doing it badly" - John Cameron, citing G. K. Chesterton

"It doesn't have to be perfect, just get it to work!" More than once this was enough to spur on his students to "just do it" and not worry about perfection. Perfection could always come later if it is necessary.

The John Cameron Memorial Lecture was inaugurated by the South East Asian Federation of Organizations for Medical Physics (SEAFOMP) in 2004 in honour of the late Professor John Cameron, University of Wisconsin [1], USA. Professor John Cameron dedicated his entire life to improving the medical physics profession in the US and many developing countries. He is well known for his original, forward thinking, and thought provoking ideas on scientific subjects.

Excerpt from 'In Memoriam: John Cameron' Health Physics Society [2]:

John died on 16 March 2005 at age 82 in Gainesville, Florida, where he lived during the winter months and served as a Visiting Professor in the Department of Radiation Oncology at the University of Florida. John, born in northern Wisconsin in 1922, was raised on a farm and experienced firsthand the Depression years. In 1937 his parents moved to Superior so that he and his seven siblings could attend college. After enrolling at UW-Superior, John's education was interrupted by service in the U.S. Army Signal Corps from 1941 to 1946. After the war, he enrolled at the University of Chicago and received a BS degree in mathematics in 1947.

Subsequently John moved to Madison and received his PhD in physics in 1952, with the thesis title "Elastic Scattering of Alpha Particles by Oxygen". Despite John's protestations about the usefulness of his thesis research, these cross sections are still used today in ion beam implantation work. As an assistant professor at the Universidad de São Paulo in Brazil, John established many lifelong friendships. After a brief stint of post-doctoral work at UW-Madison, he became an assistant professor at the University of Pittsburgh (1956-1958). Finally, in 1958 John joined the faculty of the Department of Radiology at Madison, accepting an assistant professor position, with a joint appointment in the Department of Physics.

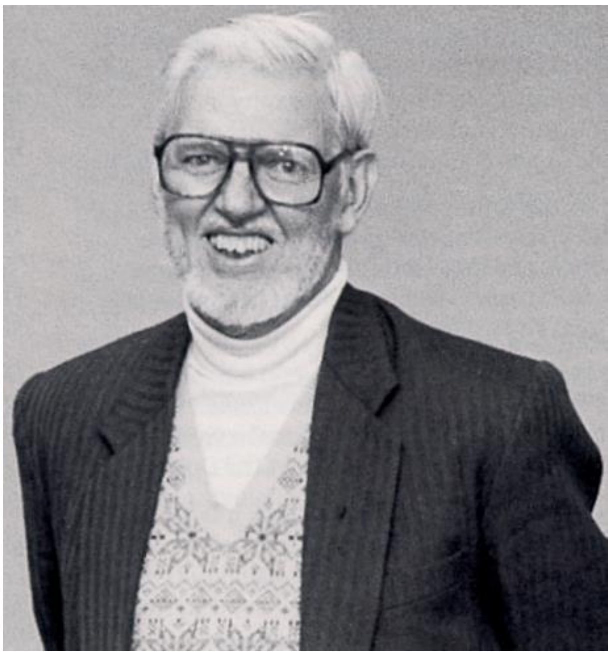


Fig. 1 A classical photo of Prof. John Cameron.

Thus began an illustrious career in medical physics. For the next three decades, John guided the UW Medical Physics Program from a "one physicist" operation to one of the largest and most productive in the world. Presently there are 21 faculty and 8 postdoctoral appointees training 86 students. Since its founding in 1958, the program has awarded more than 185 PhD and 156 MS degrees. Graduates and trainees have become leading medical physicists—a source of great personal pride for John. The program was awarded departmental status in 1981, the first medical physics program to receive departmental status in the United States. John served as chair until his retirement in 1986.

John is widely recognized for several innovative and seminal contributions to medical physics. He investigated and advanced thermoluminescence dosimetry, establishing most of the principal characteristics needed for wide applicability. This technology became the standard for personal radiation monitoring, eventually largely replacing traditional film densitometry.

At about the same time, John invented bone densitometry, which uses precise radiation measurements to determine the mineral content of bone. Since the radiation doses were very small, his graduate students often used family members (and each other) as "research subjects." A small change in a lactating mother's bone mineral was easily observed. One of his early bone densitometry publications (Invest. Radio. 3:141; 1968) was listed as its single most cited article on the 25th anniversary of Investigative Radiology. Many useful clinical applications of highly accurate bone densitometry became evident and a number of companies developed bone densitometers. Lunar Radiation (now GE-Lunar) arose directly from early work done in John's "bone mineral lab." The number of bone densitometers in the world now exceeds 20,000.

John was deeply concerned with excess radiation exposures in diagnostic radiology. He developed simple test tools and techniques to measure radiation and to evaluate the quality of x-ray images. These efforts led to the creation of Radiation Measurements, Inc. (RMI), a pioneering manufacturer in quality-assurance measurements, materials, and devices. This also led to product developments by several companies and to several standard techniques for radiation measurement and image quality assurance.

John founded Medical Physics Publishing, a nonprofit corporation whose initial objectives were to provide reprints of useful but out-of-print books. That company now publishes a wide spectrum of original books and is a major source of material relating to health physics and medical physics.

John was interested in developing new applications of physics to medicine. He preferred to hire new faculty whose research was not in the mainstream at the time. John started a program for radiation physics measurement that with federal funding became the Midwest Center for Radiation Physics. His foresight led to the early development of significant programs at UW-Madison in applications that eventually became "mainstream," including ultrasound, positron imaging, and digital angiography, to name but a few. He also helped initiate a program in magneto-encephalography, looking at the magnetic signals emitted by the brain. After his retirement, his interests spread into still more areas, including imagination and creativity.

While an outspoken advocate for reductions in diagnostic radiation exposures, John was equally concerned about the excess and unwarranted concerns about near-background levels of radiation exposure. In recent years he devoted himself to educating the public accurately about the benefits and risks of radiation used in medicine. He was especially concerned about the fear caused by low-level radiation and analyzed much data to illustrate that these fears probably are unfounded. He argued this aspect by talking about longevity being a measure of health effects of radiation (Radiology 229:14-16; 2003). Indeed, he argued (convincingly) that radiation might be a beneficial "trace element" at very low doses (Physics and Society October 2001).

John received numerous honors for his contributions to medical physics, including the Coolidge Award from the AAPM in 1980. In 1995 he was one of only four recipients of a Roentgen Centennial Medal Award from Radiological Society of North America. In 2000 John received from the International Organization for Medical Physics the Madam Curie Award for activities in medical physics education in developing countries.

For all of his research and professional contributions, John's greatest legacy is the many students, trainees, and young faculty whose budding careers were nurtured in the UW Medical Physics Program. He was a caring and generous man who went out of his way to ensure that all of these young people had the best opportunity possible to develop their careers in medical physics. He was full of optimism and had a great sense of humor, catching many students by surprise as he taught them. Every graduate or trainee of the UW Medical Physics Program owes a debt of gratitude to John for his efforts on behalf of them and of the UW program.

Among his many attributes, John is legendary for two others. John took great pride in his Scottish frugality and would demonstrate it in a humorous manner. Also John had a philosophy that he used to inspire his students and others. He would always quote in the middle of a trying time during an experiment, "Anything worth doing is worth doing poorly," meaning, "It doesn't have to be perfect, just get it to work!" More than once this was enough to spur on his student to "just do it" and not worry about perfection. Perfection could always come later if necessary.

Fig. 2 John with his wife, Lavonda (Left); The author with Prof. John Cameron, 1996 (Right).

JOHN CAMERON MEMORIAL LECTURES

Table 1 A List of the first thirteen lectures. The lecturers cover an international geographic distribution, 5 from Asia, 3 from Oceania, 2 from Europe and 3 from the USA.

No	Year	Lecture Title	Lecturer	Affiliation
1	2004	Recent Developments in Volume CT Scanning	Willie Kalender	Institute of Medical Physics, University of Erlangen, Germany
2	2007	Medical Physics in 2020: Will we still be relevant?	Kwan Hoong Ng	University of Malaya, Kuala Lumpur, Malaysia
3	2008	Frontiers of Medical Physics	Barry Allen	St George Hospital Cancer Care Centre, NSW, Australia
4	2009	Role of Medical Physics in the Design and Construction of the Colorado Translational Research Imaging Center: Legacy of Pioneers in Quantitative Imaging	Gary Fullerton	University of *Texas* Health Science Center, San Antonio, Texas, USA
5	2010	Education and Training of Medical Physicists, Biophysicists and Bioengineers in SE Asia: 2010 and Beyond	Brian Thomas	Queensland University of Technology, Brisbane, Australia
6	2011	Quality Control and Dosimetry in Diagnostic Medical Physics- An Overview	Joel Gray	DIQUAD, LLC Illinois, USA
7	2012	The Convergence of Imaging and Therapy	Thomas Kron	Peter MacCallum Cancer Centre. Melbourne, Australia
8	2013	From Evolution to Revolution - Multi-Modality Imaging Comes of Age	David Townsend	National University of Singapore, Singapore
9	2014	The Growth in Medical Physics Research: The Indonesia Case	Djarwani Soejoko	University of Indonesia, Jakarta, Indonesia
10	2015	The Potential Impact of Computer-Aided Diagnosis in Medical Imaging	Kunio Doi	University of Chicago, Chicago, USA
11	2016	Advances in Image Guided Radiation Therapy	Geoffrey Ibbot	The University of Texas MD Anderson Cancer Center, Houston, USA
12	2017	Optimization: the Role of Medical Physicist in Diagnostic Radiology	Anchali Krisanachinda	Chulalongkorn University, Bangkok, Thailand
13	2018	The role of the ICRP in Medicine: Past, Present and Future	Colin J Martin	Committee 3 International Commission of Radiological Protection, UK

1st 2004 3rd SEACOMP Kuala Lumpur, Malaysia
"Recent Developments in Volume CT Scanning"
Willie Kalender, PhD

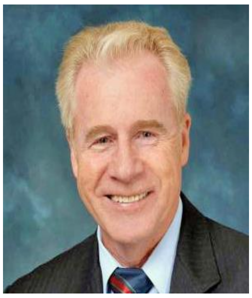
Whole body scanning within a breath hold period and truly isotropic high-resolution CT have become routinely available with the latest multi-slice spiral CT (MSCT) scanners. What is the state of the art? What are the challenges for future developments? The talk shall focus on two core issues: on scanner and detector technology and on considerations of patient dose. Several detector designs are presently available, such as isotropic and non-isotropic or adoptive arrays. Systems on the market offer the simultaneous acquisition of up to 64 slices. The underlying technical concepts will be described. The cost and the size of the detector electronics are still a problem; however, there are no physical limits. Wider arrays will become available; the use of flat panel detectors originally designed for digital radiography is under evaluation for CT imaging. Respective developments including comments on reconstruction algorithms, will be reviewed in part one of the talk. Patient dose issues are of increasing concern in Europe and worldwide. The availability of submillimetre isotropic 3D spatial resolution spurs the request for more scans and for larger scan volumes. Higher resolution has immediate implications for noise and potentially for patient dose as will be explained. However, there are also innovative approaches for reducing dose and for optimizing the CT application with respect to dose. An automatic exposure control (AEC) for CT is the challenge. The respective concepts and results will be presented and discussed; typical patient dose values will be given.

2nd 2007 5th SEACOMP Manila, Philippines
"Medical Physics in 2020: Will we still be relevant?"
Kwan Hoong Ng, PhD

From the time when Roentgen and other physicists made the discoveries which led to the development of radiology, radiotherapy and nuclear medicine, medical physicists have played a pivotal role in the development of new technologies that have revolutionized the way medicine is practiced today. Medical physicists have been transforming scientific advances in the research laboratories to improving the quality of life for patients; indeed, innovations such as computed tomography, positron emission tomography and linear accelerators which collectively have improved the medical outcomes for millions of people. In order for radiation-delivery techniques to improve in targeting accuracy, optimal dose distribution and clinical outcome, convergence of imaging and therapy is the key. It is timely for these two specialties to work closer again. This can be achieved by means of cross-disciplinary research, common conferences and workshops, and collaboration in education and training for all. The current emphasis is on enhancing the specific skill development and competency of a medical physicist at the expense of their future roles and opportunities. This emphasis is largely driven by financial and political pressures for optimizing limited resources in health care. This has raised serious concern on the ability of the next generation of medical physicists to respond to new technologies. In addition, in the background loom changes of tsunami proportion. The clearly defined boundaries between the different disciplines in medicine are increasingly blurred and those between diagnosis, therapy and management are also following suit. The use of radioactive particles to treat tumors using catheters, high-intensity focused ultrasound, electromagnetic wave ablation and photodynamic therapy are just some areas challenging the old paradigm. The uncertainty and turf battles will only explode further and medical physicists will not be spared. How would medical physicists fit into this changing scenario?

We are in the midst of molecular revolution. Are we prepared to explore the newer technologies such as nanotechnology, drug discovery, pre-clinical imaging, optical imaging and biomedical informatics? How are our curricula adapting to the changing needs? We should remember the late Professor John Cameron who advocated imagination and creativity - these important attributes will make us still relevant in 2020 and beyond. To me the future is clear: "To achieve more, we should imagine together."

3rd 2008 6th SEACOMP Ho Chi Minh City, Vietnam
"Frontiers of Medical Physics"
Barry J Allen, PhD, DSc



Medical Physics has a rather unbalanced profile, with most medical physicists attached to radiotherapy departments for cancer therapy and to a much lesser extent to Nuclear Medicine departments. As such, many medical physicists find themselves some way from the frontiers of Medical Physics

Frontier 1 There are many medical physicists involved with the implementation of new external radiation beam technologies for the therapy of cancer and imaging of cancer and other diseases. Most would say that this is the frontier today. Imaging techniques continue to resolve smaller tumours, and the development of SPECT and PET has had a major impact on the management of disease. However, subclinical disease cannot be observed and tell us where micro-metastases lie. External beam radiotherapy can target well defined volumes, achieving local control, but can never eliminate systemic disease. Such high technology and expensive equipment cannot serve rural communities in most developing countries. These limitations suggest that there are other frontiers of medical physics that must address these important issues.

Frontier 2 New advances in Immunology and the development of exquisite targeting vectors allow the systemic targeting of cancers. Radioisotopes that decay by alpha or beta rays are used to label monoclonal antibodies for systemic radio-immunotherapy. However, high LET alpha radiation is superior to betas in terms of efficacy and lower adverse events. The key objective is the control of systemic disease by targeted alpha therapy, leading to improved survival for systemic cancer patients

Frontier 3 A discipline that ignores the plight of two thirds of the world's population is not really doing its job. For rural populations in developing countries, cancer patients present at the incurable end-stage. Palliative therapy is required to reduce pain and increase quality of life.

The new frontiers for medical physics are therefore:

- High cost technology for medical imaging and external beams for local, curative cancer therapy;
- Internal high LET targeted therapy for systemic cancer;
- Low cost imaging and radiotherapy for palliative therapy in developing countries.

4th 2009 7th SEACOMP Chiang Mai, Thailand

"Role of Medical Physics in the Design and Construction of the Colorado Translational Research Imaging Center: Legacy of Pioneers in Quantitative Imaging"

Gary Fullerton, PhD

The growing importance of in vivo quantitative measurement in human subjects to evaluate drug delivery, drug response and treatment efficacy has increased demand for the use of imaging as a source of critical biophysical data. A growing number of translational research imaging centers have been created to provide improved quality of research information. This presentation reviews the process of creating the Colorado Translational Research Imaging Center C-TRIC at the University of Colorado in Denver. The planning process used input from visiting experts, site visits to centers of excellence and presentations from corporate imaging manufacturers to create a new center of excellence for 21th century research needs. The C-TRIC has six operational cores. Translational research begins within the Animal Imaging Core where basic science studies use the tools created by the Image Analysis Core to provide the basis for more complex studies in the Human Imaging Core. The data from both animal and human imaging is maintained and integrated with information from other sources using resources of the Imaging Bioinformatics Core to allow long term data mining and advanced meta-analysis methods to be applied. The most important new molecular processes of the Molecular Imaging/ Radiochemistry Core require on-site cyclotron and radiochemistry capacities to label critical bio-molecules to decipher molecular processes important to human health. Finally the growing complexity and multi-specialty knowledge demands require educational programs from Imaging Education Core to educate research scientists, post- doctoral fellows, graduate students and professional research assistants concerning the strengths, weakness and potential of research imaging data. The combined use of MRI, PET, SPET, US and optical methods in micro-formats suitable for rodent models but extending to large animal and human formats provides continuity for translation of genomics and microbiological concepts to the resolution of human disease for improved health care.

5th 2010 8th SEACOMP Bandung, Indonesia

"Education and training of medical physicists in SE Asia-accomplishments and challenges."

Brian J Thomas, PhD

John Cameron made significant contribution to the field of Medical Physics. His contribution encompassed research and development, technical developments and education. He had a particular interest in the education of medical physicists in developing countries. Structured clinical training is also an essential component of the professional development of a medical physicist. This paper considers aspects of the clinical training and education of medical physicists in south east Asia and the challenges facing the profession in the region if it is to keep pace with the rapid increase in the amount and technical complexity of medical physics infrastructure in the region. The paper was presented for the 5th John Cameron Memorial Lecture at the 8th SEACOMP conference in Bandung, Indonesia, 2010.

6th 2011 9th SEACOMP Manila, Philippines
"Quality Control and Dosimetry in Diagnostic Medical Physics- An Overview"
Joel E. Gray, PhD

Diagnostic medical physics has been a very dynamic field since the invention of the first computed tomographic scanner in 1972. Diagnostic imaging has seen major changes in technology and image quality, requiring the medical physicist to continually support these new modalities.

This presentation will discuss the history of quality control (QC) in diagnostic imaging starting with the first QC publication in 1976. Although QC should be an integral part of every imaging department, it is not in many facilities. This has been partially overcome by requirements of governments or insurance companies for QC. Some imaging equipment includes software for QC making the task much easier and, in some cases, transparent to the facility.

Radiation dosimetry has made significant gains in techniques and technology in the past 40 years. Ionization chambers were the only choice 50 years ago, with their inherent weaknesses, i.e., partial volume effect. These have been mostly replaced by solid state dosimetry systems. Thermoluminescent dosimeters (TLDs) were the standard for radiation dosimetry requiring laborious annealing, sorting, heating curves, nitrogen heating chambers, and record keeping. TLDs are being replaced by optically stimulated luminescent (OSL) materials which can be read out in seconds after exposure and do not require any of the tasks normally associated with TLDs.

This presentation will provide an overview of both quality control and radiation dosimetry in diagnostic medical physics over the past 40-50 years. The challenge for the future is to clearly define the role of the medical physicist in diagnostic imaging and assure that we have the necessary tools, techniques, and training programs available for our profession.

7th 2012 10th SEACOMP Chiang Mai, Thailand
"The Convergence of Imaging and Therapy"
Tomas Kron, PhD

Introduction: Due to the increasing complexity of the work environment for most clinical and biomedical physicists subspecialisation has become common for medical physicists and many consider themselves either a therapy or diagnostic physicist. Most therapy physicists work in radiation oncology while diagnostic physicists are often further subdivided into nuclear medicine and radiology medical physicists. However, several recent developments challenge this approach and provide rationale for broadening the scope for medical physics practice again.

The situation in radiotherapy: Many major improvements in radiotherapy planning and delivery are associated with medical imaging. This ranges from better target definition due to more sophisticated imaging to the ability to visualize the target every day of treatment with the aim to reduce uncertainty and the amount of normal tissue irradiated. As functional changes often precede anatomical ones, imaging modalities such as Positron Emission Tomography and Magnetic Resonance Imaging emerge as tools to assess response to treatment early and as such adapt the treatment approach. Be it high quality, motion resolved or longitudinal imaging, the increasing availability of a large variety of diagnostic tools allows for much improved customization of treatment for each patient and provides new challenges for image handling and quality assurance that must be met by medical physicists.

The situation in medical imaging: Imaging has become increasingly dependent on computers. The resulting image quality and variety of contrast options has the potential of greatly enhancing the capacity of radiologists and nuclear medicine physicians to diagnose disease and help patients. However, it also often comes with a confusing array of technical options, possibly higher radiation dose and need for quality assurance. While the small number of well-trained diagnostic physicists is probably the greatest problem at present, the higher doses given and the increasing use of diagnostic equipment during medical interventions move diagnostic physicists closer to therapy. This is compounded by an emerging trend for use of radionuclides for targeted therapy of a variety of cancers.

Outlook: The presentation explores the challenges associated with the convergence of imaging and therapy from the perspective of a radiotherapy physicist. While the huge scope of the work practices and the need for a combination of broad and in-depth training are major concerns, the medical physics profession is in a good position to succeed as lifelong learning, adaptation to change and multidisciplinary engagement have always been defining characteristics.

8th 2013 11th SEACOMP Singapore

"From Evolution to Revolution: Multi-Modality Imaging Comes of Age"

David W Townsend, PhD

The first decade of the 21st century has seen the introduction of hybrid imaging technologies such as PET/CT and SPECT/CT into clinical practice. The adoption of these technologies, and in particular PET/CT, has been surprisingly rapid. Over the past few years, the clinical benefit to the patient of combined anatomical and functional imaging compared with either modality alone has been extensively documented. The advent of the second decade of this century saw the introduction of the latest design of hybrid imaging devices, combined PET and MR. However, the clinical role of PET/MR has yet to be established and adoption has been slow, largely due to the significant cost. Both PET/CT and PET/MR designs have benefitted from the advances in PET detector technology. Compared with just a few years ago, PET images can now be acquired routinely in less time and with lower injected dose, and even within a 3T magnetic field environment without artifacts. Parallel advances have been seen in CT technology where considerable emphasis has been placed on dose reduction, a benefit of PET/MR since the relatively-high radiation dose associated with CT is eliminated. However, advances in CT dose-reduction techniques now results in PET/CT studies with a total radiation dose as low as 5-7 mSv. Further effort has also focused on quantitative image accuracy and the reproducibility of studies for evaluating treatment response. Consequently, with over a decade of experience, PET/CT has become the primary clinical imaging modality for staging malignant disease and monitoring response to therapy. SPECT/CT, after almost a decade of clinical experience, is widely recognized as an advance compared with SPECT alone; finally, the clinical role for simultaneous PET/MR is still being explored after only three years of availability. This presentation will review these advances that suggest multi-modality imaging is finally coming of age.

9th 2014 12th SEACOMP Ho Chi Minh City, Vietnam

"The Growth of Medical Physics Research: The Indonesian Case"

Djarwani S. Soejoko, PhD

Medical Physics in Indonesia gained late attention, in terms of education and research. Physics Department, Faculty of Mathematics and Sciences, University of Indonesia started undergraduate and graduate program on Medical Physics in 1998 and 2002, respectively. This late start causes this field development needs enhancement, one of which in term of research. To illustrate the developing process, several examples research results, in the subfield related with Radiotherapy, Diagnostic Radiology, and Nuclear Medicine, are shown. All examples were the research results of student final projects. Advance technology develops equipment and technical procedures in imaging and radiotherapy treatment to become more and more complex, and of course affecting the growth of Medical Physics research as well. However the quality of research is still limited, since most research are performed according to the availability time of students, 6 - 12 months. Therefore in order to increase the research quality, doctorate program should be available at this department in the near future. Since the successful of Medical Physics research will be greatly influence by close cooperation with user research infrastructure at hospitals, therefore the growth of research culture at hospitals should also be induced.

10th 2015 13th SEACOMP Yogyakarta, Indonesia

"Potential Impact of Computer-Aided Diagnosis in Medical Imaging"
Kunio Doi, PhD

Computer-Aided Diagnosis (CAD) has become one of the major research subjects in medical physics and diagnostic radiology. Many different types of CAD schemes are being developed for detection and/or characterization of various lesions in medical imaging, including conventional projection radiography, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound imaging. Organs that are currently being subjected to research for CAD include the breast, chest, colon, brain, liver, kidney, and the vascular and skeletal systems. Commercial systems for detection of breast lesions on mammograms have been developed and have received FDA approval for clinical use. It has been reported that more than 10,000 commercial CAD systems have been used at many hospitals, clinics, and screening centers in the United States and in Europe for assisting radiologists in their task of detecting breast cancers. It has been reported also from prospective studies that CAD has provided a gain of approximately 10-20% in the early detection of breast cancers on mammograms. CAD may be defined as a diagnosis made by a physician who takes into account the computer output as a "second opinion". The purpose of CAD is to improve the quality and productivity of physicians in their interpretation of radiologic images. The quality of their work can be improved in terms of the accuracy and consistency of their radiologic diagnoses. In addition, the productivity of radiologists is expected to be improved by a reduction in the time required for their image readings. The computer output is derived from quantitative analysis of radiologic images by use of various methods and techniques in computer vision, artificial intelligence, and artificial neural networks (ANNs). The computer output may indicate a number of important parameters, for example, the locations of potential lesions such as lung cancer and breast cancer, the likelihood of malignancy of detected lesions, and the likelihood of various diseases based on differential diagnosis in a given image and clinical parameters. Because the basic concept of CAD is broad and general, CAD is applicable to all imaging modalities, and to all kinds of examinations and images. In this lecture, the basic concept of CAD is first defined, and the current status of CAD research is then briefly described. In addition, the potential impact of CAD in the future is discussed and predicted.

11th 2016 14th SEACOMP Bangkok, Thailand

"Advances in Image Guided Radiation Therapy"
Geoffrey Ibbot, PhD

The introduction of image guidance in radiation therapy has revolutionized the delivery of treatments. Modern imaging systems can supplement or even replace the historical practice of relying on external landmarks and laser alignment systems. Rather than depending on markings on the patient's skin, image-guided radiation therapy (IGRT) using techniques such as computed tomography (CT), cone- beam CT, MV on-board imaging (OBI), and kV OBI allows the patient to be positioned based on the internal anatomy. These advances in technology have enabled more accurate delivery of radiation doses to anatomically complex tumor volumes, while sparing surrounding tissues. While these imaging modalities provide excellent bony anatomy image quality, magnetic resonance imaging (MRI) surpasses them in soft tissue image contrast for better visualization and tracking of soft tissue tumors with no additional radiation dose to the patient. However, the introduction of MRI into a radiotherapy facility carries with it a number of complications including the influence of the magnetic field on the dose deposition, as well as the affects it can have on dosimetry systems. The development and introduction of these new IGRT techniques will be reviewed and the benefits and disadvantages of each will be described. Clinical examples of the capabilities of each of the systems will be discussed.

12th 2017 15th SEACOMP, IloIlo City, Philippines

"Optimization: the role of medical physicist in diagnostic radiology"
Anchali Krisanachinda, PhD

The optimization should be applied to all categories of exposure: occupational, public and medical. The practical information will include in the workplace. The emphasis throughout is on the integration of radiation protection into the more general system of work management, and on the involvement of management and workers in setting up a system of radiation protection and in its implementation. The presentation will cover the radiation doses in imaging individual patient per procedures such as the dose in radiography is 0.001-1.5 mSv, diagnostic fluoroscopy 3-8 mSv, CT 2-15 mSv, interventional radiology 5-60 mSv, nuclear medicine 0.2-12 mSv for Tc-99m, dental of <0.2 mSv. As there is no dose limits prescribed for patients, the diagnostic reference levels, DRL, had been developed by ICRP for the standard size of patients. DRL would be changed with time as technology develops. DRL is one step in optimization while the other step would be the image quality consideration. The image quality scoring criteria should be set up. Going beyond person of standard size, the patients should be divided into various weight groups or into clinical indications. The acceptable quality dose, AQD, could be determined for local, regional and national situations for self-comparison. AQD can be used prospectively in adjusting parameters of patients whose estimated dose indicator is likely exceeding AQD+ SD. Therefore, the image quality should be primary while the radiation dose should be secondary which all patient weights could be covered. Every examination using ionizing radiation should be justified and optimized, in simple words, right examination, right dose.

The vision of optimization of radiation safety for patients and staff in medical imaging, the ideal goals are:

- No radiation induced skin injuries;
- Every examination is justified and that applied to recurrent examinations;
- Every examination is performed at radiation dose needed to get desired information and no more;
- Every patient is satisfied that examination was performed with minimum radiation dose needed for the purpose and there should be no worry about carcinogenic effect;
- No high dose examination.

The challenges are:

- Confidence building in patient on safety of medical radiological examination;
- Cutting down inappropriate referrals for radiological examinations that use ionizing radiation;
- Development of imaging equipment that minimize and optimize radiation exposure automatically for achieving clinical purpose;
- Avoidance of radiation induced skin injury in patients and radiation cataract in staff;
- Development of equipment that can provide safe imaging for patients that justifiably require few tens of imaging procedures in life time;
- Development of biological indicators of radiation dose;
- System for tracking of radiation exposure history of patient;
- Transition from dose to a representative phantom to dose to individual patient.

13th 2018 16th SEACOMP, Kuala Lumpur, Malaysia
"The Role of the ICRP in Medicine: Past, Present and Future"
Colin J Martin, PhD

The International Commission on Radiological Protection (ICRP) is a body made up of experts in radiological protection from around the world. The commission makes recommendations on protection in the application of radiation in a variety of fields, prepares guidelines for users of radiation, and has developed a system of dosimetry for evaluation of radiation hazards, including the recommendation of dose limits.

The International X-ray and Radium Protection Committee, the forerunner of ICRP, was established in 1928 to address concerns about effects observed in radiologists and the committee produced the first recommendations on occupational protection in medicine in July 1928. As other applications of radiation developed, the field of radiological protection broadened and the commission was renamed the ICRP in 1950. Several committees were established within ICRP at this time, dealing with different types of radiation, routes of exposure, and radioactive waste, and the first official ICRP report was published in 1958. During the 1960s the potential for reducing doses to patients began to be recognised, culminating in Publication 16 entitled "Protection of the patient in X-ray diagnosis" in 1970. ICRP Committee 3 "Protection in medicine" was established in 1977 and a series of reports on protection of the patient in different areas were prepared during the

1980s. Facilitating the understanding of radiation dose and the link to potential harm by non-specialists has always been a problem, and ICRP have attempted to address this through the introduction of protection quantities such as effective dose. Committee 2 “Doses from radiation exposure” works with Committee 3 to derive coefficients that allow organ and effective doses to be calculated for a wide range of radiopharmaceuticals for use by the medical community. ICRP felt that early reports produced by Committee 3 giving practical guidance were not reaching the medical community, so their impact was limited, and the emphasis has been changed to production of shorter concise reports on specific topics.

Since 2000, 24 reports have been prepared giving guidance and recommendations on areas relevant to medicine. However, a major source of ICRP income is from purchase of reports and this places a barrier to many potential users. Therefore, to mark the 90th anniversary of the founding of ICRP, the commission has launched a funding campaign with the aim of making reports available free through the internet. ICRP hope that if this step can be achieved, it will make a major difference in implementation of good radiological practice across the world.

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