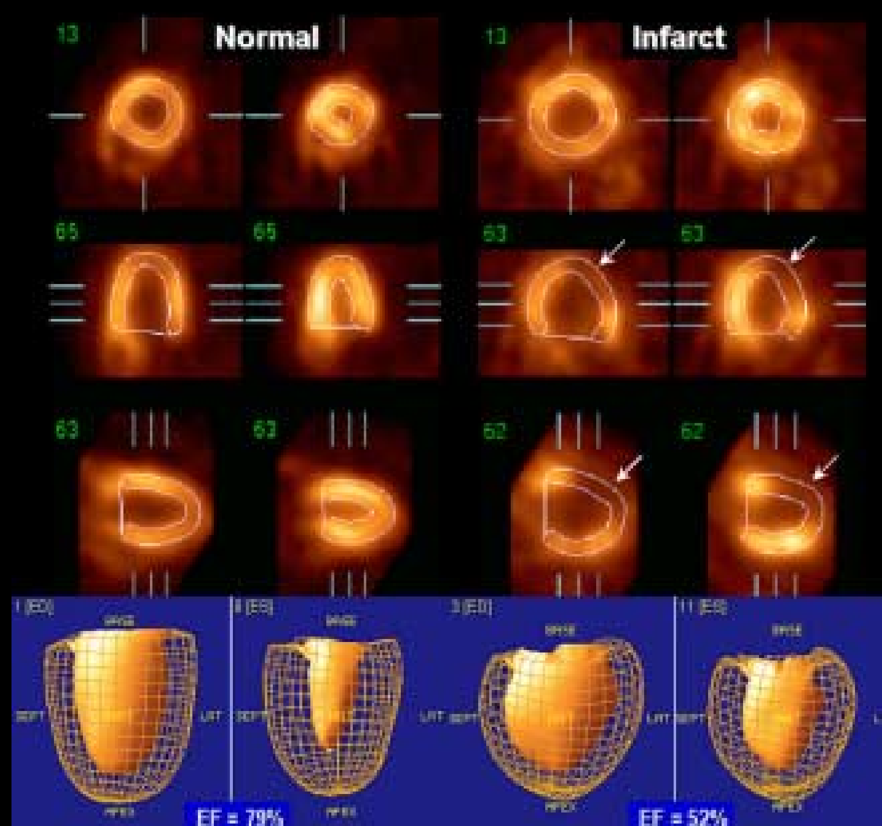
InterACTIONS

CANADIAN MEDICAL PHYSICS NEWSLETTER
Le BULLETIN CANADIEN de PHYSIQUE MÉDICALE



Functional Cardiac PET Imaging in the Rat

COMP OCPM

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CANADIAN COLLEGE OF PHYSICISTS IN MEDICINE
LE COLLÈGE CANADIEN DES PHYSICIENS EN MÉDECINE

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About our Cover

The rat heart is an excellent model for the investigation of cardiac physiology and metabolism. It has been used extensively for *ex vivo* studies as well as for the study of various heart diseases. With the advent of dedicated high-resolution small animal PET scanners, it is now possible to transpose many of the cardiac investigations routinely used in human to the rat. These include the *in vivo* measurement of myocardial blood flow and metabolism, and cardiac function parameters such as the left ventricular ejection fraction (LVEF) or the coronary vasodilatation reserve (CVR). The cover picture illustrates an ECG-gated FDG-PET study of the left ventricular (LV) function in a normal rat (*left*) and in a rat with myocardial infarction induced by ligature of the left anterior descending coronary artery (*right*). The images were obtained using the Sherbrooke avalanche photodiode PET scanner, a small animal PET device achieving 14 µl volumetric spatial resolution and high image contrast ratio. Cardiac reorientation and LV function analysis were performed using standard clinical software. A defect in the antero-lateral segment of the myocardium (white arrows) was clearly identified in the infarcted rat, and LVEF was significantly reduced. Some enlargement of the heart in response to a deficient ventricular function can also be observed. One decisive advantage of PET imaging in animal experiments is that the method is non-invasive. Therefore, follow-up studies of disease progression or monitoring of new therapeutic methods can be performed in the same animal, using it as its own control. The method is being applied in the study of cardiac post-prandial lipid metabolism, the investigation of cardiac dysfunction in sepsis, and in the assessment of experimental intramyocardial revascularisation therapy in the rat heart model.

Images provided by Etienne Croteau, François Bénard and Roger Lecomte, Centre d'imagerie métabolique et fonctionnelle, Université de Sherbrooke.

The Canadian Medical Physics Newsletter, which is a publication of the Canadian Organization of Medical Physicists (COMP) and the Canadian College of Physicists in Medicine (CCPM) is published four times per year on 1 Jan., 1 April, 1 July, and 1 Oct. The deadline for submissions is one month before the publication date. Enquiries, story ideas, article submissions can be made to:

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Please submit stories in Publisher 98, Word 6.0, Word 97, or ASCII text format. Hardcopy submissions will be scanned to generate an electronic document for inclusion in the Newsletter. Images in Tiff format at 300 dpi resolution are preferred. Advertising and corporate enquiries can be made to:
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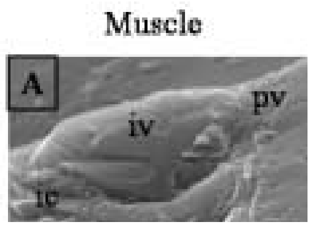

Inside this issue:

Message from the COMP Chair:

> Many important issues need to be addressed such as the design of our new website, the scope of practice for diagnostic physicists, liability coverage. I would therefore urge those who are interested, or simply want more information, to contact a member of the Executive.

The Executive of COMP met on November 29 and 30, 2002 for our annual mid-year business meeting to discuss many issues concerning our profession. Our main objectives were to prepare the Scientific Meeting in Edmonton in June. Our biggest issue was the electronic submission of abstracts. Because of the limited manpower of the Communications Committee, it was felt that this service should be provided by a third party. Although negotiations are still under way with the AAPM for the full web services for COMP, they have agreed that they could start with the abstract submission process. They would use new hardware but similar software to what they have developed for the AAPM Meetings. Access to the abstract submission would be through the home page for the COMP meeting, which is on our COMP website. The full instructions to the authors will be available through the COMP website.

The Local Arrangements Committee, headed by Sherry Connors, is hard at work in preparation for the meeting. They have a wonderful Riverboat Cruise planned as our Night-Out, which promises to be memorable. The meeting will also showcase the new installations of CBIAR (Centre for Biological Imaging and Adaptive Radiotherapy). A tour of the facility will be organised. I hope many of you will be able to join us in Edmonton. All of the Local Arrangements information (e.g. hotels, maps, housing, tourist info,...) is available on the website of COMP.

During our mid-year meeting, the Joint Executive of COMP and CCPM approved the Scope of Practice for Qualified Medical Physicists in Radiation Therapy Centres, which was produced by the Professional Affairs Committee. Our thanks to David Wilkins and the PAC for their excellent work. This very important document states the responsibilities of Medical Physicists in Radiation Therapy. It is hoped that this document will help in our efforts to have our profession recognised legally. Members will be able to download a copy of the document from the COMP website. De plus, vu l'importance de ce document, il sera traduit en français et disponible sur notre site web pour que vous puissiez l'utiliser à votre discrétion. Quelques provinces, incluant le Québec, ont entamé des processus menant vers la création d'un ordre professionnel de physiciens médicaux. Je vous souhaite tous bonne chance et bon courage. La route sera peut-être longue, mais l'effort ne sera pas en vain, j'en suis certain!

Our attempts to meet with federal politicians have not been as fruitful as expected. However, we do have a meeting scheduled with the Minister of Labour, Ms. Claudette

Bradshaw in January. Michael Henry is also hard at work trying to get a meeting with the Health Minister. These will be excellent opportunities for us to raise the profile of our profession.

The Executive will see new faces in 2003. As you already know Stephen Pistorius (thanks again Stephen!) ended his term as Treasurer in December and was replaced by Horacio Patrocinio. We will also be saying our farewells to Michael Kolios as Councillor for Communications and David Wilkins as Councillor for Professional Affairs. My most sincere thanks to both of you for the many hours you have spent working on COMP issues. Our Organization has greatly benefited from your participation. However, the vacancies left by Michael and David are also excellent opportunities for others to join the Executive. These positions are challenging but are also fulfilling and gratifying. Many important issues need to be addressed such as the design of our new website, the scope of practice for diagnostic physicists, liability coverage. These new members will be able to shape the future look of COMP. I would therefore urge those who are interested, or

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Message from the CCPM President:

Greetings,

As I write this message at the beginning of December, it seems appropriate to wish you all a happy holiday season. However, by the time you read this it will be January already so I extend my wishes for a happy and healthy 2003.

Since my last message in October, we have solicited input from our membership on two very significant aspects of our examination process and I apologise once again for the technical problems which detracted from the clarity of the communication. I believe that we have now resolved these issues and I would like to thank Barb Callaghan for her heroic efforts in overcoming the challenges presented by the technology.

The response to these two messages has been very impressive. The first was a straw vote on the question of adding a ***radiation safety component to the 2003 membership exam*** and the result was overwhelmingly positive with 100 votes to 5 in favour. We will be posting details of this extra component of the 2003 examination process on the web site early in January.

The second message requested input on whether we should ***maintain two levels of certification***. Here again, the result was clearly positive, with 59 votes in favour, 14 against and 2 uncertain. In addition to the vote count, we also received 35 messages with comments and suggestions to guide our discussions. The CCPM Board meets in person only twice per year, once immediately prior to the summer meeting and once in late November. I have just returned from the November meeting in Toronto where the Board spent considerable time considering the input and formulating a plan for moving forward.

In brief, our suggestion will be to separate Fellowship in the CCPM from competency certification. With respect to the Fellowship, the plan is to clarify the meaning and requirements for Fellowship and ensure that the process for achieving Fellowship is transparent and accountable. With respect to Membership, the plan is to re-emphasize and strengthen competency in this process by various means including the addition of an oral examination. Also, the re-certification process would be linked to the Membership qualification with the rationale that it is competency that requires maintenance.

In brief, our suggestion will be to separate Fellowship in the CCPM from competency certification.

The membership will be polled once more for input on this topic before revisions to the By-laws are presented for ratification at the AGM in Edmonton. It will be no surprise that we are planning a substantial number of proposals for Bylaw changes for voting within the two hours scheduled for this meeting. The time constraints have prompted us to consider methods for the future that may enable the democratic process to extend beyond the yearly AGM. More on that to come. We also intend to arrange postal ballots for those members who are unable to travel to Edmonton in June.

Another subject discussed at our November meeting was the ***training of dosimetrists***. In response to requests from administrators and radiation therapy professionals, the CCPM has issued a statement on requirements for appropriate *on-the-job* training and assessment of persons preparing computerised radiation therapy treatment plans. This statement is now available on the web site and all medical physicists are encouraged to help disseminate this document within the radiation therapy community.

The ***Mammography Accreditation Committee***, headed by Alain Gauvin, report that they are busy updating their records and working to renew accreditation that have time-expired.

Medical Physicists working in Ontario may be aware of a new initiative in Ontario to gain recognition of certification by CCPM as being suf

(Continued on page 23)

Message from the Executive Director of COMP/CCPM

> We need to ensure that when elected officials think of health care professions, they think about medical physics.

The New Year always brings new hopes, new aspirations, and new challenges for us personally as well as for the profession of medical physics.

In past months, we have been inundated with news of health reform, discussions on the future of health care in Canada, and the ongoing federal-provincial funding and mandate dynamic.

The Kirby Report reported that Canadians want a fully funded health care system, including timely access to the latest technology and research. The report provided focus on the issue of funding and proposed a new graduated health tax to pay for health care.

The dust had barely settled on the Kirby Report when former Saskatchewan Premier Roy Romanow released his Report on the Future of Health Care in Canada calling for $15 billion in new federal health care expenditures over the next three years. He called for an increased federal commitment to funding health care and for and increased role for the federal government in directing health care in our country.

Do we see federal and provincial governments rushing to adopt either or both sets of recommendations from a Senate Committee or a Royal Commission? - Of course not. These two institutional mechanisms are seen by federal and provincial decision makers as being less accountable to the public than elected MLAs, MPPs, MNAs, and MPs.

These two reports do serve a national purpose in focusing attention on health care and to encourage further debate on the key issues facing our health care system. This presents an opportunity for medical physics to enter into the debate.

But what should we communicate to decision makers about medical physics research and practice in Canada? What are the priorities? - Are the key issues related to research funding, capital funding, professional recruitment and remuneration?

In discussions among your executive and board about what key messages to convey to elected officials, it has become clear that we need to let elected officials know that medical physicists in Canada make significant contributions to Canadians' health care. – We need to ensure that when elected officials think of health care professions, they think about medical physics.

To help increase medical physics' profile among federal and provincial elected officials, your executive and board is committing energies this coming year to meet with local elected officials. The objective is clear – to ensure that decision makers know and appreciate the role of medical physics in our health care system.

While these efforts will help raise the profile of the profession in public policy arena, it is important for us to remember that most elected officials do not rely solely on policy briefings and formal meetings for information. Elected officials listen to their constituents in formal and informal settings – local celebrations, winter festivals, summer bar-b-ques are often key sources of information for elected decision makers.

What can each medical physicist do to contribute to raising the profile of the profession? Medical physicists in Canada talk about the profession – and its contributions. Every day can bring opportunities to tell someone about what you do for a living – about its joys and challenges. The more people who know about medical physics work, the more likely the profession will a part of national and local debates on health care in our country.

With those thoughts, please accept my best wishes to you and your families for the coming year. As always, your thoughts, suggestions, and advice are welcome.

Michael Henry
Executive Director
COMP/CCPM

49th Annual Scientific Meeting of COMP and CCPM Symposium

June 5-7, 2003

Edmonton, Alberta

The Canadian Organization of Medical Physicists and the Canadian College of Physicists in Medicine are pleased to invite you to Edmonton, AB for our 49th Annual Scientific Meeting. Our Local Arrangements Committee is hard at work and has planned a wonderful nightout. Details will be available on the COMP website (www.medphys.ca) early in January 2003.

Abstract Submission: An electronic-based abstract submission will be used for the Edmonton Meeting similar to the approach used for the 2001 Meeting in Kelowna.

Early-registration:
The Early-registration will begin on February 3, 2003 and end on May 1, 2003. Information and instructions on how to register will be posted on the COMP website.

Please visit the COMP website for all details on registration and abstract submission.

IMPORTANT DATES

February 3, 2003	- Early-registration begins
February 3, 2003	- Start of online abstract submission
February 28, 2003	- End of abstract submission
May 1, 2003	- End of Early-registration
June 5-7, 2003	- COMP Meeting

2003 Sylvia Fedoruk Prize in Medical Physics

The Saskatchewan Cancer Agency is pleased to sponsor a competition for the 2003 Sylvia Fedoruk Prize in Medical Physics. This award is offered annually to honour the distinguished career of Sylvia Fedoruk, former Lieutenant-Governor of Saskatchewan and previously physicist at the Saskatoon Cancer Centre.

The prize will comprise a cash award of five hundred dollars ($500), an engraved plaque and travel expenses to enable the winner to attend the annual meeting of the Canadian Organization of Medical Physicists (COMP) and the Canadian College of Physicists in Medicine (CCPM), which will be held on June 6-8, 2003 in Edmonton.

The 2003 Prize will be awarded for the best paper on a subject falling within the field of medical physics, relating to work carried out wholly or mainly within a Canadian institution and published during the 2002 calendar year. The selection will be made by a panel of judges appointed by COMP.

Papers published in *Physics in Medicine and Biology* and *Medical Physics*, which conform to the conditions of the preceding paragraph, will automatically be entered in the competition and no further action by the author(s) is required. All other papers must be submitted individually. Four (4) copies of each paper being entered must be sent to:

COMP Scientific Program

Clément Arsenault, Ph.D., MCCPM
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Hôpital régional Dr Georges-L. Dumont
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Moncton, NB E1C 8X3
Tel: (506) 862-4151
Fax: (506) 862-4222
E-mail: carsenault@health.nb.ca

Each paper must be clearly marked: "Entry for 2003 Sylvia Fedoruk Prize" and must reach the above address no later than **Tuesday, February 19, 2003**.

The award winners from the last five years were:

B. McCurdy, K. Luchka and S. Pistorius, "Dosimetric investigation and portal dose image prediction using an amorphous silicon electronic portal imaging device", *Medical Physics,* **28**, 911-24 (2001).

M. Lachaine and B. Gino Fallone, "Monte Carlo simulations of x-ray induced recombination in amorphous selenium", *J. Phys. D: Appl. Phys.,* **33**, 1417-23 (2000).

P.Busono and E. Hussein, "Algorithms for density and composition-discrimination imaging for fourth-generation CT systems", *Physics in Medicine and Biology,* **44**, 1455-1477 (1999).

R.G. Kelly, K.J. Jordan, and J.J. Battista, "Optical CT reconstruction of 3D dose distributions using the ferrous-benzoic-xylenol (FBX) gel dosimeter", *Medical Physics* **25**, 1741-1750 (1998).

C.E. Zankowski and E.B. Podgorsak, "Calibration of photon and electron beams with an extrapolation chamber", *Medical Physics* **24**, 497-503 (1997

From the Chief Examiner of CCPM

To all potential MCCPM candidates:

In November 2001, the CCPM was formally requested by the joint COMP/CCPM Radiation Regulations Committee to "include expertise in radiation safety as a condition for certification" and to ensure that "the testing of radiation safety knowledge be a mandatory part of the examination process for membership in the CCPM". To date, it has been implicit that CCPM members have been qualified to be appointed radiation safety officers but current practice amongst regulating bodies is to require explicit confirmation of radiation safety competence.

At the AGM in Montreal, the radiation safety question was linked to additional proposed changes in the membership exam (reference: 2002 proposed bylaw amendments, Interactions 28(2) April 2002). Rejection of all bylaw amendments implied rejection of the radiation safety component by default. For next year's AGM, the board will put forward additional bylaw proposals, where the radiation safety question is well separated from the other issues. In the interim, the board sought a mandate from the College to implement a one-time-only solution. This past fall an email vote was held by college members and administered through the COMP/CCPM central office on the following question: Do you agree to add a pass/fail radiation safety component to the 2003 MCCPM examination.

The results of this poll were overwhelmingly in favour of including such a section (see Brenda's report). Thus, in 2003, all candidates for College membership will be required to pass 5 distinct sections. Parts I through IV will be as per Appendix III of the Bylaws. The time allotted for these sections will remain as described. In addition there will be a new Part V. The duration for this section will be 1 hour. The questions will be formulated and structured with sensitivity to the fact that this is a long exam with a lot of writing. The subject of Part V will be Radiation Protection, with a detailed syllabus listed below.

The Board's intent is to continually improve the quality of our certification process, and to ensure that it remains a legitimate tool by which to assess clinical competency and the protection of the public. We believe, and have been supported by the membership at large, that adding an obligatory Radiation Safety component is the right step along this path. We realize that the format for this year's exam is not ideal and are working on a more consolidated approach for the future. However, as stated above, an interim solution is better than none.

Good luck to all the candidates!

Katharina Sixel, Chief Examiner
Canadian College of Physicists in Medicine

Syllabus for Radiation Safety section of CCMP Membership Exam:

1. Radiation protection fundamentals (eg: simple shielding calculations, dominant photon interaction mechanism in tissue at different photon energies, etc.)
2. Dosimetric quantities and units
3. Natural and human-made sources of radiation exposure
4. Biological Effects of Ionizing Radiation
5. Instrumentation
6. Basic External Dosimetry
7. Basic Internal Dosimetry
8. ALARA and shielding
9. Counting statistics
10. Monitoring and interpretation
11. Transportation and waste
12. Emergencies & incident preparation/planning and response
13. Non-ionizing radiation (lasers, etc.)
14. Organization and administration of Radiation Safety Programs (licensing, relationships to hospital administration/occupational health & safety)

Scope of Practice for Qualified Medical Physicists at Canadian Radiation Therapy Centres

The Professional Affairs Committee has written a Scope of Practice for Qualified Medical Physicists at Canadian Radiotherapy Centres. This document was adopted by COMP and CCPM at the mid-year meeting of the Joint Executive in Toronto on November 30, 2002. The document is currently being translated, and a French version will be published in the next issue of InterACTIONS.

A document from the Professional Affairs Committee of the Canadian Organization of Medical Physicists (COMP) and the Canadian College of Physicists in Medicine (CCPM).

November 30, 2002

I. INTRODUCTION

Medical physicists are health care professionals with specialized training in the medical applications of physics. Their work involves the use of physical agents, which include X rays, radioactive materials, ultrasound, magnetic, and electric fields, infrared and ultraviolet light, heat and lasers in diagnosis and therapy. Most medical physicists work in cancer treatment facilities, hospital diagnostic imaging departments, or hospital-based research establishments. Others work in universities, government, and industry.

This document describes the scope of practice for qualified Medical Physicists working at Canadian radiation therapy centres (*a.k.a.* Radiotherapy Physicists). The Canadian Organization of Medical Physicists (COMP) has issued a statement on the subject of what constitutes a qualified Medical Physicist:

The Canadian Organization of Medical Physicists accepts as evidence of proven competence in clinical medical physics certification by one or more of the

- *a) Canadian College of Physicists in Medicine*
- *b) American Board of Radiology*
- *c) American Board of Medical Physics.*

*Certification in one sub-specialty of Medical Physics does not imply competence in other sub-specialties. Competent Medical Physicists are expected to comply with the "COMP/CCPM Code of Ethics" (*www.medphys.ca/info/reports/ethics.cfm).

II. GENERAL DESCRIPTION OF RADIOTHERAPY MEDICAL PHYSICS

A. Clinical service

Medical physicists are primarily responsible for the accuracy of the radiotherapy treatment delivered. The roles of a medical physicist in radiotherapy include treatment planning and radiotherapy equipment design, specification, acceptance, testing, calibration, and troubleshooting (see also "The Role and Function of Medical Physicists in Canadian Cancer Therapy Centres", *Interactions* **44**(4):133, Oct. 1998).

B. Radiation safety

Medical physicists have expertise in radiation safety. Canadian regulations recognize medical physicists who are certified by the Canadian College of Physicists in Medicine as Radiation Safety Officers for medical facilities employing radiation-emitting devices and radioactive materials.

C. Research and Development

Canadian radiotherapy physicists play a central role in such areas as the design and construction of radiotherapy treatment equipment, the use of heat and lasers in cancer treatment, the theory of radiation absorption and dose calculation and in radiobiology. Canadian laboratories are leaders in positron emission tomography, magnetic resonance imaging, ultrasound, x-ray and radionuclide imaging and biomagnetic mapping, among other areas.

D. Teaching

In Canada, most medical physicists have some affiliation with a university. Many medical physicists teach in graduate and undergraduate medical physics and physics programs. They also teach radiology and radiation oncology residents, medical students, and radiology, radiotherapy, and nuclear medicine technologists.

E. Professional status

Most Canadian medical physicists belong to the Canadian Organization of Medical Physicists (COMP, www.medphys.ca). COMP promotes the application of physics to medicine through scientific meetings, technical publications, educational programs, and the development of professional standards. COMP is linked to medical physics organizations in other countries through the International Organization of Medical Physics. Membership in COMP stands at approximately 400 in 2002.

Most Canadian clinical medical physicists are also certified by the Canadian College of Physicists in Medicine (CCPM), which was established in 1979 to recognize proven competence in physics as applied to medicine. Candidates with suitable educational background and experience become members of the College by passing a written examination. CCPM has 87

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Scope of Practice *(Continued from page 10)*

Members and 107 Fellows in 2002. CCPM certification is becoming widely accepted in Canada and other countries and in many provinces is a requirement of employment or career advancement. Each year CCPM supports continued professional education by sponsoring symposia on specialized topics and by providing a travel award for a young member in honour of Harold E. Johns.

F. Employment of Medical Physicists in Canada

Approximately 75% of Canadian medical physicists work in cancer centres, hospitals and hospital-based research establishments, 7% for government, 8% for industry, and an additional 10% are university faculty who are not hospital-based. The number of medical physics positions has generally increased by about 5-10% per year.

While medical physics is a diverse field, most medical physicists in Canada work in clinical service in one of the approximately 37 radiation therapy centres in Canada. This document concentrates on the scope of practice of qualified radiotherapy medical physicists.

III. EDUCATION OF MEDICAL PHYSICISTS

All clinical radiotherapy physicists in Canada have a graduate degree in medical physics, physics or a related discipline, with two thirds holding a doctorate degree. This is followed by an approximately two year period of clinical residency or on the job training in a radiation therapy centre. In some provinces, the end of this residency is marked by a formal review and oral examination. After two years of clinical experience, a medical physicist is eligible to apply for Membership in the CCPM, upon successfully passing a written and oral exam. The primary mandate of the CCPM is to certify that members of the College are competent medical physicists.

Certified medical physicists must participate in continuing education and demonstrate ongoing maintenance of their competency every 5 years through the CCPM recertification process. A point system based on attendance at conferences, courses, research and teaching activities, and development of clinical techniques ensures that the certified medical physicist keeps abreast of the rapid evolution of the profession.

The medical physics profession has a mechanism to accredit medical physics graduate and residency programs through a program audit by the Commission on Accreditation of Medical Physics Education Programs (www.campep.org). The Canadian medical physics community supports this accreditation process, with the CCPM being an official sponsor organization of CAMPEP (together with the American Association of Physicists in Medicine, the American College of Medical Physics, and the American College of Radiology). Two CCPM members serve on the board of CAMPEP.

IV. COMPETENCY AND EXPERTISE OF MEDICAL PHYSICISTS

Medical physicists have the most detailed knowledge of any profession of all aspects of the radiation therapy treatment preparation and delivery process, including medical imaging, treatment planning, dose calculation, patient immobilization, mechanisms of operation of treatment delivery devices, interactions of radiation with matter, and the biological response of cells and tissues to ionizing radiation. The complex nature of modern radiotherapy requires that the process be overseen by a professional with an understanding of both the big picture and the technical minutia. Medical physicists, with an education that emphasizes fundamental understanding of basic science and problem solving, are ideally suited for this role.

When difficulties arise in radiation therapy, due to complex cases, equipment malfunction or breakdown, computer communications problems, software irregularities, or human errors, medical physicists are available to apply their expertise and problem solving abilities to rectify the situation. Medical physicists are the authoritative technical and scientific resource persons in a radiotherapy program.

Medical physics is an evolving field, and the specific areas of expertise will change with new developments in the basic science and technology of radiotherapy. Currently, radiotherapy medical physicists have expertise in at least the following areas:

A. Equipment Selection

The medical physicist must have current knowledge of developments in equipment for radiation therapy, provide critical assessment of manufacturer's claims, recommend selection of the best equipment to meet program requirements with the available resources, negotiate technical details with manufacturers, and specify equipment performance in purchase documents.

B. Facility Design and Shielding

Modern radiotherapy equipment has complex infrastructure and safety requirements. In siting new equipment, a medical physicist must provide for appropriate electrical power, ventilation, climate control, radiation monitoring, radiation shielding to protect staff and members of the public, safety interlocks, audio and video monitoring of the patient, etc. Designs must be submitted to the appropriate regulatory authorities for approval, and detailed radiation measurements must be made by the medical physicist to verify shielding design and construction.

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Scope of Practice *(Continued from page 11)*

C. Acceptance Testing

Following installation of new radiotherapy equipment, it is the responsibility of the medical physicist to perform a series of tests and measurements to verify that equipment performance meets the requirements of the purchase.

D. Commissioning

Detailed measurements are performed by medical physicists to completely characterize the operation of radiotherapy equipment. Measured data are processed and compiled in a form appropriate to facilitate routine clinical use of the equipment.

E. Treatment Planning Systems

Sophisticated computer systems are used to model the delivery of radiotherapy, in order to accurately predict the dose delivered during treatment and to help optimize the planned treatment. The medical physicist is responsible for understanding the algorithms used by planning systems, investigating and documenting their shortcomings, populating the software with valid data, verifying the accuracy of calculations, training and supervising technical staff using treatment planning systems, performing system administration functions, and integrating computerized planning systems with other computer systems used in radiotherapy, such as imaging and treatment record and verify systems.

F. Imaging

Radiotherapy relies heavily on medical imaging information, for diagnosis, staging and treatment planning of cancer. Computerized tomography (CT), magnetic resonance imaging (MRI), fluoroscopy, film and digital radiography, nuclear medicine, digital subtraction angiography (DSA), Positron Emission Tomography (PET), and other imaging modalities are routinely used. Medical physicists have specific expertise in the physics and technology of these imaging techniques, and ensure their optimal and appropriate use in radiotherapy.

G. Computer Systems and Networking

Modern radiotherapy relies on the transfer of large amounts of information between an assortment of commercial software operating on a variety of hardware platforms, such as treatment planning, record and verify systems, Picture Archiving and Communications Systems (PACS), and custom software written in-house by physicists and programmers. Medical physicists, often working with information systems support personnel, act as system administrators for these systems, ensuring the accurate transfer of data between platforms, and the accurate operation of treatment delivery devices under software control.

H. Absolute Dosimetry

The calibration of radiotherapy equipment and radioactive sources is performed by medical physicists using precise measurement equipment whose calibration can be traced to national measurement standards laboratories. Medical physicists are experts in the measurement of ionizing radiation, and have current knowledge of the latest measurement protocols recommended by standards labs and national medical physics organizations.

I. Quality Assurance

Medical physicists establish and maintain ongoing comprehensive programs of quality assurance on all aspects of radiation therapy planning, treatment delivery and equipment performance. Prior to the start of treatment, a medical physicist normally performs a quality assurance review (a “chart check”) of the planned treatment, with the goal of ensuring the proposed treatment is safe, appropriate and optimal for the patient.

J. Treatment Planning

The technical aspects of treatment planning are under the supervision of medical physicists. Radiation oncologists, dosimetrists and therapists consult with medical physicists daily regarding treatment strategies and details. In addition, complex or unusual cases are often planned directly by the medical physicist.

K. Radiation Safety

The Medical Physicist is responsible for ensuring the radiation safety of staff and patients. In most cancer treatment facilities, a qualified medical physicist acts as the Radiation Safety Officer for the institution. A radiation safety program includes application for and control of all licensing of radiotherapy facilities, establishment and supervision of the personnel dosimetry program, monitoring of radiation levels through surveys and wipe tests, radiotherapy facility design (shielding, isotope storage, etc.), staff radiation safety training, radioactive material inventory control, source acquisition and disposal, assessment of any radiation incidents and communications regarding these incidents with the appropriate regulatory authorities, and assurance that all aspects of license compliance are met.

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L. Technique Development

The methods of radiotherapy are continually evolving with new technical capabilities and better understanding of the treatment of cancer. Development, evaluation and clinical implementation of new techniques in radiotherapy is part of the ongoing work of medical physicists.

M. Radiobiology

The models describing the response of tumours and normal tissues to radiotherapy involve complicated mathematics, and are best understood by physicists, who have training in the biological effects of radiation, as well as statistics and mathematical modeling. Medical physicists are frequently called upon to perform calculations based on these models in order to estimate such things as the dose equivalency of different radiotherapy fractionation schemes and the best way to compensate for interruptions in radiotherapy treatments.

N. Teaching and Research

It is common for medical physicists to be involved in teaching of undergraduate and graduate students in physics and medical physics, radiation oncology residents, and medical radiation therapists. Many medical physicists have academic appointments at universities, hold research grants, present research at scientific or medical conferences, or publish in peer-reviewed scientific journals.

V. ACCOUNTABILITY OF MEDICAL PHYSICISTS

The primary responsibility of the medical physicist is to the patient, to assure the best possible treatment with the available technology, resources, and expertise of the radiation therapy team. Therapeutic doses of ionizing radiation can only be prescribed by an appropriately trained and experienced physician. The responsibility of the medical physicist is to ensure that radiation therapy is delivered in an accurate, safe and effective manner. In fulfilling this responsibility, the medical physicist is accountable to the patient, the physician who has prescribed the treatment, other members of the radiation treatment team, the public, and to regulatory authorities, such as the Canadian Nuclear Safety Commission, who have a legislated mandate to protect the public and the environment from the potentially harmful effects of ionizing radiation. In addition, a certified medical physicist is answerable to the CCPM, which has in its bylaws a mechanism to revoke membership in the College for failure to abide by the COMP/CCPM Code of Ethics (www.medphys.ca/info/reports/ethics.cfm).

The medical physics department of a cancer centre or hospital is normally contained within the radiation therapy program, with medical physicists typically reporting to the head of the physics department, who is also a medical physicist. A common organizational structure has the head of the department reporting to the head of the radiation therapy program for matters relating to clinical service, to the CEO of the cancer centre for radiation safety matters, and to the head of the affiliated university department or to the CEO of the cancer centre for academic matters.

VI. COMMITMENT TO QUALITY ASSURANCE

Quality assurance is extremely important in radiotherapy. The only way to ensure that radiotherapy is actually being delivered as prescribed is through a routine and comprehensive program of detailed physical measurement. Medical physicists are responsible for developing, initiating and maintaining quality assurance programs to ensure that radiotherapy is delivered in a safe and effective manner. The criteria for such QA programs have been defined by medical physicists through organizations such as the Canadian Organization of Medical Physicists, the American Association of Physicists in Medicine, the Canadian Nuclear Safety Commission, and the Ontario Healing Arts Radiation Protection Commission. It is the responsibility of medical physicists to know and understand the requirements and rationale of the QA programs recommended or mandated by these organizations, and to implement and maintain these programs to ensure accurate delivery of radiotherapy, which is safe for the patient, staff, and the public.

VII. MEDICAL PHYSICISTS MITIGATE POTENTIAL RISK

The potential health risks of exposure to ionizing radiation have been well documented, and include tissue damage, carcinogenesis and mutagenesis. The expected benefit of therapeutic administration of ionizing radiation must outweigh the potential risk to the patient, and it is the joint responsibility of the medical physicist and the radiation oncologist to ensure that the estimated benefit/risk ratio is sufficiently large to justify the therapy.

In addition to radiation risks, modern external beam radiotherapy equipment poses potential risks to the patient and staff arising from high-voltage electrical systems, automatic motion of equipment, electromagnetic emissions, and possible exposure to hazardous materials. It is the responsibility of the medical physicist to ensure that these risks are assessed and managed, and that quality assurance programs are in place to verify the accurate and safe functioning of radiotherapy devices.

The use of ionizing radiation for therapeutic purposes also poses potential risks to the staff of health care facilities, and to

(Continued on page 14)

Scope of Practice *(Continued from page 13)*

members of the public. Medical physicists are specifically trained and certified in radiation safety, and are responsible for administering a radiation safety program. This program is mandated by the Canadian Nuclear Safety Commission, and includes facility shielding design and verification, dose monitoring of personnel, wipe testing and inventory control of radioactive sources, and staff education.

VIII. MEDICAL PHYSICS IS EVIDENCE BASED

Medical physicists hold graduate degrees from accredited universities and are trained in the methodology of scientific research. The field of medical physics has evolved through a century of scientific research and development to a level of knowledge which allows radiation therapy to be delivered with impressive accuracy. A medical physics culture of sound research, meticulous attention to detail, open communication of research results at scientific conferences and in peer-reviewed journals, and active participation in national and international associations, has contributed to maintaining radiation therapy on a sound, evidence-based, scientific foundation.

Advances in the field of medical physics are published in peer-reviewed scientific journals such as *Medical Physics* and *Physics in Medicine and Biology* (official scientific journals of COMP and CCPM), the *Intrnational Journal of Radiation Oncology, Biology and Physics* (official scientific journal of the American Society of Therapeutic Radiation Oncology (ASTRO)), and the *Journal of Applied Clinical Medical Physics* (official scientific journal of the American College of Medical Physics). In addition, COMP publishes a quarterly newsletter called *Interactions* (ISSN 1488-6839), aimed at the Canadian medical physics community. These journals, along with participation in conferences such the annual scientific meetings of COMP, AAPM, ASTRO, and regional meetings such as WESCAN and the Atlantic Medical Physics Group, are the primary forums for communication of research results, developments, and new practices in radiotherapy medical physics.

IX. MEDICAL PHYSICISTS' WORKPLACE SETTING AND CULTURE

Canadian radiotherapy medical physicists are employed in one of approximately 37 radiation therapy outpatient treatment centres across the country. In most provinces, these centres are part of a provincial cancer agency and are attached to a host hospital, which is usually a tertiary care teaching hospital. Medical physics departments consist of anywhere from one to 15 medical physicists (staffing standards recommend approximately one medical physicist for every 300 courses of radiotherapy delivered annually), and usually dosimetrists, electronics technologists, physics assistants, mechanical technologists, computer support personnel, secretaries, students, and postdoctoral fellows. One or more medical physicists fulfill the role of department head, with administrative, supervisory and leadership roles. Medical physicists work with members of their department as well as with radiation oncologists, radiologists and other medical specialists, medical radiation therapists, and nurses as part of a team dedicated to providing the best possible therapy for patients.

Medical physicists act in support of the clinical radiation therapy program, with overall responsibility for the technical aspects of treatments and the accuracy of the radiation dose delivered. Development and implementation of new radiotherapy techniques is an important part of the medical physicist's role, and as a result most are involved in programs of research and/or development. It is common for medical physicists to have an academic appointment at a university, either in the Faculty of Medicine, reflecting their role in teaching radiation oncology residents, and/or in a Department of Physics, reflecting their involvement in teaching courses to undergraduate and graduate physics students, and supervision of medical physics graduate students. Other academic duties can include teaching radiation therapy student technologists, supervising radiation therapy student technologist research projects, supervising summer and co-op students, teaching radiation oncology residents and medical physics residents, and providing in-service education to other members of the radiation therapy team. The magnitude of the academic component of a medical physicist's role varies between institutions, but is strongly encouraged through the CCPM recertification process, which awards points for authoring peer-reviewed publications, teaching courses and attending conferences. Participation at scientific conferences is widely recognized as a vital method for communicating research results and keeping abreast of developments in the field.

Medical physicists work in a knowledge-based environment as part of a team whose goal is to provide excellent patient care. The rapidly evolving, high technology nature of modern radiotherapy requires the integration of knowledge in such diverse areas as medicine, physiology, anatomy, radiation physics, patient care, mathematics, statistics, electronics, computer programming and networking, mechanics, anatomy, radiation biology, medical imaging, and radiation safety. While different members of the radiotherapy team are expert in different areas, it is the medical physicist who bridges the gaps between these diverse fields, and provides continuity in the form of basic scientific understanding of the process of radiotherapy, a systematic approach to trouble-shooting and creative problem-solving.

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HAROLD JOHNS TRAVEL AWARD

The Board of the Canadian College of Physicists in Medicine is pleased to honour the Founding President of the College by means of the Harold Johns Travel Award for Young Investigators. This award, which is in the amount of $1500, is made to a College member under the age of 35 who became a member within the previous three years. The award is intended to assist the individual to extend his or her knowledge by traveling to another centre or institution with the intent of gaining further experience in his or her chosen field, or, alternately, to embark on a new field of endeavour in medical physics.

Further information can be obtained from:

BOURSE de VOYAGE HAROLD JOHNS

Le Conseil du Collège Canadien des Physiciens en Médecine est heureux d'honorer son président fondateur en offrant aux jeunes chercheurs la bourse Harold Johns. Cette bourse, d'une valeur de $1500, est éligible aux membres du Collège agés de moins de 35 ans at qui sont membres depuis moins de trois an. La bourse a pour but d'aider le récipiendaire à parfaire ses connaissances dans son domaine ou à démarrer dans un nouveau champ d'activités reliées à la physique médicale, en lui permettant de voyager vers un autre centre spécialisé.

Les demandes seront addressées à:

Dr. Christopher Thompson
The Registrar / Le Resistraire
CCPM
c/o Montreal Neurological Institute
McGill University
3801 University, WB3
Montreal, Quebec, H3A 2B4

The deadline for applications for the next award is **May 1, 2003**. The award will be announced at the 2003 CCPM Annual General Meeting in Edmonton.

La date limite pour les demandes du prochain concours est le **1er mai 2003**. Le récipiendaire de la bourse sera annoncé à la rencontre annuelle de 2003 du CCPM à Edmonton

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Members of the COMP and/or CCPM can make a donation to the fund by volunteering to increase their 2003 membership dues.

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Dynamic Contrast Enhanced Magnetic Resonance Imaging (dMRI):

Verification of Subcellular Contrast Agent Location Using Analytical Electron Microscopy

By Michael D. Noseworthy[1,4,5], Cameron Ackerley[2], Xuiling Qi[3], Graham A. Wright[3,4]

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Introduction

Dynamic MRI involves rapid imaging of a tissue of interest during capillary perfusion of a contrast agent. The agent, or tracer, is typically a low molecular weight chelate of gadolinium (Gd), for example Gd-DTPA (diethylene-triaminepentaacetic acid, Magnevist) and Gd-DTPA-BMA (diethylene-triaminepentaacetic acid bis-methylaminde, Omniscan). The MRI signal in the tissue changes as the bolus enters and leaves. Subsequently the signal changes may be modelled to determine characteristics of the microvasculature such as perfusion, capillary permeability, and local (tissue) blood volume. These parameters have been used to assess, for example, cancer[1,2] and cerebrovascular disease[3,4], both of which involve transformed microvasculature. Application of dMRI permits the non-invasive evaluation of tissue microvasculature *in vivo* [1,5,6,7,8], and due to its simplicity and safety it has grown in popularity.

To accurately model the data from dMRI, a bolus is typically given rapidly at a known injection velocity. The observed signal change in dMRI reflects a complex association of tissue perfusion, microvascular permeability, blood volume, and extravascular volume[5,9]. Many assumptions are made when modelling the data in an attempt to estimate these parameters. Of particular significance is tissue contrast agent location. In brain it is fairly well understood that the contrast agent remains in the vascular space, causing a change in MR signal during transit; the resulting signal returns to baseline as the bolus passes into the draining veins. An intact blood-brain barrier (BBB) does not allow the agent to leak into the extravascular space. In brain tumours, and indeed other tissues where ultrastructural barriers are absent, it is assumed that microvascular leakage plays a highly significant role in sustaining the contrast enhanced signal change, thus preventing the signal from returning to baseline following bolus passage. In some dMRI models the content of tracer in the blood is assumed negligible, simplifying the mathematical model. Change in MRI signal then should reflect permeability between plasma and extravascular spaces. In other circumstances, some investigators have used blood-pool (intravascular) agents, such as ultrasmall iron oxide particles (USPIOs), which are macromolecular complexes assumed too large to get out of the microcirculation into the interstitial space[10]. Whether with small or macromolecular contrast agents, there are numerous imaging and modelling strategies available. However, the methods and results of so many studies are difficult to compare due to the wide variety of existing mathematical models, each having their own assumptions and constraints[5]. Knowledge of the contrast agent subcellular localization would be beneficial for validating the appropriate mathematical model to best suit dMRI. Nevertheless, an accurate understanding of the spatiotemporal distribution kinetics of MRI contrast agents is still not completely available.

Microscopy methods seem the logical choice for understanding contrast agent subcellular localization. Macromolecular contrast agents containing Gd have been histochemically assessed using light microscopy[11]. For example, Van Dijke *et al.* demonstrated via light microscopy post streptavidin staining that even macromolecular contrast agents permeate out of the intravascular space over a period of an hour in a breast cancer model[12]. However, light microscopic methods are not currently able to provide detailed images showing distributions of small chelates of heavy metals such as gadolinium. An electron microscopic technique, energy dispersive X-Ray microanalysis (EDXS), is one method capable of providing such information. There are more sensitive biochemical methods, other than EDXS, for measuring heavy metal content. For example, inductively coupled plasma (ICP) atomic emission spectrometry, polarized X-ray fluorescence excitation analysis (FEA), and HPLC. However, these procedures lack the ability to precisely localize the contrast agent within the tissue architecture[13]. The tissue specimen must be first homogenized, digested, or vaporized, before it can be analyzed by the ICP-AES, FEA, or HPLC instruments.

The transmission electron microscope (TEM) can be used, in combination with EDXS (also called energy dispersive X-Ray spectrometry or microanalysis) to assess the subcellular content and location of heavy metals like gadolinium and iron[13,14,15]. This method analyses the characteristic X-rays that are produced in electron microscopy experiments. Briefly, an electron beam displaces atomic inner shell electrons. Electrons from higher energy shells drop to these now available lower energy states and in the process produce an X-Ray at an energy level characteristic of the atomic species. Higher energy X-rays are more characteristic of higher molecular weight nuclei. The resultant X-ray spectrum can be deconvolved to give information on lower molecular weight (physiologically relevant) nuclei such as Na^+ K^+, Cl^-, and Ca^{2+}. Higher molecular weight species such as Gd produce high energy X-rays that are easily deconvolved from a tissue EDXS spectrum. Where the concentration is high enough elemental distribution maps can even be produced[15]. A previous study has shown the feasibility of combined MRI/EDXS studies[16]. This was done to examine whether Gd-DTPA leaked out of the cerebral vasculature of Guinea pigs with experimental allergic encephalomyelitis, a multiple sclerosis-like disorder that causes breakdown of the BBB. Neither ultrastructural MRI contrast

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agent quantification nor elemental mapping were performed in this study, due to equipment limitations. However, this important study showed the feasibility of combining both methods in the study of microvasculature. With the rapid advances made in MR and EDXS imaging technologies over the last 5 years, the merging of the macro and microscopic technologies is now feasible.

In an experiment to localize the subcellular location of Gd-DTPA, New Zealand white rabbits implanted with vx2 tumor cells[17] were evaluated using a combination of dMRI and analytical electron microscopic methods[18]. Dynamic MRI was performed 21 days following tumor implantation and pixel-wise parametric maps of enhancement slope, time to peak, capillary permeability and perivascular volume were calculated. Biopsies of the hypervascular-hyperpermeable regions of the tumour were rapidly cryopreserved and analysed using EDXS methods to assess subcellular concentrations of Gd.

Methods

In a protocol that was approved by the animal care committee, New Zealand white rabbits (4-5kg) were implanted with ~0.7×10^6 vx2 tumour cells, intramuscularly (biceps femoris)[17]. Dynamic MRI was performed 21 days following implantation. Anaesthetized animals (Ketamine: 50mg/kg, Xylazine: 5 mg/kg, IM) were imaged using a GE Signa 1.5T LX system (General Electric, Milwaukee WI), equipped with 4G/cm gradients capable of slew rates of 150mT/cm/s, and a 3" receive-only surface coil. A T_1 map, modified for spiral k-space acquisition was acquired prior to contrast agent administration[19]. Subsequently dMRI was performed using a T1-weighted SPGR sequence to track IV bolus injection of Gd-DTPA (0.2mM/kg, Magnevist, Berlex). Data was modeled according to Tofts *et al.*[20], employing the pre-contrast T_1-map in the calculations. Pixel-wise analysis using Matlab (v.6.1 , The Mathworks, Natick VA) produced parametric maps of enhancement slope, time to peak, capillary permeability and perivascular volume.

Five minutes following dMRI scanning rapidly acquired biopsies of muscle and tumor were frozen immediately by plunge freezing the tissues into either liquid pentane or ethane, cooled in a liquid nitrogen bath. This method of cryopreservation preserves tissue architecture and minimizes distortion due to ice crystal damage[21,22]. Remaining tissues were fixed in either formalin or glutaraldehyde and processed for either routine light or electron microscopic examination. Ultra-thin cryosections were prepared from some of the tissues which were cryotransferred to the scanning transmission electron microscope and freeze dried prior to quantitative analysis using EDS and Hall's thin film corrections[23]. Portions from all of the frozen tissues were cryofractured and rendered conductive with either aluminium or chromium. They were then examined under a field emission scanning electron microscope (FESEM, Jeol, Peabody, Mass.) at -150ºC using a liquid nitrogen cooled cold stage. Quantitative EDS analyses was performed using $\phi\rho Z$ corrections for bulk specimens[24].

Results and Discussion

dMRI-modelled data demonstrated the tumour tissue as hypervascular and hyperpermeable, relative to surrounding muscle (figure 1). The tumour presented as a ring of hypervascular tissue surrounding a necrotic core. The pixel-wise χ^2 of the model fits was acceptable for tumour rim and surrounding muscle (figure 2).

Histological as well as ultrastructural examination of the tumour revealed filament rich polygonal shaped cells growing in the endomysium surrounding the fibres where the tumour cells had been seeded. A well-established vasculature was also observed. EDS results from the ultra-thin cryosections were comparable to those from the bulk samples.

Using quantitative EDXS, gadolinium was detected in the lumen of blood vessels in both tumor and muscle tissues, as expected, at concentrations similar to that observed in plasma collected prior to euthanasia. Interestingly at 5 minutes post contrast injection, a point when extra and intravascular spaces are theoretically in equilibrium, with respect [Gd], there was a 4 fold larger Gd accumulation in the tumor extravascular space. And, contrary to all reports on the *in vivo* behaviour of small molecular weight Gd based contrast agents, Gd was detected within the endothelial cells lining blood vessels of both tumor and muscle (figure 4). The nature of the intracellular signal was speculated to arise from Gd being transported within vesiculo-vacuolar organelles (VVOs), which are known to transport molecules across vascular endothelial cells between intra- and extravascular spaces, or within transendothelial cell channels[25]. With the existence of an intracellular pool of Gd it is possible, therefore, that current dMRI models could be overestimating blood volume or extravascular (perivascular) volume. There was no significant effect of the cryopreservation technique on cellular integrity, as assessed by EDXS evaluation of other physiologically relevant ions[26]; intra and extracellular concentrations of sodium, potassium, chloride ions, and calcium were all within physiologically relevant ranges.

Summary & Conclusions

To date we have only evaluated one time point post-Gd injection (5 minutes). We are currently evaluating serially acquired biopsies with EDXS. In addition non-ionic contrast media (e.g. Gadodiamide) are being assessed to determine whether chelate charge has an important role in these results. However, other difficult factors still complicate dMRI modelling. For example errors in estimating proton exchange between vascular/extravascular compartments may lead to as much as 10% inaccuracy in dMRI modelling[27]. Also, there has been recent evidence of relaxivity dependence on protein concentration[28]. Gd relaxivity is assumed constant in the dMRI modelling. Overall it may be easier to model dynamic CT data which does not have these complications. However, CT contrast agent subcellular localization should also be assessed with EDXS.

It is suggested that these findings may have profound implications in the modelling of contrast enhanced MRI data, especially when using small molecular weight Gd based agents.

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 Figures 1 and 2—next page

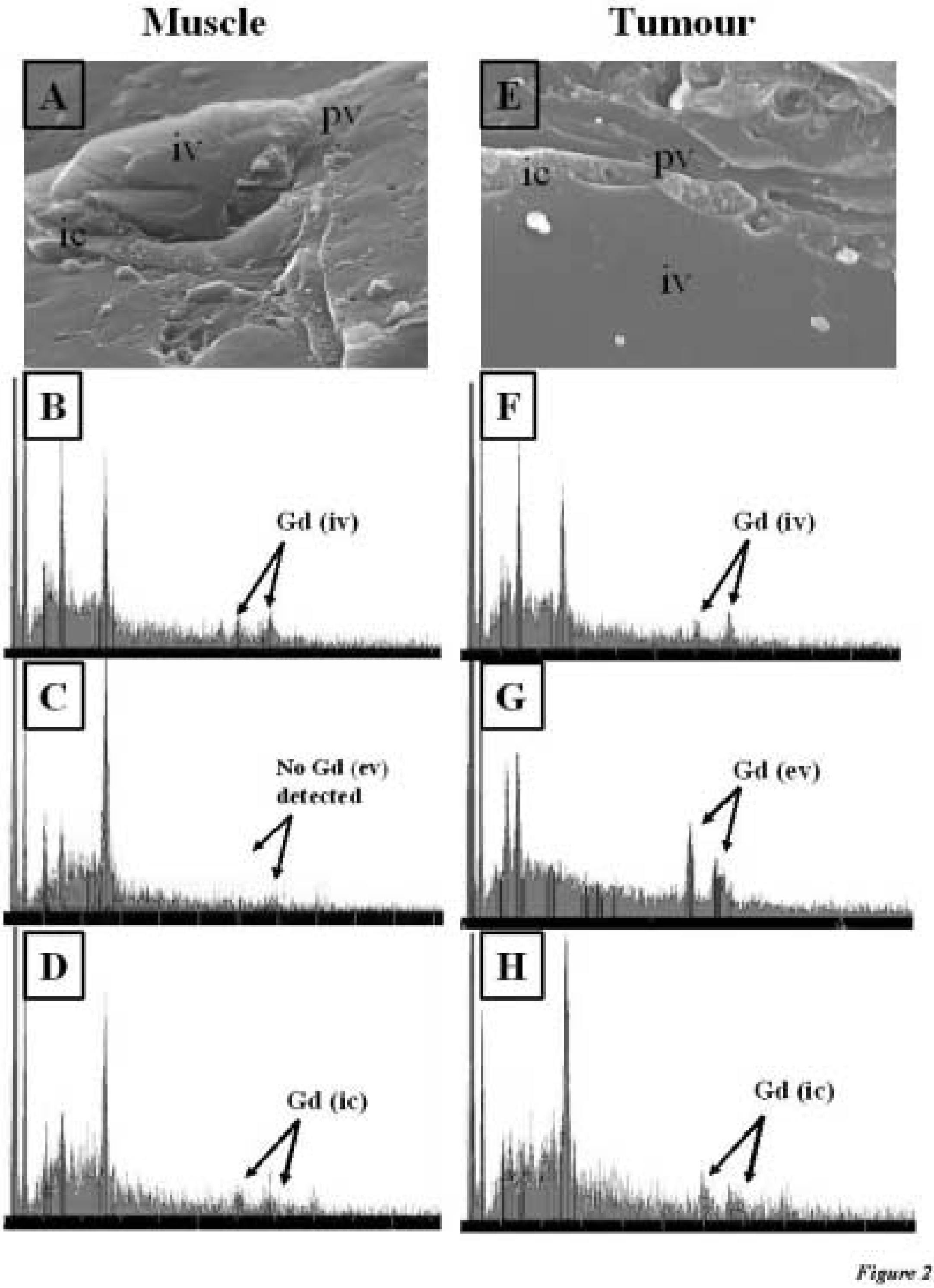

Figure 3. Cryofractured sections of normal thigh muscle blood vessel (A), and tumour blood vessel (E). Vascular endothelial cells showing inside endothelial cell (ic), perivascular space (pv), and intravascular space (iv) are visible. In both muscle and tumour, EDXS spectra demonstrate presence of Gd in the intravascular space (B=muscle, F=tumour). The Gd contrast was found in the perivascular space of tumour tissue (G) but was not detected in the perivascular space of resting muscle (C). The EDXS method also detected Gd within the vascular endothelial cells of both muscle (D) and tumour (H) vasculature.

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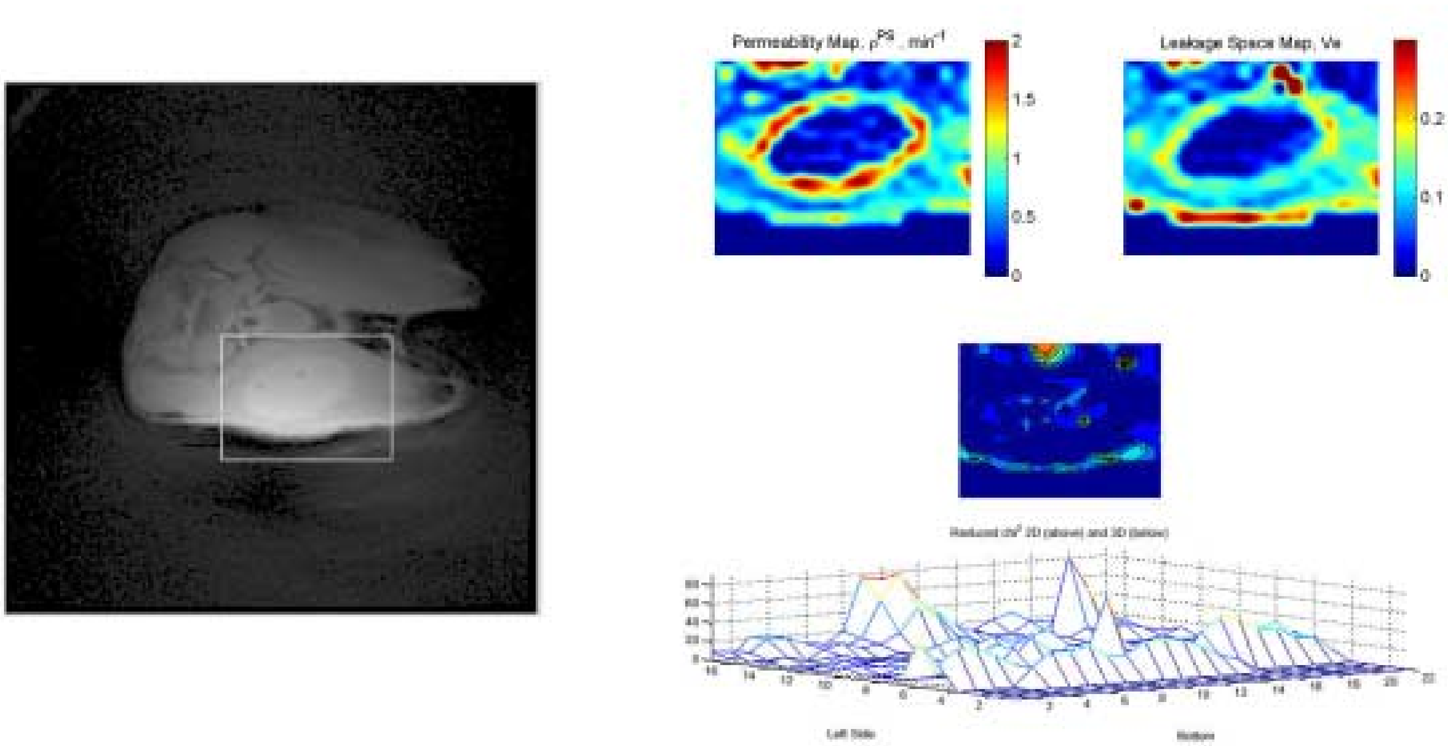

Figure 1. Dynamic MRI parametric mapping of vx2 tumour tissue following a bolus injection of Gd. The T1-weighted image on the left shows the ROI used in parametric analysis. Parametric maps of modeled microvascular permeability ($k^{PS\rho}$) and leakage space (v_E) demonstrate the hypervascular-hyperpermeable nature of the tumour rim. The χ^2 map shows the model to be acceptable in this hypervascular region. Biopsies from the tumour rim were frozen with cryopreservative, freeze fractured, and subsequently analyzed using energy dispersive X-ray microanalysis (EDXS).

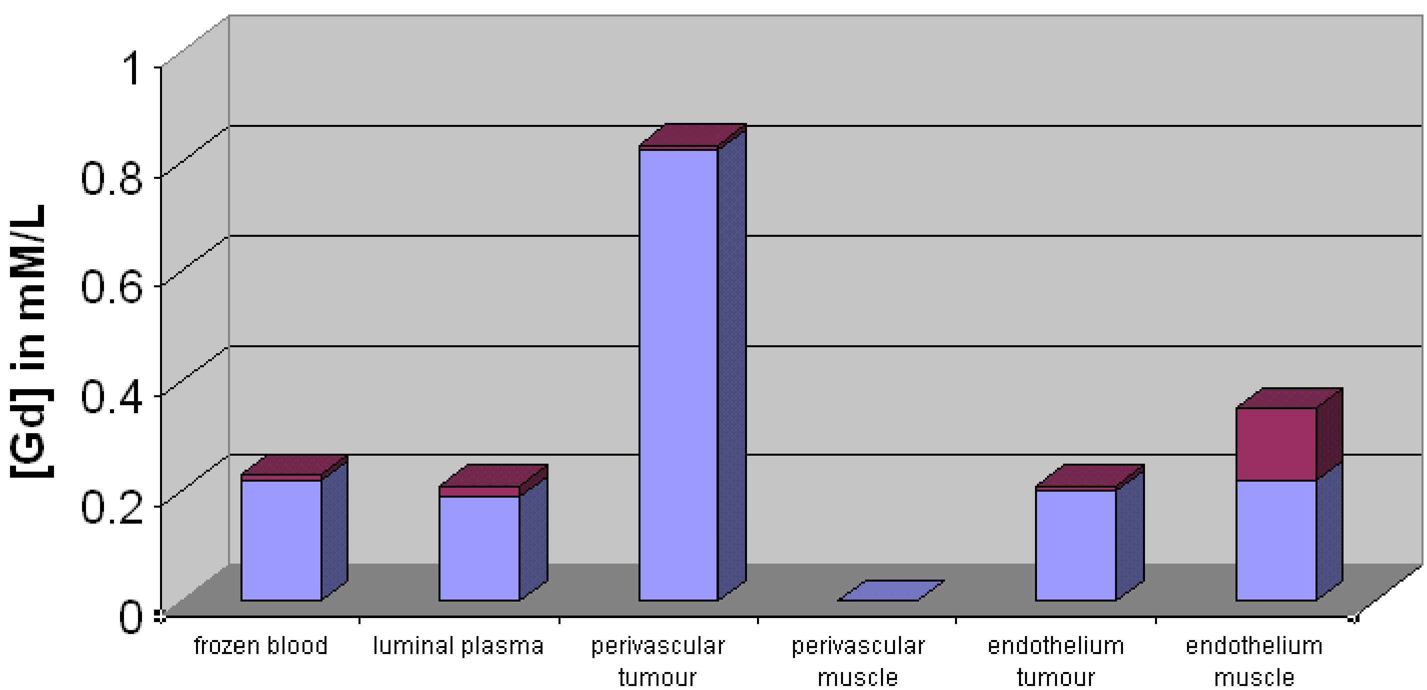

Figure 2. Histogram showing concentrations of gadolinium, as obtained by EDXS, at 5 minutes post intravenous injection.

Canadian Light Source Users Meeting

Saskatoon, November 2002

By Paul Johns
Carleton University

In November I attended the annual meeting of prospective users of Canada's first synchrotron, now under construction on the campus of the University of Saskatchewan in Saskatoon. The first radiation from this $173M machine is anticipated in mid 2003 but in fact this was the *fifth* such annual meeting! The attendance exceeded 300. There are many Canadian scientists - chemists, biologists, and physicists - currently doing work at synchrotrons throughout the world who would like to transfer their projects to Canada.

The Canadian Light Source (CLS) subsumes the old Sasktatchewan Accelerator Lab on the U Sask campus. The original 250 MeV accelerator is used to provide electrons to a new booster ring which accelerates them to 2.9 GeV after which they are transferred to the storage ring. The storage ring will hold up to 204 "buckets" of electrons, equivalent in total to a time-averaged circulating current of 500 mA. The storage ring has circumference 170.9 m, and 12 straight sections. On three of these are located transfer from the booster ring, the RF cavity, and diagnostics. Synchrotron radiation can be generated by insertion devices (ID's)(undulators or wigglers) placed on the straight sections which produce radiation for their corresponding beamlines which extend tangentially outwards from the storage ring. Synchrotron radiation can also be produced from the bend magnets. Ultimately a total of about 30 beamlines could be put on the machine. Initially, 7 beamlines are being constructed and the radiation from the first of these should commence mid-2003. There are proposals for several more beamlines in Phase II, including one for biomedical imaging and novel cancer therapies.

On Friday November 15 four workshops were held in parallel: Materials Science with Synchrotron Radiation, Synchrotron Applications to Environmental and Industrial Science, Applications of Synchrotron Radiation in the Biological / Life Sciences (which I attended), and High Heat Load and Novel X-Ray Optics. In the Biological / Life Sciences workshop, the highlight for me was the talk by Stephen Wilkins of CSIRO Australia on phase-contrast imaging and phase/amplitude retrieval using x rays. This overview talk showed that while x-ray imaging technology since 1895 has been exclusively based on straight-line propagation, there are subtle refraction effects that can also be exploited to yield enhanced visibility of interfaces. Essentially, the wave optic aspects of x rays can also be used for imaging, just as they are for visible light and other electromagnetic radiation. Although these effects are most easily demonstrated with synchrotron radiation, they are also possible with a microfocus x-ray tube (10-20 µm focal spot).

On Saturday 16 November the Users' Meeting itself was held. It opened with an introduction to Bill Thomlinson, the new CEO of the CLS, who had started onsite just a couple of weeks before. He was previously the head of the biomedical group at the European Synchrotron Research Facility (ESRF), Grenoble. There were then talks on the status of the machine, and research talks on applications to biology, materials science such as high T_c superconductors, and to industry e.g. Dow Chemical analysis of polymer films. In addition, a total of 49 posters were shown.

Looking at the science, it struck me that most of the chemists and biologists use synchrotron radiation in a fairly non-quantitative way, basically looking for signatures of different materials in images or in spectra. Often they are satisfied just to know if something "is there", or "is not there". Physicists tend to quantify what they have found, and demand to know about systematic errors and the like.

On Sunday, specialized meetings were held for several beamlines. At the BioMedical Imaging meeting, it was announced that a CFI proposal for this beamline will go forward in the next round. There is intent to recruit a senior scientist to a U Sask CRC Tier 1 position to lead this effort. For the interim, Dr. Gregg Adams, of U Sask Veterinary Biomedical Sciences, will be the team leader. Colleen Christensen, who is on contract with Saskatchewan District Health, will continue as Beam Team Manager. Medical physicists interested in collaborating on this effort should review the website information and contact Colleen or Gregg. Do it sooner rather than later! Plus, there are other beamlines capable of making photons of relevant energies: the protein crystallography beamline should generate x rays up to 18 keV, and the XAFS beamline to 40 keV.

Overall, my impression is that synchrotron radiation, while still "way out there" as far as clinical relevance, can provide a very useful testbed for new ideas with x rays that could then be implemented more practically with more common equipment. It's worth exploring.

Saskatoon is also the birthplace of ^{60}Co radiation treatment in Canada. I was able to visit the Saskatoon Cancer Centre the day before the CLS activities. There is a 1952 ^{60}Co treatment unit on display in a waiting area (for some reason, it has been hung from the ceiling for display), a plaque outside commemorating the 50th anniversary of Cobalt treatment in Canada [see Interactions **47**, 118 (2001)], and in the cancer clinic library, which is named after Harold E. Johns, a collection of Harold Johns' papers from the era. It was of great interest. Thanks to physicists Narinder Sidhu, Pat Cadman, their assistant Tracey Sanche, and the rest of their department for the hospitality.

Web links for more information:
- General CLS Site:
  - www.lightsource.ca
- Report on Annual Users Meeting 2002:
  - www.lightsource.ca/uac/cls-um5-rep.pdf
- Biomedical Beamline Proposal:
  - www.lightsource.ca/bioimaging

Update from CAMPEP

- Congratulations to Gino Fallone and his colleagues for gaining CAMPEP accreditation for the Graduate Education Program at the University of Alberta, effective 1 December 2002. This program becomes the second in Canada to gain this distinction, a mere 10 years behind McGill where the Medical Physics graduate program was first accredited by CAMPEP in 1993.

- CAMPEP is renovating the process for application of Continuing Education Credits. There will shortly be an all electronic application facility on a newly designed website. This promises to streamline applications from program directors, a process which has historically been cumbersome and time consuming. The new software is scheduled to be available in time for this year's application by COMP for the summer meeting.

Respectfully submitted by your CAMPEP representatives: Brenda Clark and Peter Dunscombe. Please feel free to contact either one of us if you have any questions or suggestions regarding accreditation of programs through this organisation.

Virtual Radiation Museum

I hope that some members of COMP will be interested in the "new born" web page Virtual Radiation Museum" at http://www.medphysics.wisc.edu/~vrm. I am seeking suggestions for improving it. I expect that it will have a more easily remembered URL but at the moment it pops up early on the Google search engine if you use "radiation museum". We especially want appropriate URLs to link to. I hope next year we can start a sister "virtual museum of medical physics". Eventually we want to have many virtual museums which can be gathered into the Virtual Science Museum.

John Cameron

COMP Chair *(Continued from page 4)*

simply want more information, to contact a member of the Executive.

I am happy to report that our Executive Director, Michael Henry, has accepted to renew his contract with COMP and CCPM for 2003. Michael always brings a different perspective, and rather refreshing I must say, to our discussions. Thank you Michael, we are very happy to have you with us.

Finally, in my first message, I had asked readers to e-mail me just to see how many had read my message. Well, I got 16 replies! I hope this isn't an indication of how many readers actually read Interactions but rather that many were just too busy to bother e-mailing me. As always, I would be very happy to receive your thoughts on any of the issues facing our profession. My best wishes to all of you for 2003. May the new year bring you happiness, joy, ... and new equipment and more staff!!

CCPM President *(Continued from page 5)*

ficient for appointment as a Radiation Protection Officer. Clearly we are in support of this initiative.

By the time that you read this message, your membership renewal fee should have been paid, together with any donations you may care to include towards the ***Harold E. Johns Travel Fund***. This fund has been established to assist young (under the age of 35 years) College Members to gain further knowledge during the first years of their career by traveling to another centre or institution. Not only do I encourage your donation to this worthy cause, I also encourage applications from appropriately aged College Members. For the last 3 years, there have been no applications for this award. Surely there is a young College Member somewhere in Canada who would like to take advantage of this offer?

Brenda Clark

Canadian College of Physicists in Medicine Examination Schedule 2003

Membership Examination:

Applications due: 10 January 2003
Examination date: 15 March 2003
Fee: $150.00

Decisions will be announced on February 7

Fellowship Examination:

Applications due: 11 April 2003
Examination date: 4-June 2003
Fee: $200.00 (in Edmonton)

Decisions announced on May 6. (or later for those who do the membership exam)

Note: The application forms, exam study guide, and sample exams are available on the COMP web site under the heading "Certification with CCPM". All new candidates for membership and fellowship must use the new (dated 2003) application forms.

For further information contact the Registrar:

Dr. Christopher Thompson. Registrar, CCPM
Montreal Neurological Institute. # 798
3801 University St.
Montreal, Quebec, H3A 2B4

Christopher.Thompson@McGill.Ca

Scope of Practice *(Continued from page 14)*

X. LEGAL LIABILITY AND INSURANCE IN MEDICAL PHYSICS

Despite rigorous quality assurance and multiple independent checks, given the complex nature of modern radiotherapy, misadministrations of therapy can occasionally occur. Upon assuming responsibility for the accuracy of the radiation dose delivered, medical physicists place themselves in a position of potential liability should an error in treatment occur. As employees of cancer centres, medical physicists performing within the scope of their employment and acting in the interests of their employers have a reasonable expectation of being shielded from liability by their employer. Any medical physicist who acts as a private consultant or who is self-employed should carry liability insurance to guard against the unlikely event that a misadministration in radiation therapy leads to legal action against the physicist. An Errors and Omissions Liability Insurance plan for clinical medical physicists is offered through the Canadian Organization of Medical Physicists.

XI. REGULATION OF MEDICAL PHYSICISTS

Medical Physics is currently an unregulated profession in Canada, that is, there is no federal or provincial legislation which defines the term "medical physicist" or restricts its use to persons with particular qualifications. Medical physicists are not covered by the regulated health professions act of any province, and are not specifically mentioned in the federal Nuclear Safety and Control Act or its regulations. Efforts on the part of the Canadian medical physics community to achieve regulatory status and recognition have been hampered by the small number of medical physicists in Canada. In the United States, New York, Florida and Texas are in the process of or already have enacted licensure for medical physicists. In these states, legislation defines the practice of medical physics, restricts that practice to licensed physicists, and establishes the qualifications necessary for obtaining a licence. Canadian medical physicists intend to pursue similar legislated licensure in the years to come.

Errors and Omissions Liability Insurance

COMP is pleased to announce the launching of an Errors and Omissions Liability Insurance Program – exclusive to COMP members.

Together with our selected insurance broker, Aon Reed Stenhouse Inc., Ottawa, COMP is pleased to provide a competitive, broad policy for errors and omissions liability protection for individual members of COMP. The options that will be available are as follows:

EMPLOYED PHYSICISTS

PER CLAIM LIMIT	AGGREGATE LIMIT	DEDUCTIBLE	*ANNUAL COST
$ 500,000.00	$1,000,000.00	NIL	$ 600.00
$1,000,000.00	$2,000,000.00	NIL	$ 725.00
$2,000,000.00	$4,000,000.00	NIL	$ 880.00

CONSULTING PHYSICIST

PER CLAIM LIMIT	AGGREGATE LIMIT	DEDUCTIBLE	*ANNUAL COST
$ 500,000.00	$1,000,000.00	NIL	$ 860.00
$1,000,000.00	$2,000,000.00	NIL	$ 1,050.00
$2,000,000.00	$4,000,000.00	NIL	$ 1,290.00

**Annual cost includes all fees and commission. (Taxes are in addition: 8% ON, 9% QUE, 15%NFLD).*

The policy is a claims made policy which will respond to claims made and reported within the policy year. A special feature has been added which will include ALL prior acts which you are not aware but may cause a claim during the policy period. The territorial limits are within Canada.

To Apply For Coverage – simply complete a specific COMP/Aon application (which will be forthcoming to each member) and is also available at www.medphys.ca. Payment must be received with the application (Visa/MasterCard or cheque). Coverage will commence February 1, 2002. If you purchase coverage between February 1st and July 31st, the full annual cost is applicable. If you purchase coverage between August 1 and January 31st, ½ the annual cost is applicable. All applications and payments must be forwarded to Aon Reed Stenhouse Inc., 710-1525 Carling Avenue, Ottawa, ON K1Z 8R9, 1-800-267-9364 or you can contact Mary-Ann Hamel, Vice President, mary.ann.hamel@aon.ca

Be on the lookout – an official announcement and correspondence will be mailed to you later this month!

Dave Wilkins

Book Review

Intravascular Brachytherapy / Fluoroscopically Guided Interventions – AAPM Monograph 28

Editors: Stephen Balter, Rosanna C. Chan, Thomas B. Shope, Jr.

Review by: Horacio J. Patrocinio
McGill University Health Centre
Montreal, Quebec

The organizers of the 2002 AAPM Summer School had the difficult task of combining two loosely related subjects in to a single venue: intravascular brachytherapy (IVBT), generally of greater interest to therapy physicists, and fluoroscopically guided interventional radiology, a diagnostic topic. The result was a summer school schedule with joint sessions for the first half of the lectures, followed by separate sessions specializing in either subject. AAPM monograph No. 28, the proceedings from the summer school, reflects this arrangement, with common topics covered first and followed by separate discussions of both areas.

The book begins with a well-written introduction summarizing the issues affecting both disciplines. Radiation biology for both IVBT and interventional radiology is then discussed followed by a review of quantitative methods in coronary angiography and intravascular ultrasound. An interesting chapter follows on the unresolved issues surrounding IVBT including late thrombosis and the edge effect. Two chapters are devoted to a thorough review of clinical techniques for interventional cardiology and interventional radiology and an additional two deal with radiation safety, separately covering issues related to staff and patient protection. The final chapters of the joint sessions address regulatory issues, and although these deal exclusively with US regulations, some of the issues raised may be applicable in Canada as well.

The subject then shifts to IVBT with chapters dedicated to the physics of radioisotope production and photon and electron emitters used in IVBT devices. Dosimetry of IVBT sources is discussed in three chapters, the first dedicated to measurements and the TG 43/60 protocol formalism, the second to Monte Carlo modeling and the third to source calibration. Operational IVBT programs are reviewed along with radiation safety issues, and treatment planning is addressed in a separate chapter. Quality management and the role of the physicist in an IVBT program round up the subjects covered. The final third of the book discusses fluoroscopically guided interventions. Imaging detectors, image display systems and picture archiving systems are first described. Skin exposure estimation and pediatric interventional radiology are then addressed in dedicated chapters. The final chapters of the book discuss purchasing and acceptance testing of interventional radiology equipment, training of personnel and accrediting of programs.

Overall, this is an information rich monograph, with many areas covered in great detail. It serves as an excellent

News from McGill

During November this year, 8 members of the McGill Medical Physics group attended an 8 hour CPR course held at the Montreal General Hospital. The course covered the basic Heimlich and CPR procedures for infants, children and adults and followed a didactic and practical training program.

The day long event included practice on both ourselves and dummies (... I know ... sometimes hard to tell the difference...). As with any education, one only realizes how much we don't know when we begin to learn, and we certainly hope this training will not have to be put into actual use.

The rational for holding this course was that we as medical physicists are often in the clinical setting near patients with various degrees of illness. However most of us have no formal medical training despite our daily proximity to patients in potential distress.

We felt that this course gave us some confidence to at least recognise signs of distress and initiate the minimum help possible while obtaining professional medical assistance. The course was attended by Ervin Podgorsak, Marina Olivares, William Parker, Horacio Patrocinio, Cenzetta Procaccini, Pierre Leger, Vlad Bobes and Michael Evans. As an aside it is also of interest to note that William Parker and Horacio Patrocinio recently became licensed pilots and are eager to take visitors to Montreal on short flights around the city!

Michael Evans,
McGill University Health Center-MGH

CAMPEP Accreditation
MSc and PhD Program in Medical Physics
Cross Cancer Institute, University of Alberta, Edmonton, AB

I am happy to announce that the MSc and PhD programs in Medical Physics of the University of Alberta, Edmonton have achieved accreditation from the Commission on Accreditation of Medical Physics Education Programs, Inc (CAMPEP) as of Dec. 1 2002 for the next five years. The Program is centered at the Cross Cancer Institute in Edmonton.

This program is a cross faculty one involving the Department of Physics, Faculty of Science and the Department of Oncology, Faculty of Medicine and Dentistry at the University of Alberta. The students are registered and obtain their degrees from the Department of Physics, and must thus satisfy all requirements from that department. The courses are however, listed in the Faculty of Medicine with the great majority of instructors having primary appointments in that Faculty. The facilities and the funding support for graduate students through scholarships, teaching and research assistantships are excellent. The University offers a very comprehensive program in the medical physics of radiation therapy, diagnostic imaging (radiology, nuclear medicine, ultrasound, MRI), health physics and radiation biophysics. The Program is well-equipped to develop experimental work in these fields by relying on the clinical and experimental equipment available within its jurisdiction: linear accelerators, treatment simulators, dynamic MLC, forward and inverse treatment planning systems, portal imaging devices, CT simulators, dose measuring equipment, radiographic and fluoroscopic equipment, gamma and SPECT cameras, PET cameras, cyclotron, high and ultra-high MRI/MRS systems, CT, image analysis systems, electronic shops, machine shops, health physics measuring devices, and radiation calibration devices. The programs involve a large didactic course component followed by a research project in medical physics. For further information, please link to our website: med.phys.ualberta.ca.

B. Gino Fallone, Program Director.

Cloning Experiments at KRCC

The Kingston Regional Cancer Centre is pleased to report that recent cloning experiments by Dr Andrew Kerr have been successful. The results of these experiments are expected to provide a unique Canadian solution to the worldwide shortfall of medical physicists.

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Contact: Ms. Mairi Miller
mmiller@thomson-elec.com

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Fax: (650) 493-5637
website: www.varian.com
Contact: Ms. Jan Roth
JRoth@os.varian.com

McMaster University

Medical Physics & Applied Radiation Sciences - Tenure-Track Appointment

McMaster University invites applications for a tenure-track appointment in the Unit for Medical Physics and Applied Radiation Sciences in the Faculty of Science. The position is targeted to begin on 1st July, 2003. Candidates should possess a PhD and have demonstrated both an excellent research record and an aptitude to teach. The ideal candidate will be able to teach in the area of the fundamentals of radiation physics, with particular emphasis on radiation transport and radiation dosimetry. She/he would be expected to contribute particularly to graduate and undergraduate programmes in Medical Physics and Health Physics through teaching, attracting research funding and mentoring research students.

The successful candidate's research is expected to draw strength from facilities, personnel and colleagues associated with the McMaster Institute of Applied Radiation Sciences. Applicants should describe how they would expect their research to prosper at McMaster, taking into account existing research strengths and opportunities. Several faculty members of the Unit for Medical Physics & Applied Radiation Sciences are appointed to the local cancer centre or hospitals. There are extensive opportunities for collaboration with these colleagues and such collaboration will be welcomed.

Extensive recent investment in research infrastructure in applied radiation sciences has created a platform on which to build research, particularly with a focus on biomedical applications. Existing research fields include photon and electron dosimetry, physical techniques for body composition studies, the role of DNA damage and repair processes in carcinogenesis and tumour cell response to therapies, using molecular cytogenetics to study human health risks of low doses of ionizing radiation, the cellular and molecular basis of photodynamic therapy, radiation geochronology, novel methods of imaging bone and joint structure, and structural and functional imaging in neurosciences. A more complete description can be found at www.science.mcmaster.ca/medphys/

All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be considered first for this position. McMaster University is strongly committed to employment equity within its community and to recruiting a diverse faculty and staff. The University encourages applications from all qualified candidates, including women, members of visible minorities, Aboriginal persons, members of sexual minorities and persons with disabilities.

Applications, including a statement of research interests and teaching philosophy, together with letters from three referees should be sent by February 14th, 2003 to:

Unit for Medical Physics and Applied Radiation Sciences
NRB-124, McMaster University
1280 Main Street West
Hamilton, Ontario, L8S 4K1, Canada.
Tel (1) 905 525 9140 ext 27650
FAX (1) 905 528 4339
contact e-mail: malarek@mcmaster.ca.

Mayo Clinic/Foundation

Clinical Medical Physicists in Radiation Oncology

LOCATION: Mayo Clinic/Foundation
Rochester, Minnesota

CONTACT: Michael G. Herman, Ph.D.
Vice Chairman and Physics Section Head
Division of Radiation Oncology
Mayo Clinic/Foundation
200 First Street SW
Rochester, MN 55905
(507) 284-7763 – email:herman.michael@mayo.edu

POSITION: Clinical Medical Physicists in Radiation Oncology

We are seeking applicants for Clinical Medical Physicist positions in the Division of Radiation Oncology at Mayo Clinic in Rochester, Minnesota and LaCrosse, Wisconsin. Successful candidates will join a staff of 17 radiation oncologists, 4 faculty and 8 clinical physicists, 2 IS development and support persons, 9 dosimetrists and 30+ registered therapists. Equipment includes 10 Varian Clinac 2100C and 2100EX linear accelerators, a Leksell Gamma Knife, Orthovoltage, 4 Varian simulators, an AcQsim CT simulator, Theraplan Plus, Eclipse, Helios and Brainlab planning computers, Nucletron HDR afterloading system, conventional brachytherapy, electronic portal imaging devices and a multiple water, film and chamber-based dosimetry systems.

The physics section is a cohesive group that works as a team responsible for all aspects of therapy physics in support of external beam and brachytherapy treatment in addition to special procedures (IMRT, IORT (electrons and HDR), TBI, TSET, Hyperthermia, HDR, Stereotactic Radiotherapy, Gamma Knife Radiosurgery, intravascular brachytherapy and prostate implants) in Rochester and at satellite facilities (within 90 miles). Active participation is encouraged in developmental projects, meeting presentations and teaching in the radiation therapist and medical physics residency programs. A multi-year linac replacement program is under way and a dedicated brachytherapy suite is being built.

Minimum qualifications include a Master's degree in medical physics or a Master's degree in physics with 3 or more years of clinical experience in radiation oncology and board certification. Successful candidates are expected to function independently with excellent oral and written communication skills. Experience with any of the special procedures listed would be beneficial.

Interested applicants should submit a letter of interest and a resume outlining their training and experience. References will need to be made available at the time of an in-person interview. Mayo Foundation is an equal opportunity/affirmative action employer/educator. Mayo offers an outstanding competitive benefits package. Please review our benefits by visiting our web site at www.mayoclinic.org. Mayo values family time and supports a favorable working environment. Rochester is a city of 90,000 located in southeast Minnesota, about 1 hour from Minneapolis-St. Paul. Rochester has recently been ranked by Money Magazine as one of the best places to live in the nation.

L'Institut national de santé publique du Québec a pour mission de soutenir le ministre de la Santé et des Services sociaux et les régies régionales instituées en vertu de Loi sur les services de santé et les services sociaux dans l'exercice de leur mission de santé publique.

De façon plus particulière, le Laboratoire de santé publique du Québec offre aux laboratoires hospitaliers, aux directions de santé publique et au ministère de la Santé et des Services sociaux une expertise et des services de référence en microbiologie, physicochimie et en radioprotection.

AFFICHAGE 2002-20

L'INSPQ désire combler un poste de professionnel(le) à titre de
PHYSICIEN
pour son laboratoire de Sainte-Anne-de-Bellevue (LSPQ)

Poste permanent temps complet

.
Attributions : Sous l'autorité de la directrice adjointe, le candidat choisi sera appeler à contrôler, coordonner et évaluer les activités du programme de radioprotection chez les professionnels de la santé, notamment selon les exigences des lois, règlements et normes de juridiction provinciale, afin d'assurer la sécurité des opérateurs, des usagers et de la population contre des radiations ionisantes.

Lieu de travail : 20045, chemin Sainte-Marie, Sainte-Anne-de-Bellevue (Montréal)

Exigences : Le candidat sera détenteur d'une maîtrise en sciences physiques avec expérience minimale de deux (2) ans dans un domaine approprié.

Rémunération et conditions de travail : Selon les normes applicables à l'INSPQ.

Inscription : Les personnes intéressées devront faire parvenir leur curriculum vitae avant le 13 janvier 2003.

CONCOURS 2002-20
Direction des ressources humaines et informationnelles
Institut national de santé publique du Québec
945, avenue Wolfe, 3e étage
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Télécopieur : (418) 654-3649
Courriel : **drhi@inspq.qc.ca**

N.B. L'INSPQ remercie tous les candidats et toutes les candidates de leur intérêt mais ne communiquera qu'avec les personnes retenues

TENURE TRACK POSITION IN MEDICAL PHYSICS

Department of Physics and Astronomy
University of Victoria

The Department of Physics and Astronomy at the University of Victoria invites applications for a tenure-track position at the rank of Assistant Professor or junior Associate Professor. We are looking for someone who will initiate an experimental program in the area of Medical Physics. Applicants are expected to possess an exceptionally strong and internationally recognized research record and outstanding promise for future research accomplishments. The successful candidate will have a commitment to graduate and undergraduate education, and will help to oversee our graduate program in Medical Physics. His or her work will be conducted in association with the staff of the BC Cancer Agency's Vancouver Island Centre (VIC), a state-of-the-art radiation therapy clinic; hence, the appointment must also be acceptable to the VIC. Involvement with the VIC will initially include some teaching and administrative relief.

At present, the Department of Physics and Astronomy consists of approximately 17 faculty members working primarily in the research areas of particle physics, astronomy/astrophysics, thin-film magnetic spin properties, and ocean physics. The department has a successful and productive association with the near-by TRIUMF laboratory, whose applied programs include PET, medical isotope production, and proton irradiation therapy. See http://www.phys.uvic.ca for further information.

The University of Victoria is an equity employer and encourages applications from women, persons with disabilities, visible minorities, aboriginal peoples, people of all sexual orientations and genders, and others who may contribute to the further diversification of the University. All qualified candidates are encouraged to apply; however, in accordance with Canadian Immigration requirements, Canadians and permanent residents will be given priority.

Applications, including a curriculum vitae, publication list, statement of present and future research interests, and the names and addresses of at least three referees, should be sent to: **Charles Picciotto, Chair, Department of Physics and Astronomy, University of Victoria, P.O. Box 3055 Stn Csc, Victoria, BC V8W 3P6, Canada**

Applications will be reviewed as they are received and the search will continue until the position is filled. Initial starting date is expected to be July 1st., 2003.

Jennifer Duggan, Secretary to the Dean of Science
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RYERSON UNIVERSITY

Canada's leading university for applied education with over 40 career-oriented undergraduate and graduate programs, distinguished by their relevant curriculum and applied research, scholarly and creative activities. Canada's largest Continuing Education Division, offering courses and certificates for personal and professional development.

Tenure-track Appointments in Physics

Ryerson University invites applications for two tenure-track appointments in Physics with the Department of Mathematics, Physics and Computer Science in the Faculty of Engineering and Applied Science. These positions are subject to budgetary approval. Candidates should possess a Ph.D. in Physics, have a demonstrated research record in Medical Physics or related areas, and have a strong commitment to undergraduate teaching. The successful candidates are expected to attract external research funding and contribute to the development of new undergraduate and graduate programs in Medical Physics/Biomedical Engineering. The positions are targeted to begin on July 1, 2003.

The successful candidates will join a dynamic team of four medical physicists undertaking research in laser/ultrasound thermal therapy, photodynamic therapy, ultrasound biomicroscopy, prostate brachytherapy and trace element detection in bone. Since 1998, this team has attracted over $2.5 million in research funding from agencies including the Natural Sciences and Engineering Research Council, National Cancer Institute of Canada, Canadian Institutes of Health Research, Canada Foundation for Innovation, Photonics Research Ontario and Whitaker Foundation. A number of faculty members are appointed to local cancer centres and there exist opportunities to collaborate with these colleagues.

Salary is dependent on qualifications and rank of appointment, in accordance with the Ryerson Collective Agreement. Interested applicants should submit a curriculum vitae, a statement of current and future research interests and the names of three references to: Professor Alain Lan, Acting Chair, Department of Mathematics, Physics and Computer Science, Ryerson University, 350 Victoria Street, Toronto, Ontario, M5B 2K3.

Ryerson University has an employment equity program and encourages applications from all qualified individuals, including Aboriginal peoples, persons with disabilities, members of visible minorities and women. Members of designated groups are encouraged to self-identify. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

RADIATION THERAPY PHYSICIST

Long Island Jewish Medical Center
New Hyde Park, New York

Position available immediately. The Department of Radiation Oncology has active programs in 3D-CRT and IMRT, stereotactic radiosurgery and TBI. Brachytherapy techniques include prostate implants, LDR and HDR remote afterloading, and IVBT.

Major Equipment includes an R/F and a CT Simulator, four linacs with d-MLC and Portal Vision, Nucletron HDR and LDR systems. RTP systems with image fusion, 3D and Inverse Planning capabilities and a network for imaging, and Record and Verification are also in place.

This position involves shared duties in all modalities, QA, Dosimetry, special procedures, acceptance and commissioning of systems and support of the departmental activities and requires an earnest team approach.

The Physics section plays a major role in the department, with excellent interdisciplinary working relationships. Intense interaction with other sections and departments requires excellent verbal communication and written documentation skills. The dynamic environment presents many stimuli and opportunities for professional growth.

Graduation from an Accredited Medical Physics program and a Post-Doc/Medical Physics residency or ABMP/ABR certification is desired. A graduate degree in Physics and On-the-job training in Radiation Oncology Physics by a Certified Medical Physicist will be considered. Hands-on familiarity with all advanced image based treatment planning, and computer applications is required use of dosimetry instrumentation and analytical tools are necessary.

LIJ Medical Center is located in a residential area on the border of NY City and Nassau County, with easy access to outdoor recreation in Long Island and to the cultural activities of Manhattan. LIJ is the Long Island campus for the Albert Einstein College of Medicine. We offer a competitive compensation package. An equal opportunity employer.
Send letter and resume to:

Yakov Pipman, Ph. D.
Physics Section Head
Department of Radiation Oncology
Long Island Jewish Medical Center
270-05, 76th Ave.
New Hyde Park, NY 11040
e-mail: pipman@lij.edu
Tel: 718-470-7199
FAX: 718-470-9756

RADIATION THERAPY SYSTEMS MANAGER/LINAC ENGINEER

Long Island Jewish Medical Center
New Hyde Park, New York

A position is available immediately, in the Physics Section of the Radiation Oncology Department, for a dynamic technical person to play a key role in technical maintenance and support of the departmental services. The main responsibility is to lead and actively participate (with vendor service personnel and Hospital IS personnel) in maintaining the various systems used throughout the Department for radiation beam guidance, delivery and verification. Secondary responsibilities are electronic/technical/computer tasks suited to the applicant's background and experience, as needed by the department.

The department, which is part of a comprehensive cancer care center, provides advanced radiation therapy services such as IMRT, 3-D conformal radiation therapy, ultrasound guided transperineal implants, low dose rate and high dose rate brachytherapy, Total Body Irradiation and stereotactic radiosurgery.

The department has modern equipment and facilities, including three linear accelerators (soon to be four), dynamic MLC's, EPID's, HDR and LDR remote afterloaders, CT and conventional simulators, superficial therapy equipment, record and verify system, various treatment planning systems and extensive QA, dosimetry and support equipment.

The successful candidate is expected to have a degree in electronics or a related discipline. Certification such as MCSE in NT/Windows 2000, or similar is highly desired.

Ideal applicants should have several years of experience with technical repair, support and preventive maintenance of linear accelerators for radiation therapy, electronic/digital equipment, and in-depth knowledge of mixed LAN's, including various UNIX workstations. Expertise in high voltage, microwave and vacuum systems are a plus.

The successful applicant will work independently, as well as with a team of experienced Medical Physicists, work with cutting edge technologies and methods, and will have opportunities to attend formal training courses.

Situated at the border of Queens (NY City) and Nassau County in a residential area, LIJ has easy access to the City's cultural activities and to outdoor recreation. Compensation is competitive and commensurate with training and experience.

Interested candidates are invited to apply by FAX, e-mail or US Mail.

Yakov Pipman, Ph. D.
Physics Section Head
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Long Island Campus of Albert Einstein College of Medicine
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MEDICAL DOSIMETRIST

Long Island Jewish Medical Center
New Hyde Park, New York

A medical Dosimetrist position is available immediately in the Physics Section of the Department of Radiation Oncology. This clinical position involves duties in all modalities of treatment planning, including IMRT, SRS/FSRT, TBI, Brachytherapy, Quality Assurance, chart review, Dosimetry and support during simulation procedures.

Excellent verbal communication and written documentation skills are required.

Qualifications include a Bachelors Degree, in Physics or in a closely related field, or graduation from a Dosimetry program. Graduates from a Radiation Therapy Technology program with college level Mathematics and Physics background and at least one-year work experience with Therapy techniques and radiation dosimetry will be considered. Experience as a medical dosimetrist is preferred and certification by the Medical Dosimetrist Certification Board (MDCB) is highly desirable.

Salary is commensurate with education and experience.

Contact with a letter and resume:
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