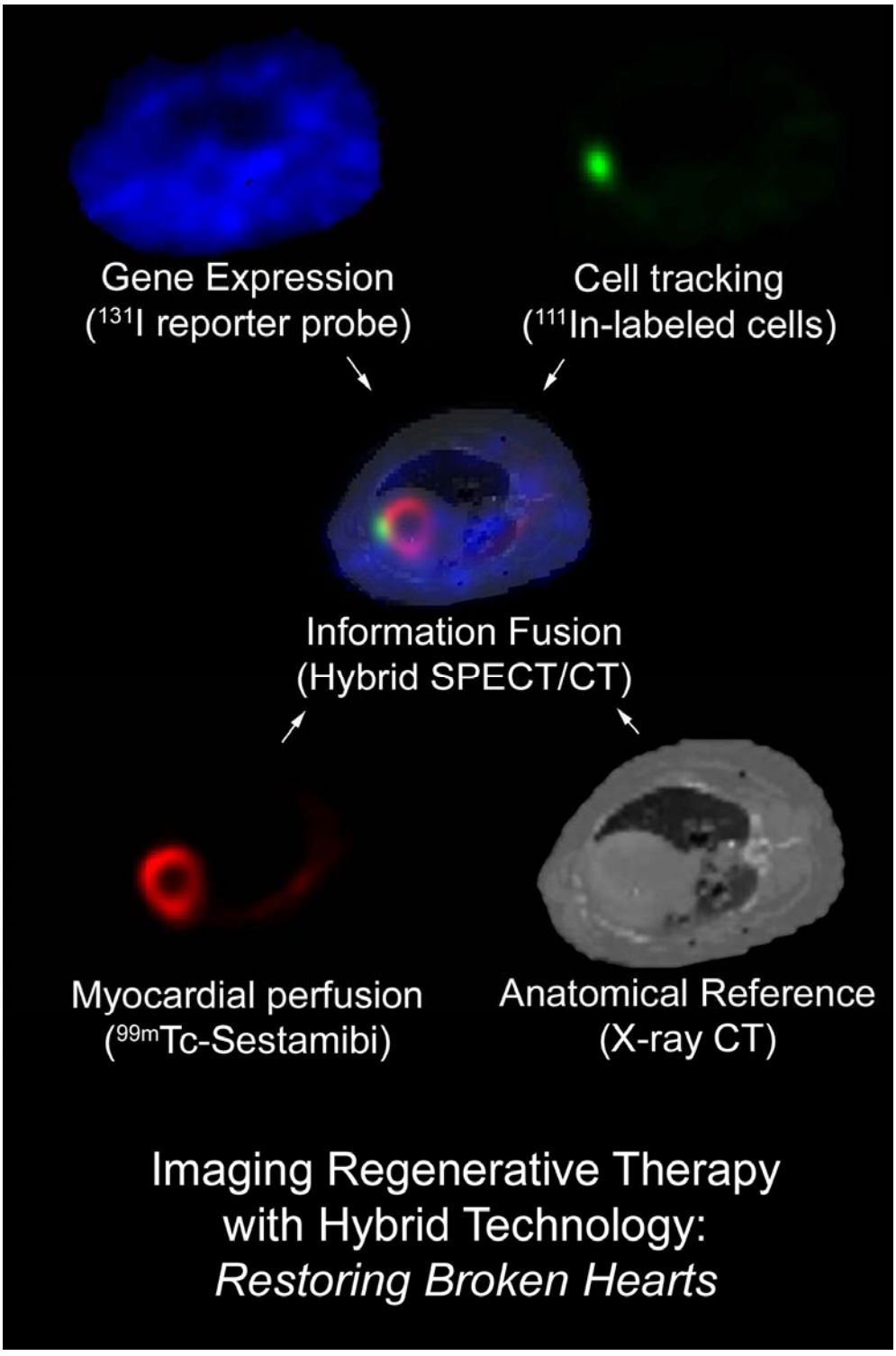
InterACTIONS

CANADIAN MEDICAL PHYSICS NEWSLETTER
Le BULLETIN CANADIEN de PHYSIQUE MÉDICALE



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

52 (4) octobre/October 2006

About our Cover

Applying stem cell therapy for myocardial infarction will require rigorous assessment to determine optimal route of delivery, time between infarction and transplantation, and number of transplanted cells. It is anticipated that medical imaging will figure prominently in evaluating the potential of this therapeutic modality and helping to understand its underlying mechanisms.

In the Department of Nuclear Medicine at St Joseph's Health Care - London and the Lawson Health Research Institute, we are investigating the use of molecular imaging and hybrid imaging (SPECT/CT and PET/CT) to monitor stem cell therapy. Much of our work focuses on canine models of heart disease due to similarities to humans in terms of physical size and cardiac physiology. Recently, we have developed a method to simultaneously track transplanted cells, interrogate the transplanted cells for expression of a transgene, and monitor the status of underlying cardiac tissue.

The figure shows an example of this technology: the top right panel shows the location of the transplanted cells, which have been radiolabeled with ^{111}In. The top left panel shows the distribution of a radiolabeled reporter probe which is taken up by the transplanted cells but also has very significant non-specific uptake. The bottom left panel shows the distribution of a tracer for myocardial perfusion. The images were acquired simultaneously using the multi-spectral capabilities SPECT, and they can be fused with X-ray CT to aid in anatomical referencing.

Images provided by: Kimberley Blackwood, Frank Prato and Robert Stodilka. Department of Nuclear Medicine, St Joseph's Health Care – London ; Imaging Program, Lawson Health Research Institute ; Department of Medical Biophysics, University of Western Ontario.

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, images, and 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 (both corporate and job) enquiries can be made to:
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P.O. Box 72024, Kanata North RPO
Kanata, ON K2K 2P4
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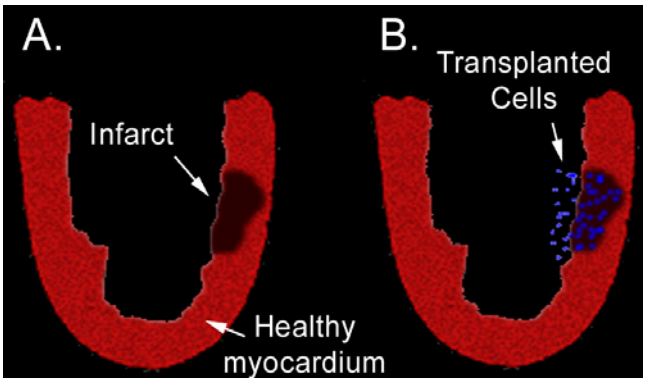

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Message from the COMP Chair:

Dr. Stephen Pistorius
COMP President

Our upcoming strategic planning exercise will ensure that your needs are clearly understood and that we have a clear strategy to meet those needs, in priority.

At this years Annual General Meeting I took over the gavel from Peter O'Brien who has so ably carried out the duties of the chair for the last two years. A number of important initiatives were completed on his watch and I hope that with the assistance of the dedicated group of members who serve on the executive, its subcommittees and those individuals who operate behind the scenes, we will continue to grow the organisation to something you will all be proud of. Peter will still be quite visible over the next two years, both as past-chair and as the chair of the Local Arrangements Committee for the 2007 COMP meeting which will be held jointly with CARO in Toronto.

I would like to take this opportunity to once again thank Clément Arsenault, Darcy Mason and Horacio Patrocino who have served on the Executive for a number of years. New to the executive are Michelle Cottreau as Councillor for Communications, Jason Schella as Chair Elect and Maryse Mondat, who joined us as Treasurer in January. Our new editor is Parminder Basran who has taken over from Boyd McCurdy who did a great job of editing our flagship publication. I would like to express my appreciation to them, as well as the long list of members who volunteered their time to help with the refereeing and judging of the papers at the scientific meeting this year. And now a plea! This organization requires the input and assistance of its members to make it function effectively. If you are interested in helping out in any capacity or have ideas and/or constructive criticisms that would help improve COMP, please let me know.

I have recently returned from the World Congress in Medical Physics and Biomedical Engineering in Seoul, where I attended various IOMP and IUPESM meetings. One of the highlights of the meeting was the awarding of the IOMP Marie-Sklodowska Curie Award to John Cunningham in recognition of a distinguished career contributing to the advancement of international medical physics through research, teaching and leadership. Congratulations, Jack, on this much deserved award.

The IOMP has produced a "Way Forward" document which describes its planned direction for the next six years. The full document is available ontheir web site. To summarize, they intend to try to improve their web site and to make it an educational resource, to start to produce internationally recognised Medical Physics standards and policy documents and to strengthen links with other communities and agencies. The Secretary-General, Dr. Peter Smith, asked council to remind the members of their respective organizations that they are all members of IOMP and to invite them to make use of the services that the IOMP provides. A future issue of Interactions will have a short article describing the IOMP roles and services.

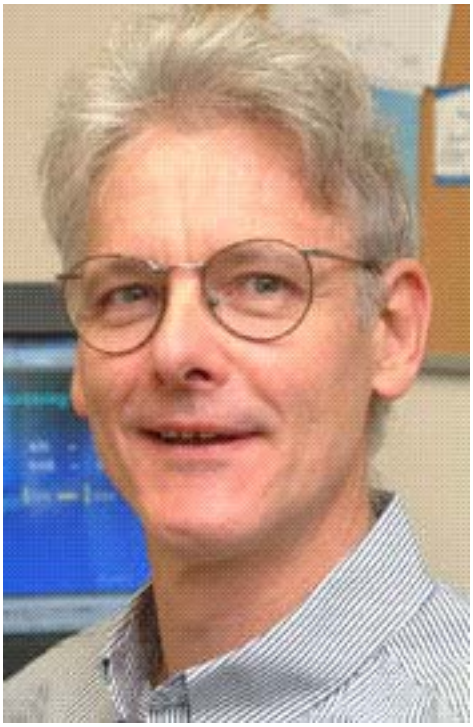
Our upcoming strategic planning exercise will ensure that your needs are clearly understood and that we have a clear strategy to meet those needs, in priority. We also have to monitor our performance in this regard; keep you, the membership

(Continued on page 155)

Message from the CCPM President:

I have a confession: up until last year I was not contributing to the Harold E Johns (HEJ) trust fund. Unfortunately I'm not the exception. Three hundred and seventy members only contributed $527 to the fund in 2005, which was even less than the $891 contributed in 2004. This means we were only willing to contribute 1 cup of Tim Hortons coffee per member over a whole year to support education within our own society. At this rate of donation, the HEJ fund will become bankrupt, since the income from this fund will be less than $800 interest this year plus $500 in donations while the award itself is $2000 per year, a shortfall of $700 this year with bigger future shortfalls as the interest income decreases with the shrinking principal. The HEJ fund is not a line item in the CCPM budget, but an independent trust fund; the "trust" means that money cannot be transferred between the CCPM operating budget and the HEJ trust fund. Reducing the value of the award is a poor option and the award should actually have been increased to keep pace with inflation.

This stinginess is an embarrassment to our profession, but very easy to correct. All I am requesting is that each of us donates the equivalent of 10 cups of Tim Hortons coffee ($15) to the HEJ fund at the next dues renewal. Thank you.



Dr. Dick Drost,
CCPM President

From the Editor

The Toronto air is starting to feel more crisp and the leaves are starting to change their color. I have to admit that this is my favorite season, especially now living in Toronto where the summer months can be as unbearable as those in winter. The (odd) fresh air in T.O. makes my transition as the new *InterACTIONS* Editor probably not as painful as it should be. But before I started on this edition, I started to panic. An old Bulgarian proverb immediately came to mind:

> *"If you wish to drown yourself, do not torture yourself with shallow water"*

I still don't know why I accepted the position of Editor. Fortunately, this transition has been particularly easy by having a lot of support from previous editors/gurus Boyd McCurdy and Pat Cadman. I have to give them a big thanks for all their help so far. I know that I'll be e-mailing them frequently to tease out as much expertise as electronically possible. I was also very impressed with all the contributors who sent me material and making it so much easier to put the issue together. Ms Nancy Barrett, our Executive Director, is such a valuable resource to COMP/CCPM and she deserves many thanks: some of it for being able to keep details of the Newsletter in check and queue.

As Editor, I feel that making significant changes on an already excellent newsletter is a task not worth undertaking. I think the format that has evolved from the last several years has proven to work very well and so I have no intentions of changing the format of the newsletter. Having said that, it is amazing what bribery with carbonated frothy beverages can do to ones devotion to tradition.

Because of your contributions, I think this edition will prove to be an enjoyable one. Fortunately, Boyd did a great job including many of the details from the COMP AGM in Saskatoon in June. So, there was little else to mention apart from a few specifics of the venue and a some pictures.

If you know me, you may also know that I am a terrible conversationalist. Hopefully, fellow readers will soon realize that it is in their best interest to contribute articles and tid-bits of information to the Newsletter, rather than to be subjected to my personal diatribes. Seriously, your contributions and participation make this Newsletter. And your contributions – whether inane or otherwise– are greatly appreciated.

Sincerely,
Parminder S. Basran

Message from the Executive Director of COMP/CCPM:

It is important to recognize that strategic planning is a continuous process.

It is difficult to believe that it is October already! I would like to welcome Parminder Basran to the roster of committed COMP volunteers. It has been a pleasure working with Parminder on his first issue as Editor. I appreciate the enthusiasm and ideas that he has brought to the role already.

Thank you to all those who completed the Saskatoon Annual Scientific Meeting delegate survey. Your feedback is important and will be reviewed by the Conference Committee and the LAC Chairs of future conferences. An analysis of the feedback you provided can be found in this issue. Congratulations to Marie-Claude Lavallée who was the winner of the draw for the Chapters gift certificate.

By now, you should have received a copy of the most recent salary survey. Once again, your participation is critical to ensure meaningful results. Thank you to Peter McGhee and the Professional Affairs Committee for taking the lead on this initiative.

This past June, I was invited to represent COMP at the Vancouver bid seminars which are hosted and paid for by Vancouver Tourism and provide information on all that is involved in hosting an international conference. We were invited to these seminars because we have been approached to consider participating in bidding on the 2015 International Federation for Medical and Biological Engineering's World Congress. The seminar was worth attending as I had an opportunity to learn from others who are in the process of organizing an international congress. I submitted a report to Stephen Pistorius for discussion at a future COMP Conference Committee meeting outlining the rewards and risks of bidding on an international conference and the steps involved in deciding whether or not to bid. Many of you may have been involved in hosting international conferences and your ideas and input are most welcome.assistance with this, please feel free to contact admin@medphys.ca.

Ms. Nancy Barrett,
COMP/CCPM Executive Director

At the annual general meeting in Saskatoon, the COMP Executive received approval to move forward with a strategic planning process. This process involves engaging the services of a professional facilitator for information gathering, facilitation and the development of a strategic plan. It is important to recognize that strategic planning is a continuous process. Once a well-informed plan has been developed, further work is required as time passes to ensure that the plan remains relevant and achievable in light of environmental changes. My role in this exercise involved the development of a "Request for Proposal" for consulting services and distributing it to experienced consultants in the association sector. A formal RFP clearly outlines the required services and deliverables and ensures that we get the maximum value for the time and financial investment. The COMP Executive will evaluate the proposals submitted and select the consultant. As Peter O'Brien stated in his column in the July issue, "Canadian medical physicists are a relatively small but strong group and there are many opportunities for the future. We must examine these carefully

(Continued on page 155)

Report COMP Annual Meeting
Saskatoon, Saskatchewan May 31– June 3, 2006

Submitted by: Brian Keller
Toronto Sunnybrook Cancer Centre
Toronto

This year's annual meeting of the Canadian Organization of Medical Physicists was held in Saskatoon, Saskatchewan at the Delta Bessborough Hotel. The official opening took place on Thursday morning but there were a few interesting talks on the night before. Lisa Rendall, a breast cancer survivor, gave a talk entitled "Cancer lives with me: living proof that research works" and Rock Mackie followed with a talk about cancer imaging for radiotherapy. Lisa shared her warm, yet matter-of-fact, experiences with cancer and I thought that this was a nice way to launch the meeting and to remind us of our contributions. Rock revealed how he previously worked as a bartender in this same hotel where he is now a guest speaker and shared some of his experiences from his Saskatoon days where he was initially enrolled as an English major.

Once again, young scientists were given the chance to strut their stuff at the Young Investigators Symposium that involved talks from ten students on mainly imaging-related topics. The winner of this year's symposium was Arman Sarfehnia from McGill University with his talk on high contrast imaging using orthogonal bremsstrahulung beams. One of the major highlights of the conference was the first ever gold medal awards ceremony. Medals were presented to Doug Cormack, Jack Cunningham and Sylvia Fedoruk for their outstanding contributions to the field of medical physics. Associated with each award winner was a short presentation outlining his or her achievements. All three were a pleasure to listen to while they accepted their awards. Doug had a number of stories to tell and at one point had to be gently removed from the stage. As well, just prior to the gold medal ceremony, Jerry Battista gave an enthusiastic and informative talk on the history of Cobalt-60 research in Canada. His talk included some fascinating historical detail such as letter correspondence between Harold Johns and Erwin Schrödinger regarding an invitation from Johns to witness the first use of Co-60 teletherapy for cancer treatment.

The night out banquet was held at the Wanuskewin National Heritage Park. The banquet included nature walks (for those brave enough to fight off mosquitoes), a number of award presentations, overall great food including buffalo, and a wonderful authentic first nations ceremonial dance. Aside from the meeting, I thought Saskatoon in general was a pretty city with friendly people. Also, for those staying at the University of Saskatchewan residence, there was an interesting dinosaur exhibit that was worth checking out. The walk between the University campus and the Bessborough Hotel was scenic along the river and relatively short. Congratulations to all who contributed to this years meeting.

Next year's COMP will be held in Toronto (date and venue to be determined). Toronto is a vibrant multi-cultural experience that has something to offer for everyone (See: http://ww.torontotourism.com or http://www.livewithculture.ca/). See you next year in Hogtown!

2006 Recipients of the COMP Gold Medal

By: Parminder S. Basran
Toronto-Sunnybrook Regional Cancer Centre
Toronto, ON

This year, there are three recipients of the COMP gold medal: Dr John (Jack) Cunningham, Dr. Sylvia Fedoruk, and Dr Douglas McCormack. All three can trace themselves to the wonderful province of Saskatchewan at some point in their careers. This made the venue for the ceremony particularly special with it held during the COMP AGM in Saskatoon (see COMP AGM write-up for details).

Congratulations to all!

Gold medal recipients (from left to right): Jack Cunningham, Sylvia Fedoruk, Doug McCormack

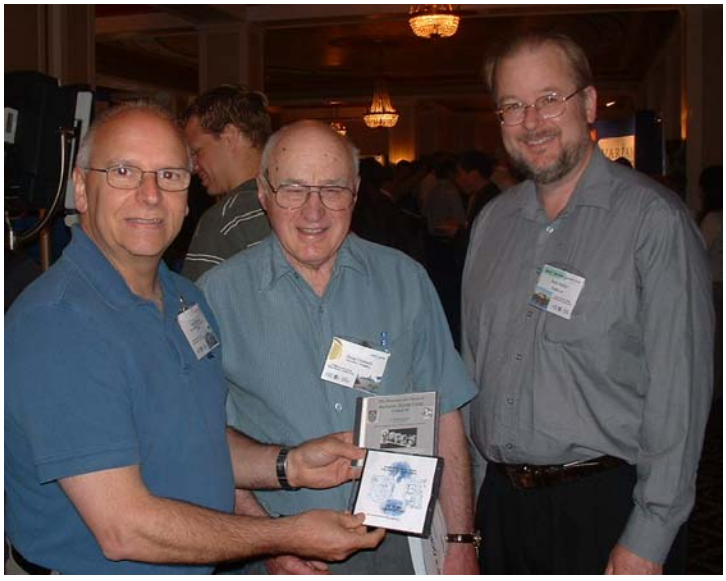
Pictures from COMP AGM 2006

Pictures contributed by Darcy Mason and Pat Cadman

The Delta Hotel in Saskatoon, venue for the conference.

The CCPM lecturer from Dr Chapman from the Biomedical Imaging Group at the Canadian Light Source

CCPM presidents (incoming-left, outgoing-right) shaking hands.



Folk-guitarist Dr Battista attempting to sell CDs to Doug Cormack and Rock Mackie.

Speed dating in Saskatoon… notice the one on the left is not smiling

More pictures from COMP AGM 2006

Canadian College of Physicists in Medicine
Examination Schedule 2007

Membership Examination:
Applications due: 5 January 2007
Examination date: Written 10 March 2007
Oral 12 May 2007 (Montreal)
Fee: $450.00
Decisions announced on or before February 23
(Note: Non-Radiation Oncology specialty orals to be held at the same time as Fellowship orals)

Fellowship Oral Examination:
Applications due: 5 January 2007
Examination date: 1-2 days prior to COMP Meeting in Toronto (October)
Fee: $300.00
Decisions announced on or before February 23
(later for those who do the membership exam in the same year)

Note:
The application forms, exam study guide, and sample exams are available on the COMP website under the heading "CCPM Certification". Application forms must be the ones currently posted on the COMP website.
Membership & Fellowship examination application deadlines are set to the same date. This allows the Credentials Committee to review all applications in one time period.
It is critical for the success of your application that you respect the deadlines.

For further information contact the Registrar:

Dr. Wayne Beckham. Registrar, CCPM
BC Cancer Agency, Vancouver Island Centre
2410 Lee Ave.
Victoria, British Columbia, V8R 6V5
Phone: (250) 519-5620 Fax: (250) 519-2024
wbeckham@bccancer.bc.ca

Excellence in Medical Physics Research by Canadians

Contributed by Parminder S. Basran and Joe Hayward

It comes as no great surprise when we see our Canadian colleagues describe ground-breaking discoveries or publish in well respected journals that have a significant impact across the border or overseas. Recent examples of Excellence in Medical Physics research include the following.

Two of the top fourteen outstanding papers reviewed in Physics in Medicine and Biology were based in the Sunnybrook Imaging Lab in Toronto:

R Dharmakumar *et al* 2005Anovel microbubble construct for intracardiac or intravascular MR manometry: a theoretical study *Phys. Med. Biol.* **50** 4745–62

R Chopra *et al* 2005 Method for MRI-guided conformal thermal therapy of prostate with planar transurethral ultrasound heating applicators *Phys. Med. Biol.* **50** 4957–75

The most outstanding paper, and winner of the Roberts Prize for 2005, was from the Hamilton group:

J S Dysart and M S Patterson 2005 Characterization of Photofrin photobleaching for singlet oxygen dose estimation during photodynamic therapy of MLL cells *in vitro Phys. Med. Biol.* **50** 2597–616

Congratulations to Drs Dysart and Patterson!

As many know, Dr Ervin Podgorsak was the recipient of the William Coolidge Award (see July 2006 issue of INTERACTIONS). Toronto-Sunnybrook's Imaging Group were contributors in the Sylvia Sorkin Greenfield Award, given to the best diagnostic imaging paper published in Medical Physics

Performance of a Static-Anode/Flat-Panel X-ray Fluoroscopy System in a Diagnostic Strength Magnetic Field: A Truly Hybrid X-ray/MR Imaging System," Medical Physics 32, 1775 (2005).

I encourage fellow readers to send an e-mail to me (COMP Newsletter Editor), when our colleagues do well!

COMP Gold Medal

The 2007 COMP Gold Medal will be awarded to a member (or retired ex-member) of the Canadian Organization of Medical Physicists (COMP) who has made a significant contribution to the field of medical physics in Canada. A significant contribution will be defined as one or more of the following:

1. A body of work which has added to the knowledge base of medical physics in such a way as to fundamentally alter the practice of medical physics.
2. Leadership positions in medical physics organizations which have led to improvements in the status and public image of medical physicists in Canada.
3. Significant influence on the professional development of the careers of medical physicists in Canada through educational activities or mentorship.

The Gold Medal is the highest award given by COMP and will be given annually to currently active or retired individuals to recognize an outstanding career as a medical physicist who has worked mainly in Canada.

Nominations for the 2007 medal are hereby solicited. Nominations are due by Dec 15 2006 and must be made by a member of COMP. Nominations must include:

- The nominator's letter summarizing the contributions of the candidate in one or more of the areas listed above;
- The candidate's curriculum vitae;
- The candidate's complete publication list (excluding abstracts) which highlights the candidate's most significant 10 publications;
- Additional 1 to 2 page letters of support from three or more COMP members.

The applications will be made electronically to Nancy Barrett at the COMP office (preferably in pdf format to: nancy@medphys.ca) and the authorship of the submission e-mail will be verified by the COMP Office.

A committee of COMP members appointed by the COMP executive will consider nominations and recommend award winners to the COMP executive by Feb 15, 2007. The COMP executive will make the final decision and the awardee will be notified by March 15, 2007 to give time to arrange to be at the 2007 COMP annual meeting in Toronto.

Ervin Podgorsak Awarded William D. Coolidge Award

At the 47th Annual AGM of the AAPM in Orlando, Dr Ervin Podgorsak, from McGill University and the Montreal General Hospital was awarded with the AAPMs highest distinction. For more details of this award, please see the July 2006 issue of InterACTIONS. A detailed report of the AAPM is also provided inside this issue.

Shown on from left to right are previous McGill students and colleagues Sherry Connors, Ellen Wilcox and Cheryl Duzenli.

Congratulations!

Report on 13th International Meeting of the Leksell Gamma Knife® Society

Submitted by: A. Berndt and J. Beck
Manitoba Cancer Care, Winnipeg, Manitoba

The Leksell Gamma Knife® Society meets every two years to provide neurosurgeons, radiation oncologists and physicists with the opportunity to share their experiences. This year the meeting was held from May 21-26 in Seoul, Korea.

Seoul is a bustling modern city centered around a variety of restored palaces (apparently everything burned to the ground in the early 1900's). The Korean people were unbelievably friendly and helpful. No sooner had we consulted our map for directions to our next destination, and some obliging stranger was ready to test their English skills and point out the way. We found Seoul to be an interesting mix of big city sophistication and traditional Korean culture ranging from high end department stores selling designer goods to street vendors selling "food" items of a decidedly unfamiliar sort.

The foreign cuisine definitely made an impact upon the North American visitors. Identifiable features of the first conference lunch consisted of raw fish and rice. Water tanks containing unfamiliar floating objects were found everywhere in the markets along with other exotic items such as ginger roots, barbequed whole pigs feet, and of course, kimchi, one of the staples in the Korean diet, served for breakfast, lunch and dinner. Kimchi is basically Korean "sauerkraut" infused with a generous amount of chili powder. It has been rumored that this rather potent concoction is the reason no Koreans have been afflicted with the Avian flu . . .

One of the conference highlights was a presentation by former Korean President and 2000 Nobel Peace Prize Laureate Kim Dae-Jung. His speech outlined some of the Korean history since the Second World War, along with the challenges associated with and hopes for reunification between North and South Korea. The complete rebuilding of Seoul after the destruction of most Korean infrastructure during the Second World War and Korean War is a testament to the tenacity and industriousness of the Korean people.

Another conference highlight was the unveiling of the new Leksell Gamma Knife® PERFEXION™ system. Elekta has completely redesigned the Gamma Knife® to completely eliminate the need for manual mode (trunnions), helmet changes, and clearance checks by expanding the diameter of the treatment sphere and incorporating all collimator options into the central body of the unit. This presents a dramatic improvement over the current system and will greatly reduce the set-up component of treatment times and eliminate the need for multiple head frame placements to reach extreme lesions.

The conference itself consisted of a large number of "case study" talks in which centers presented their experience in treating various tumors. Several sessions incorporated an electronic voting terminal for each conference participant in order to poll the audience and display a graphical distribution showing how the community at large would treat various clinical scenarios. The physics talks were well done and provided us with new treatment planning tips and techniques for achieving even more conformal coverage than at present. A number of new phantoms and quality assurance approaches were also presented. Unfortunately, little was mentioned by the Elekta speakers about the quality assurance associated with the new PERFEXTION™ system where all aspects of patient positioning and helmet selection have been automated

(Continued on page 155)

Imaging Regenerative Therapy with Hybrid Technology: *Restoring Broken Hearts*

Authors:
Kimberley J Blackwood, BSc
Frank S Prato, PhD, FCCPM
Robert Z Stodilka, PhD, MCCPM

Imaging Program, Lawson Health Research Institute
Department of Medical Biophysics,
University of Western Ontario
Department of Nuclear Medicine,
St. Joseph's Health Care
London, Ontario, Canada

Introduction

Medical imaging researchers strive to develop new methods needed to push the frontiers of our knowledge of normal and pathological states. Operationally, this translates into increasing specificity and sensitivity. The new discipline of "molecular imaging", created by the merger of molecular biology and medical imaging, has already provided us with reporter probes possessing the ability to select/detect a single gene event. Interestingly, this previously unheard of specificity has, on the one hand, created vast opportunities to image very specific events at very high sensitivities. On the other hand, it has been a driver for hybrid imaging platforms. Conversely, the availability of hybrid imaging platforms will quicken the pace of the development of molecular imaging

Hybrid imaging is needed to provide complementary information from more than one molecular probe and also for image context. It has been argued by some that software image registration can fulfill most of these needs. However, it is becoming increasingly apparent that this is far from the truth even if the software registration is "perfect" and the reader has confidence in this "truth". Imaging with molecular probes finds targets without anatomical reference points so software registration using endogenous markers is not possible. The other failure of software registration is the inability to follow more than one dynamic process. Almost all biochemical, biomechanical, and electrochemical processes occur within fractions of seconds. Ultimately, what we really need is truly simultaneous hybrid imaging systems capable of recording events at the sub-second level.

The evolution of hybrid systems started in earnest with PET/CT; a sequential two imaging technology that provides needed anatomical context for PET – which is a unispectral modality. More recently SPECT/CT systems have become available. Historically, SPECT has been the poor relative of PET having poorer spatial resolution and detector sensitivity. However, as you will see below, SPECT is multi-spectral! This technology can simultaneously - and we mean simultaneously - follow 3 molecular probes with second resolution. We predict that the next wave of hybrid platforms will include MRI. Perhaps the first will be PET/MR. If the MR has a high enough magnetic field, truly simultaneous image acquisition of molecular biology and function will be possible. As there is no concept of dose with MR and as MR can provide complementary functional information this hybrid platform will, for example, be able to measure in a single study, neuroreceptor occupancy with PET, radioligand delivery by measuring brain blood flow by MRI, correction for patient motion in the PET image once every 100 ms using navigator echoes by MR and neurotransmitter concentrations by MRS! Again many will argue that simultaneous acquisitions are not needed. But we know that biological processes are sub-second. In many cases no one has yet looked at what happens in short time scales to complementary quantities in vivo in humans and large animals and how these fluctuate on a short time scale with pathology.

We are at an exciting time where the quickly expanding disciplines of molecular biology and medical imaging have met and the opportunities seem endless. Molecular imaging begets hybrid imaging and hybrid imaging begets molecular imaging. Below we see an application to stem cell biology.

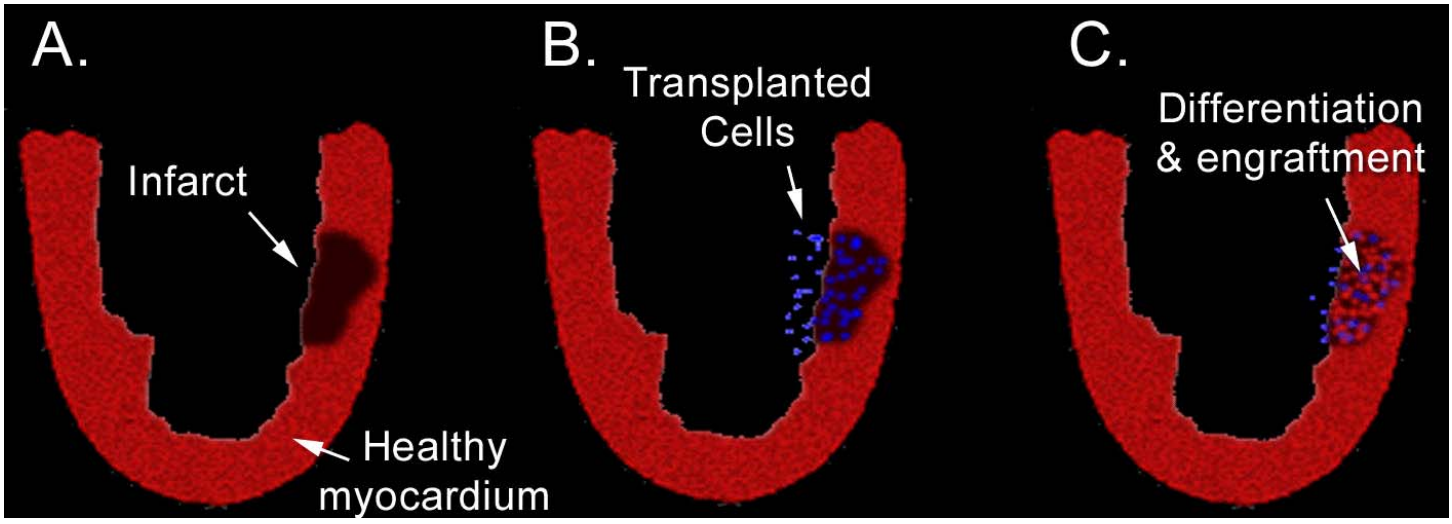


Figure 1: Treatment of myocardial infarction using stem cell therapy. Figure shows cross-section of left ventricle, where healthy tissue is red and an infarction is colored darkly (A). Stem cells (blue dots in B) are transplanted directly into the infarction or into a nearby region. Over time, the transplanted cells differentiate into myocytes (red dots in C) and engraft with surrounding tissue, reducing the size of the infarction and restoring regional contractility.

Cardiac Regenerative Therapy

The effectiveness of the myocardium to contract, therefore circulating blood to the tissues is a function of its basic cellular unit: the cardiomyocyte. Communication between cardiomyocytes is accomplished through specialized junctions that allow the spread of electrical signals resulting in unified contraction. This is what constitutes the myocardium as a syncytium. Of equal importance is the maintenance of structure within healthy myocardium, which is composed of a complex scaffold of extracellular proteins in association with the cardiomyocyte. Consequently, the structure of the myocardium as a whole plays a significant role in maintaining its vital function.

Disease that affects the normal functioning of the cardiomyocyte consequently affects the syncytium, disrupting the flow of electrical information throughout the myocardium. For instance, ischemic disease resulting from arterial blockage deprives the myocardium of oxygen and nutrients along with the necessary removal of metabolic wastes. As the blockage persists, cellular damage quickly becomes irreversible and cell death is imminent. Collateral circulation supplying overlapping regions of myocardium compensates well for disrupted flow. This typically leaves a region of salvageable tissue given that revascularization techniques are utilized in time. However, dead tissue resulting from inadequate blood flow and poor collateral circulation will not benefit from such techniques. Essentially, this region of dead tissue disrupts the communication system between cardiomyocytes and consequently, function is affected.

The events culminating into chronic dysfunction are initiated by ineffectual repair mechanisms. Once these mechanisms have been activated, structural changes within the affected areas oversee the development of non-contractile scar tissue. To compensate for cardiomyocyte loss, structural changes also occur within areas remote of the ischemic event. For example, changes can be observed in the quantity and quality of extracellular protein, the size of individual cardiomyocytes as they bulk up to increase myocardial mass, and abnormal gene expression. Additionally, chronic cellular reorganization causes ventricular wall thinning and ventricular chamber enlargement. It is clear that progressive tissue remodeling continues to influence the complex scaffold of the myocardium thereby leading to chronic heart disease such as heart failure. To this end, clinically available surgical or therapeutic solutions do not exist to counteract residual remodeling effects once scar tissue has developed. Under these conditions, the heart is not able to generate the force required to pump blood throughout the systemic circulation. Heart transplantation remains an accessible source for normal organs, although donor absence and immunorejection remain major limiting factors.

Given the need to re-establish the connection between cardiomyocytes and halt or slow progressive tissue remodeling following massive cell death, regenerative therapies involving cell-based applications are under investigation. The basic idea involves cells that exhibit particular characteristics allowing them to either become functional replacements or somehow influence the surviving host tissue. Precursor cells, or stem cells, are likely candidates given that these cells can mature into many tissue types, a process known as differentiation. They are made more attractive by the fact that they self-replicate, constantly maintaining a tissue population of cells with differentiation potential.

Successful regenerative therapy assumes some kind of established interaction between transplanted cells and host tissue. Cells residing within the damaged site, improved or maintained blood perfusion, and reduced mechanical stress to slow potentially destructive tissue remodeling would support this. Numerous small animal studies have consistently demonstrated a reduction in cardiomyocyte death, increases in capillary density and subsequent improvement in regional blood perfusion. Infarct size reduction has also been reported. These positive results have paved the way for multiple clinical trials investigating the safety and efficacy of cell therapy in the infarcted heart. Yet, it is still largely unknown how cellular therapy can influence changes within the myocardium. Many investigators have shown that specified stem cell populations differentiate into cardiomyocytes in vitro and in vivo. In vivo differentiation to cardiac tissue would inherently increase the number of cardiomyocytes contributing to the workload, thereby partially reducing mechanical stress. Furthermore, it has also been shown that transplanted cells undergo epithelial differentiation, which may participate in blood vessel development. This is important in improving the delivery of blood to tissue regions at risk surrounding the dead zone. Another mechanism explains how transplanted cells support surrounding tissue using chemical messengers. Such paracrine effects have been responsible for reductions in anti-apoptotic (programmed cell death) signals, tissue-remodeling attenuation, and improved ventricular contractility. Any number of mechanisms could be responsible for improving regional and global heart function. However, the real test lies in how long these improvements can be sustained.

Regenerative therapy continues to be faced by a number of challenges, which need to be addressed. Given the impressive results of the small animal work, how well can these results be translated to the clinical realm? Stem cells are easily expanded in culture once harvested. However, it is currently not known how many cells are necessary to achieve sustained repair, which stem cell population promotes optimal repair, and whether intramyocardial or intravascular injection is the best route for maximal cellular benefits. Massive cell death following transplantation within poorly perfused regions bordering tissue damage is another major hurdle. Moreover, autologous transplantation, in which the donor and recipient are the same individual, benefits from a very low risk of immunorejection unlike heart transplantation. Nevertheless, if stem cell number and quality is poor, then regenerative therapy using the patient's own cells is unlikely.
Realistically, many of these logistical considerations must be addressed in large animal models such that issues of scale are more closely matched. The basic idea has been demonstrated in small animal models, however research must continue in large animals in order to address issues that cannot be investigated in human studies.

Why Do Cell Tracking?

Maintaining healthy numbers of viable and functional cells will be critical to sustaining ventricular improvements, while controlling destructive tissue remodeling following cell therapy. However, myocardial regeneration after cell delivery is difficult to verify in vivo since cardiac biopsy is the only way to obtain cellular information before physiological manifestation. Therefore, this presents a limitation for therapeutic application given the invasive nature of cardiac biopsy. Furthermore, poor subsequent functional recovery after transplantation may actually be due to

cell deficiency or cell dysfunction at the transplantation site. Presumably, sufficient dose of functional cells should define the success of therapy. For this reason, constantly updated information regarding engraftment, differentiation, viability, and localization after transplantation has importance in assessing their functionality and subsequent potential for effective regeneration. The only foreseeable method for obtaining such information non-invasively in vivo would require imaging of a tracking agent corresponding with transplanted cells.

Cell Tracking: In vitro Labeling Techniques

Some of the oldest cell tracking technologies have used radiolabeling techniques to non-invasively image leukocyte trafficking in inflammation. These kinds of techniques require that cells are extracted and directly loaded with the radiolabel in vitro and injected back into the body for subsequent imaging with PET or SPECT. Among its advantages, nuclear imaging benefits from high specific activity generating desirable levels of image contrast, while imaging tissue function within picomolar to nanomolar ranges. In fact, a number of studies have incorporated radioactively labeled compounds using ^{111}In, ^{18}F, ^{99m}Tc, and ^{64}Cu directly into cells to be transplanted.

Ideal cell tracking technologies should possess a number of inherent characteristics. Firstly, it must be biocompatible and non-toxic to avoid adverse cell function. Secondly, specificity should be maintained such that the tracking agent does not label surrounding tissue upon cell death. Furthermore, cell proliferation should not considerably affect the ability to track cells by diluting the agent over successive periods of cell growth. Non-invasive cell quantification in vivo should be possible with known concentrations of the tracking agent per cell. Lastly, single cell detection would also be ideal however, current imaging systems do not have the resolution capabilities to achieve this in vivo.

With respect to myocardial cellular therapy, our group has been investigating autologous transplantation of various bone marrow derived cell populations in a canine model of myocardial infarction. In particular, to address the need to obtain updated information on transplanted cells non-invasively, we have focused on the development of methods to track cells repetitively either immediately or longitudinally following transplantation.

Our preliminary work has evaluated the use of ^{18}F Fluorodeoxyglucose (FDG) as an in vitro label to follow cells non-invasively with PET[1]. In vitro studies determined that bone marrow cell (BMC) viability was maintained at 80-93% with doses ranging from 0.5 to 7.2 MBq for 10 days. However, decay corrected washout activities demonstrated limited retained activity with 72% residing within the cells at 1 hr and 50% at 4 hours. In vivo PET evaluation of ^{18}F FDG labeled BMCs set out to investigate the effects of alternate routes of transplantation on cell distribution in myocardium. In these animals, PET imaging indicated that 27% and 2.5% of labeled cells remained within the myocardium immediately after direct or coronary artery injections, respectively.

With regards to minimal cell leakage, the best results thus far have been obtained with ^{111}In tropolone. Early in vitro work in BMCs has shown that 75% of the label was retained within the first 24 hours post-labeling. In contrast to ^{18}F FDG, the relative stability of ^{111}In tropolone and its longer half-life permitted SPECT imaging of ^{111}In labeled BMCs out to 14 days post-transplantation within infarcted myocardium[2]. Furthermore, we determined that ^{111}In labeled cellular debris from lysed cells injected into normal canine myocardium cleared from the injection site such that 1% of the injected dose remained within the myocardium 18 hours post-injection. This resulted in a biological half-life of 2.6 hours, compared to that of 6 days following transplantation of healthy ^{111}In labeled cells in myocardium. Due to the nature of how ^{111}In tropolone labels BMCs, in vitro studies also revealed the inability of labeled cellular debris to transfer the ^{111}In label to healthy intact BMCs. These results might suggest that ^{111}In released from non-viable BMCs is not taken up into surrounding myocardial tissue. In this case, ^{111}In tropolone labeling may be considered a non-invasive marker of cell viability following transplantation.

Magnetic Resonance Imaging (MRI) is another clinically available technology currently used to non-invasively image transplanted cells. Such in vitro techniques have achieved success with particulate iron oxide contrast agents (e.g. superparamagnetic iron oxide) which generate contrast by disturbing the local magnetic field near excited spins known as T_2* relaxation. MRI is highly acclaimed for its high spatial resolution allowing unambiguous interpretation of anatomical features but still suffers from intrinsically low sensitivity requiring large amounts of iron. Moreover, hypointense regions created by iron oxide particles make image interpretation difficult and the potential to track the signal long-term still requires evaluation as signal loss occurs with cell division and iron biodegradation.

In summary, in vitro labeling techniques are useful in determining cell distribution within the first few hours or days of transplantation depending on the physical and biological characteristics of the contrast agent. Conversely, they are somewhat limited in their ability to provide long-term tracking information due to dilution effects following cell division. For MRI, iron oxide is further degraded by the cell and is toxic at high doses. For in vitro radiolabeling techniques, there exists a tradeoff between radioisotope half-life and exposure to ionizing radiation. Additionally, these techniques provide little molecular information.

Cell Tracking: Genetic-Based Tracking Agents

Interrogating cellular function such as the degree of host tissue coupling with transplanted cells requires information regarding sub-cellular processes. Only fully functional cells can carry out molecular processes associated with changes in gene expression. To monitor these changes non-invasively in a living organism would be of remarkable diagnostic value, as it would relate to the cellular therapeutic potential. Achieving this kind of system requires manipulation on the genetic level employing genes that report the functional status of the cell. This describes the emerging technique of molecular imaging which is defined as non-invasive detection of targeted macromolecules and biological processes in an intact living system.

In contrast to in vitro labeling, a major strength of genetic based tracking technologies is found in the ability to do longitudinal tracking since the signal is not diluted with successive rounds of replication. This occurs when the reporter gene integrates stably

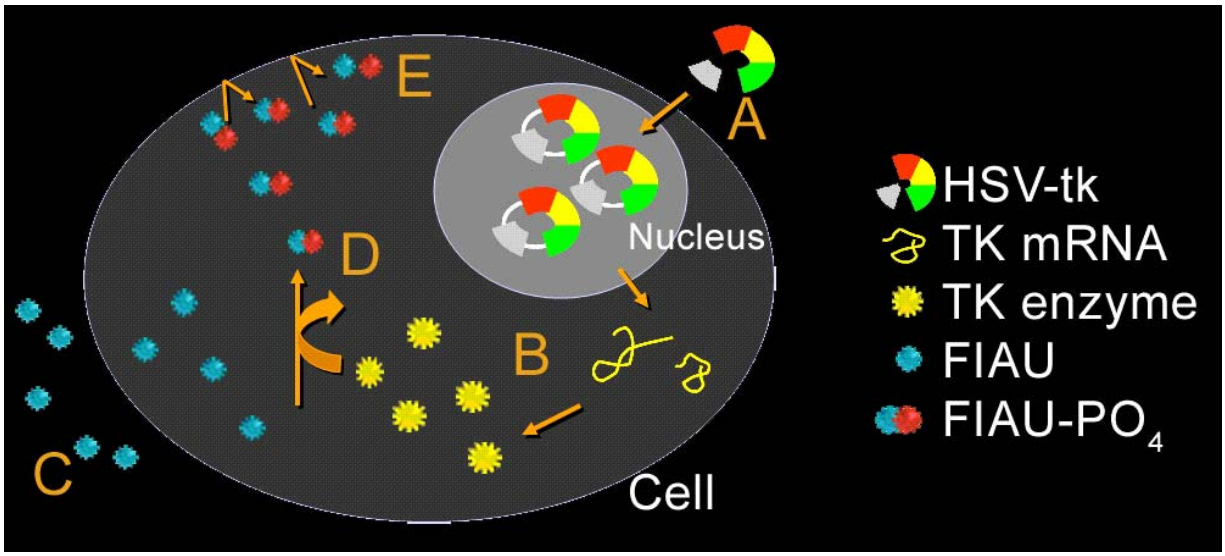


Figure 2: Non-invasive monitoring of gene expression using the Reporter Gene / Reporter Probe paradigm. Marrow-derived stem cells are transfected (*in vitro*) with the reporter gene HSV-tk (A). The stem cells are then transplanted into the patient to the site requiring therapy. HSV-tk expression produces the TK enzyme inside the cells (B). Subsequently, the reporter probe FIAU (radiolabeled with ^{131}I) is administered intravenously into the patient (C). FIAU entering cells expressing HSV-tk is phosphorylated by TK (D) and becomes trapped (E). Over time, FIAU accumulates inside these cells, ultimately leading to a signal detectable non-invasively by SPECT.

within the host genome. The host genome is comprised of the chromosomes of the cell, which are passed on to successive generations following replication during the cell cycle. Essentially, the resulting daughter cells will maintain the gene necessary to report function non-invasively.

The key features of molecular imaging include (1) the reporter gene and the functions of its gene product, (2) the reporter probe substrate, and (3) the imaging modality needed for detection. To date, considerable work has been done characterizing reporter gene systems to image expression of fluorescent proteins with fluorescence or optical imaging, luciferases with bioluminescence imaging (BLI), herpes simplex virus-1 thymidine kinase with PET and SPECT, and transferrin receptor and ferritin protein with MRI in vitro and in vivo.

Optical and bioluminescence imaging are techniques that capture the emission of light. In the case of bioluminescence, the reporter gene codes for the enzyme luciferase, which catalyzes a light producing reaction. These techniques can then be used to image any cells expressing this enzyme. For example, stem cells expressing the luciferase gene have been visualized in an in vivo rat model after transplantation within the myocardium. However, the light absorption and scattering properties of tissue prevents the visualization of luciferase activity with penetration depths over 2 cm, precluding its use in larger animals. Nonetheless, reporter gene products like enzymes are particularly advantageous because they can process a large number of substrate molecules without being consumed themselves and are therefore able to amplify the signal significantly.

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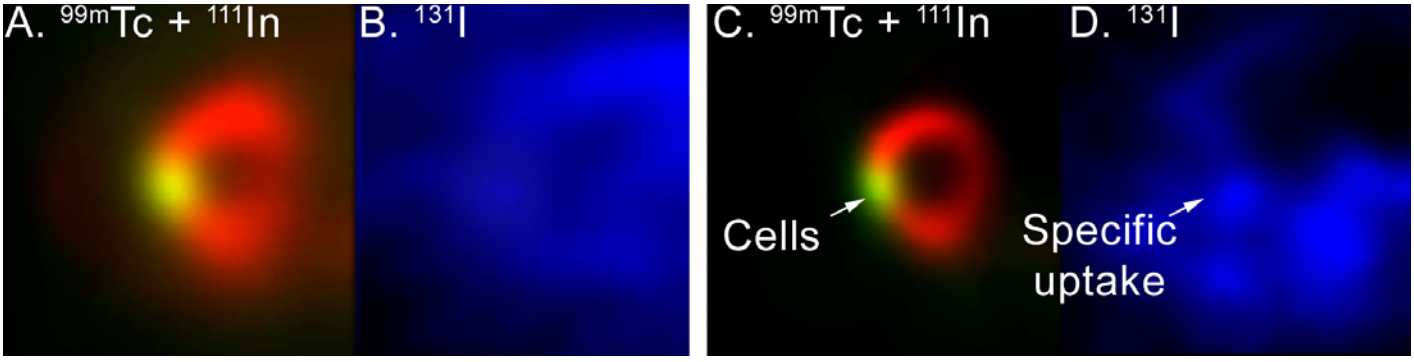

Figure 3: Impact of scatter and attenuation corrections for multi-radionuclide SPECT is shown for monitoring stem cell therapy in a canine model of myocardial infarction. Images show short-axis slice through left ventricle. The red scale corresponds to ^{99m}Tc-Sestamibi (tracer for myocardial perfusion), the green for ^{111}In-tropolone (radiolabeling transplanted cells), and blue for ^{131}I-FIAU (reporter probe). 3A and 3B are without scatter and attenuation corrections, and 3C and 3D are with corrections. Corrections improve visualization of specific reporter probe uptake, despite significant accumulation in surrounding tissue.

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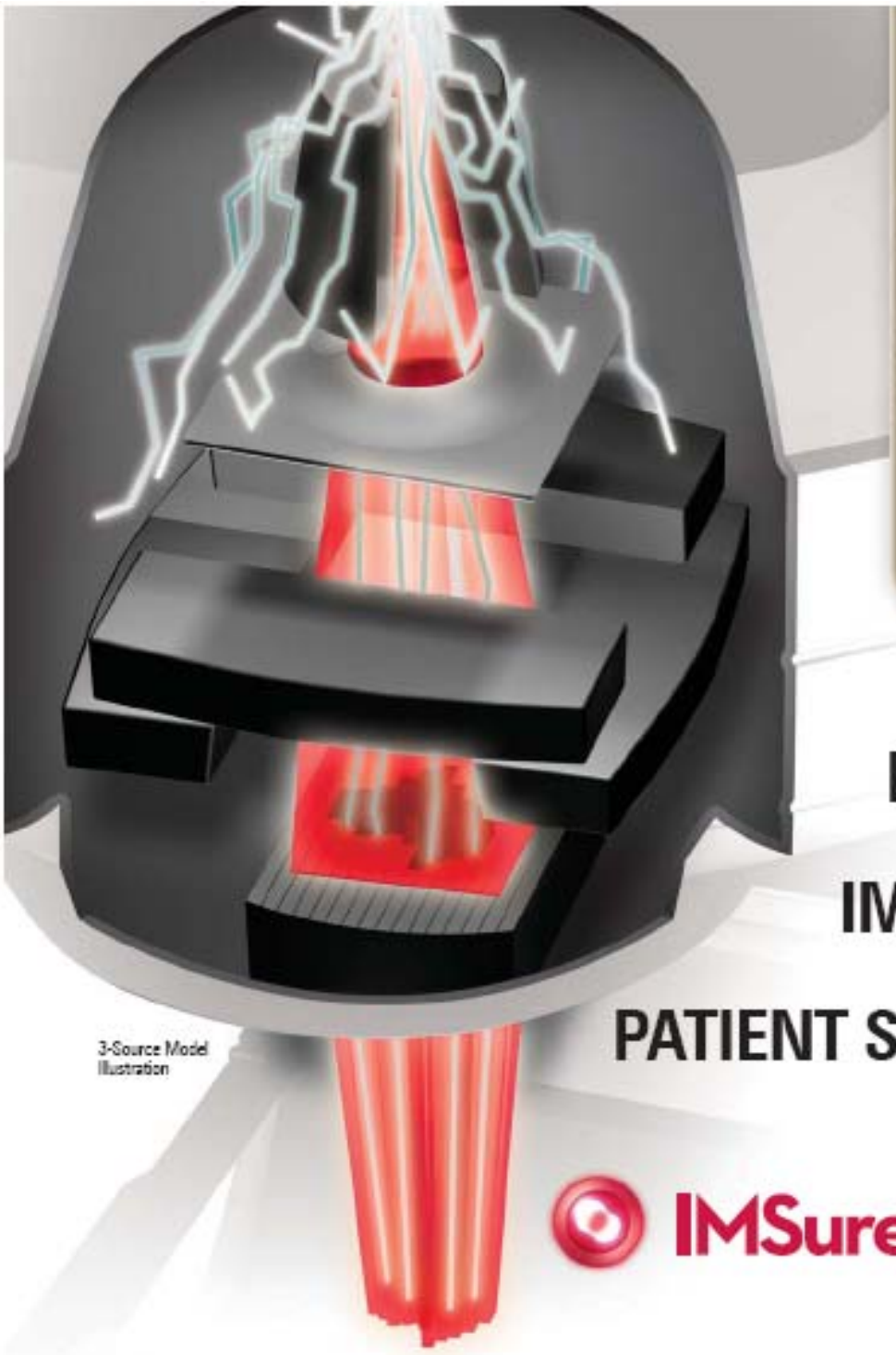

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1. T. C. Zhu, B. E. Bjarngard, Y. Xiao, and C. J. Tang, "Modeling the output ratio in air for megavoltage photon beams," Med. Phys. 28, 1352–1358 (2001).


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With regards to BLI or nuclear medicine imaging with PET or SPECT, the reporter gene product must be probed in order for visualization to take place. This requires that the receptor or enzyme has a ligand or substrate, respectively to act upon. For example, the luciferase enzyme needs the probe luciferin to produce light. Likewise, the thymidine kinase enzyme requires a nucleotide derivative to act as the probe. Tagging the probe with a radiolabel allows visualization of concentrated reporter probe, as it is enzymatically converted by thymidine kinase trapping it within the cell. To obtain direct evidence of cell function, reporter genes can be coupled with therapeutic genes or genes that signify changes in gene expression such as differentiation. Consequently, probe accumulation signifies that these events have taken place.

Applying molecular imaging techniques to image cellular therapy in a large animal model is largely dependent on modalities that have sufficient sensitivity to track transplanted cells. Radioisotope imaging in nuclear medicine meets the demand of sensitivity based on the emission and detection of high-energy gamma rays. Additionally, PET and SPECT have good temporal resolution and are highly accessible. In particular, we chose to use SPECT for its multispectral properties allowing simultaneous acquisition of multiple parameters relating to myocardial stem cell therapy in the canine. Specifically, our approach is to develop a practical SPECT technology that allows non-invasive and repetitive functional assessments of transplanted BMCs as they exist in autologously transplanted myocardium in vivo. In our system, herpes simplex virus thymidine kinase (HSV-tk) activity was coupled with the radioiodinated reporter probe ^{131}I FIAU for detection with SPECT. BMCs were harvested from female canines, transfected with the HSV-tk reporter gene, and maintained in culture for 4 weeks. Initial in vitro studies showed that BMCs expressing thymidine kinase demonstrated a 10-15 fold increase in the uptake of ^{131}I FIAU compared to controls that did not express HSV-tk. In vivo experiments investigated the kinetics of ^{131}I FIAU after intravenous injection in a canine. Prior to transplantation, cells were labeled with ^{111}In tropolone and directly injected into infarcted myocardium of the same canine. High non-specific uptake of the reporter probe necessitated the use of ^{111}In tropolone for a priori information to initially locate cells[3]. Furthermore, work done in this model also demonstrated how important corrections for physical effects such as scatter, cross talk between the ^{131}I and ^{111}In energy windows, and attenuation were to relative quantification of data[4]. Time activity curves generated from 20 hours of SPECT acquisition demonstrated that these corrections improved correlations with high purity germanium well counter measurements considered to be our gold standard.

Canine studies measuring the washout effects of ^{131}I FIAU compared to ^{111}In tropolone demonstrate cell viability over 40 hours of SPECT imaging but also cell function. In these studies, HSV-tk expressing cells were incubated in vitro with ^{111}In tropolone and ^{131}I FIAU and transplanted into canine myocardium and imaged with SPECT. Following maximal uptake, ^{131}I FIAU washout was much faster than that of ^{111}In. As ^{111}In activity reports on cell viability, this greater ^{131}I FIAU efflux could not be explained by cell death alone. This dual isotope SPECT technique demonstrates a powerful method for evaluating different reporter genes and probes in vivo. ^{111}In imaging allows us to obtain information about cell viability and without it premature probe efflux might suggest massive cell death. Future work would include evaluating other reporter genes and probes using this dual isotope system.

Molecular Imaging and Dual Isotope SPECT

The success of dual isotope SPECT imaging depends on its ability to accurately and precisely locate transplanted cells and quantitatively measure radioactivity. Molecular imaging techniques must use sensitive imaging technologies to detect low abundance signals and this relies on the inherent sensitivity of the imaging modality, the signal intensity from each reporter molecule and how well this can be amplified. We have shown that SPECT has the sensitivity to track small amounts of activity[5], but is hampered by poor resolution due to the inability to locate the exact location of radioactive decay. What does this mean for molecular imaging with SPECT? We can start by understanding the biological determinants of image quality with respect to in vitro radiolabeling and genetic-based tracking techniques, but first we must make a number of assumptions. It must be assumed that once co-labeled cells have been transfected with the reporter gene, they remain viable once transplanted within the myocardium. Secondly, we assume that the cells will grow within their new environment. Lastly, we assume that the reporter gene is stably integrated and therefore maintains expression as the transplanted colony grows. With these assumptions in place, we can quantify how biological parameters influence SPECT performance. Computer simulations were done on a digital phantom modeling transplanted cells in the myocardium based on experimental canine data. Specifically, a number of scenarios considered the significance of a priori size and location from the ^{111}In tropolone in vitro radiolabel, the effects of colony growth, and the influence of poor ^{131}I FIAU reporter probe specificity to cells expressing HSV-tk on SPECT performance[6].

Looking at the affects of colony growth, it would be expected that ^{111}In signal would become diluted while maintained HSV-tk expression with colony growth would mean that ^{131}I uptake would increase. In fact, the results show that as the colony grew, precision estimates for ^{131}I signal to background improved substantially. Interestingly, ^{111}In signal to background also improved despite signal dilution.

Accurately imaging molecular events non-invasively is largely dependent on the specificity of the probe and high non-specific uptake would create difficulties in delineating the site of target expression. In our study, it was clear that a priori information from the ^{111}In radiolabel was necessary to quantify and locate ^{131}I accumulation in transplanted cells. This was especially true when contrast and counting statistics were poor. Regardless, this benefit was temporary due to the effects of physical decay and ^{111}In signal dilution resulting in compromised precision in identifying the size and location of the transplanted cells. In contrast to this, simulation results show that as ^{131}I signal to background increases due to probe specificity, SPECT precision for cell colony detection improves substantially. These results suggest that SPECT sensitivity is not a major concern since improvements in probe specificity will contribute

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Report on the 48th Annual Meeting of the AAPM Orange County Convention Centre, Orlando Florida July 30-August 3, 2006

A students perspective

Submitted by: Niranjan Venugopal,
Graduate Student, CancerCare Manitoba, MB

Orlando is the perfect venue for the HOTTEST topics in medical physics"
– Jeff Siewerdsen (Scientific Program Co-Director, Imaging Program)

This year's 48th annual AAPM meeting took place in balmy Orlando, Florida. With an average daily temperature (Celsius) ranging in the thirties, Dr. Siewerdsen was correct, it definitely was HOT! But overall, Orlando is a great city with many international tourist attractions like Sea-World, Universal Orlando Resort, Walt Disney World Resort, Gatorland, Kennedy Space Center Visitor Complex, and myriad of other activities. The conference itself took place at the Orange County Convention Center. The facility, which is located along the serene International Boulevard, was an ideal location for the conference.

While many of you (full COMP members, and students alike) have had the experience of attending past meetings, for your's truly, this was my first AAPM. So this report may be particularly unique from previous *Interactions* reports on the AAPM.

The meeting started on Sunday July 30th and went on until Thursday, August 3rd. The content for an AAPM newbie, such as myself, can actually be quite overwhelming. This year there were over ~3700 attendees, 22 invited symposia, and 504 oral presentations. Because the meeting contains several concurrent sessions ranging in topics from *IMRT optimization*, to *Imaging the Tumor Micro-environment and Response to Therapy*, it was crucial to plan out your day, well in advance. This way you stood a chance to make it to a session that may be related to your research, or a talk that interests you. Luckily, the AAPM coordinators provide you with several methods to gain access to the meeting contents. One is your handy AAPM meeting pocket planner. Never leave the hotel room without it! For the tech savvy individual, you can bring along a laptop or wi-fi ready handheld pc and wirelessly tap into the online AAPM meeting homepage. This was a great feature that I saw many attendees making use of.

Each day, the AAPM presented a very large assortment of talks and educational courses. In talking to colleagues who have been to previous AAPM's, the format followed the usual style. From 7:30am to 9:30am there were the continuing education courses followed by the scientific sessions from 10:00 am to 12:00 pm. The afternoon sessions continued from 1:30 pm and lasted until 5:00 pm.

This was the typical schedule with the exception of Sunday, the first day of the conference. On the first day, the AAPM student meeting took place. This was particularly interesting to me, as it gave me a chance to meet and interact with other graduate students from the US & Canada. The talks in this section gave the speakers a forum to present some of their own ideas as to what the new and exciting areas of medical

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physics research were, and further emphasized the fulfilling career as a medical physicist. This session was well attended and as a student you definitely did not feel alone (which can sometimes happen when you are chained to a cubicle/lab doing research, not that I'm complaining!).

Shortly after this session was the Young Investigators Symposium. And I have to say that out of all the sessions, this one was the most well attended. The student talks, in general, were well done. This year, it seemed like the University of Wisconsin dominated the student talks with 3 out of the 10 talks being presented by their students. We did have one Canadian component in the symposium from McGill University which did very well. Keep reading for the results of the competition.

The moderated poster session, which took place later that day, were an excellent way to present and have discussions around a poster. The authors were present, and in a friendly manner the entire group had a chance to evaluate the work they did and bring about questions regarding their work. If possible, this is something that we could incorporate into our annual COMP meeting.

The dominant topic reflected through out the entire meeting, was centered on 4D CT, MVCT, inter-fraction organ motion correction, and deformable models. While IMRT QA also had a large following, the general interest in radiation therapies using mutli-modality imaging techniques was huge. Out of all the talks pertaining to all areas of therapy, for myself, the talk given by Dr. L. Xing from Stanford, entitled, *"Functional and Molecular Imaging for Radiotherapy Guidance"* was extremely fascinating. In this talk Dr. Xing showed how diagnostic imaging techniques, like PET and MRSI, have the potential to predict tumour response after treatment. The conclusion from this session was very clear. There is a growing need for a deeper understanding of tumour response, and then linking that understanding to our diagnostic imaging.

While the conference was very informative, and an exciting experience for an AAPM newbie like myself, the icing on the cake really came on Monday night at the AAPM Award Ceremony. I am very happy to report to you that the winner of the 2006 AAPM John R. Cameron Young Investigator Award went to our own Arman Sarfehnia from McGill University in Montreal who presented a talk entitled, "Radiation Quality in High Contrast Imaging with Orthogonal Bremsstrahlung Beams". Congratulations Arman! As Arman got the ball rolling, Michael Evans gave a superb introductory speech to this years William D. Coolidge Award recipient, Dr. Ervin B. Podgorsak. Dr. Podgorsak needs no introduction to the Canadian Medical Physics community. (In fact, I am now convinced anyone from a Canadian medical physics graduate program is somehow connected to him by at most 2 degrees of freedom!) Following the acceptance of this prestigious award, Dr. Podgorsak spoke very eloquently about his life, medical physics, and even fundamental differences in US and Canadian's views on life. It was a very proud Canadian Medical Physics moment. More information on the award and Dr. Podgorsak can be found at the AAPM website link http://www.aapm.org/org/history/bio/2883/ .

The Canadian "night out", which followed the award ceremony, took place across from the convention center at a Mexican pub and grill. The Canadian "night out" was organized by Sherry Connors, from the Cross Cancer Institute. It was well planned, and also doubled as a reception for Dr. Podgorsak. Everyone present had a great time, and most people got a chance to personally congratulate Dr. Podgorsak.

Lastly there was the planned AAPM night out at the Orlando Universal Resort. The Universal CityWalk Block party was really something unique. There was entertainment from five different venues. My personal favorite was "Bob Marley's", a Reggae bar featuring live music. But if you wanted to relax, chat with colleagues, and listen to live Spanish Guitar, the Latin Quarter was the place to be.

This year's 48th Annual AAPM meeting was definitely a fruitful conference, and for a first-timer it was an eye opener to a very large medical physics community. I'll definitely try to attend in the future. See you in Minneapolis next year!

I recently asked my son (age 4) what he wanted to be when he grew up. He said he wanted to be a computer programmer, like his dad. I then intimated that, perhaps, he should consider following in my career path, and becoming a physicist. He responded in a tone of shock and disgust at my foolishness, with which I am sure I will become more familiar as he gets older, "No Mom! That's a GIRL'S job!"

Courtesy Wendy Smith, Tom Baker Cancer Centre

Conference Announcements

WESCAN 2007

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IMPORTANT DATES:
Call for abstracts will go out in early January, 2007
Early registration cut-off: Wednesday, February 21, 2007
Deadline for discounted hotel rates: February 19, 2007

CONTACT INFO:
Scientific Chair: Marco Carlone (marcocar@cancerboard.ab.ca)
Local Arrangements: Sherry Connors (sconnors@cancerboard.ab.ca)
Shinny hockey: Alasdair Syme (alasdair@cancerboard.ab.ca)

Web pages of interest:
www.wescan.org
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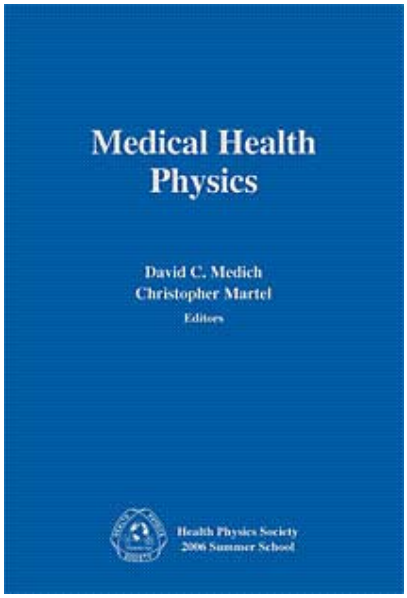
Book Review:
Medical Health Physics
Edited by David Medich and Christopher Martel



Textbook prepared for the 2006 Health Physics Society Summer School held at Brown University in Providence, Rhode Island

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Submitted by Don Robinson
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This text begins with a brief overview regarding the practicalities of conducting a radiation protection program at a medical institution. While focused upon the regulatory environment specific to the United States, the astute reader will glean valuable insights applicable to other jurisdictions as well. Chapter 2 provides a rudimentary introduction to the basics of patient related dosimetry encountered in the field of diagnostic imaging. The unfortunate use of outdated units such as "rem" and "Rad" in this chapter and throughout the remainder of the book serves to detract from its didactic impact. Chapters 3, 4 and 5 provide basic reviews covering diagnostic radiographic equipment, Nuclear Medicine instrumentation with an emphasis on PET, and brachytherapy respectively. Particularly useful is the provision of brief subsections in chapter 3 covering history, operating principles, prevalence of use, utilization, principles of evaluation, shielding considerations, patient dosimetry, and other pertinent factors for each modality. The emphasis given to PET in Chapter 4 is warranted due to its increasing clinical importance. Chapter 6 presents a brief but useful introduction to practical aspects of licensing with regard to the use of radioactive materials. Of particular interest are some insightful recommendations concerning the manner in which a license application should be worded. Chapter 7 covers many of the issues that a medical physicist may expect to encounter when participating in medical research. The role of the medical physicist in handling incidents of misadministration is explored in Chapter 8. Several examples along with corrective actions are provided. Chapter 9 provides a brief introduction to the issue of source tracking which has attracted considerable attention in the wake of the September 11 terrorist actions in the U.S. The subject of radioactive waste management is examined in Chapter 10 and covers topics ranging from staffing requirements to the disposal of radioactive sources. Also included at the end of this chapter are a number of appendices for easy reference containing exerts from the regulations of the U.S. Nuclear Regulatory Commission (NRC). A timely review of medical laser safety is presented in Chapter 11. Shielding considerations are the focus of Chapters 12 and 13. The calculation of transmission factors for primary, scattered and leakage radiation barriers specific to diagnostic energies is covered in Chapter 12 while a brief treatment of door and maze shielding for high energy accelerators is presented in Chapter 13. Dealing with a radiation related emergency is dealt with in Chapter 14. A reflection of the time in which Americans find themselves living, the focus here is upon preparedness for the aftermath of a terrorist action involving the detonation of "dirty bomb" or radiological dispersion device. Unfortunately, only passing mention is made of incidents such as radioactive spills and accidental exposures which medical physicists will more likely have to deal with in the course of their careers. Safety audits are the subject of Chapter 15 and this subject is covered from the perspective of a U.S. regulatory inspector. Practical suggestions with regard to preparations for a safety audit are presented in Chapter 16. A concise and well balanced review of the basics of radiation related health effects is provided in Chapter 17. A brief overview of the management of an effective radiation safety program rounds out this volume with numerous practical tips for an RSO.

This text provides a good basic introduction to the subject of health physics which will be helpful to those new to the field. Particularly useful are the numerous references provided at the end of each chapter which render this book a valuable reference volume.

2006 COMP/CCPM Annual Scientific Meeting Survey Results

Submitted by:
Nancy Barrett
COMP Executive Director

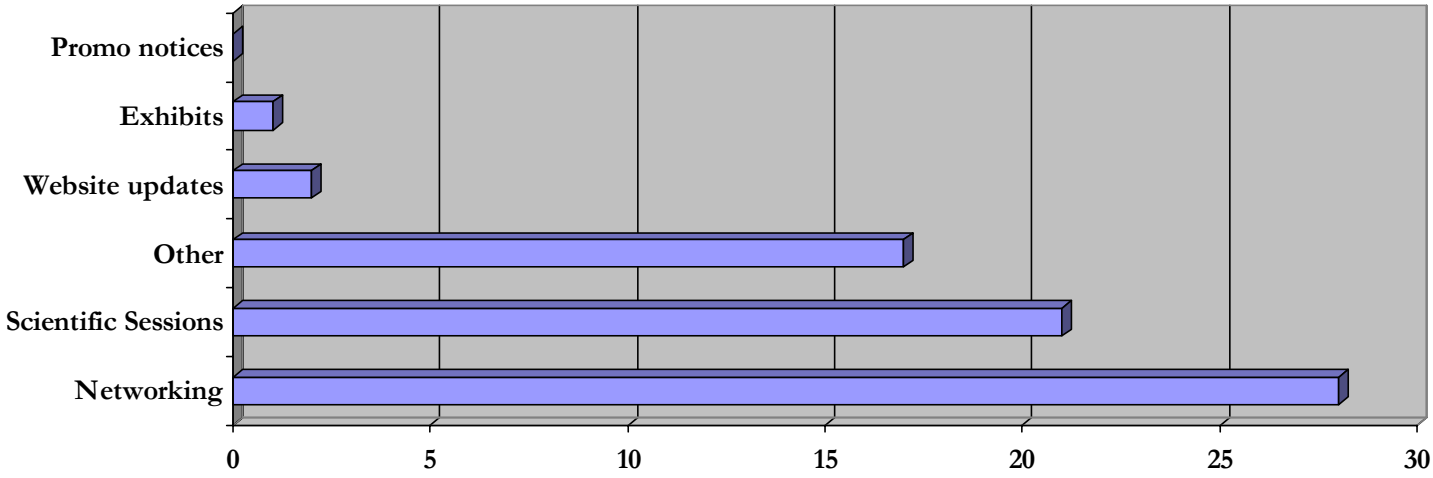
The motto for this year's Annual Scientific Meeting: "Bright Past, Brilliant Future" was quite fitting given the resounding success of this years meeting, and our hope for the continued success of our meetings. As you will see, virtually every aspect of the meeting – from the presentations to the program to the technical exhibit – were a hit with registrants. Before we analyze the results of the survey, we would first like to thank the 69 participants who took their time to respond to the survey. Further congratulations go to Mare-Claude Lavallée whose name was drawn from the survey participants to win a $50 Chapters gift certificate.

Once again delegates came away from our Annual Scientific Meeting with a positive impression of the events. Of particular note, the Gold Medal Awards Ceremony was extremely well received, with 93% of attendees rating it Excellent or Very Good. Furthermore, the CCPM Symposium and the Scientific Sessions were also well received. In fact, if you go down the list, there are very few aspects of the meeting that didn't receive the majority of their responses in the Excellent or Very Good categories.

Looking at what influenced the decision to attend this year's Annual Scientific Meeting, the general consensus was to network and to learn, as can be seen from the chart on the next page.

In terms of the direct questions:
The majority of the registrants stayed at the Delta Bessborough (65.2%), with 23.2% staying at another hotel, 8.7% staying at the University residence and 2.9% staying elsewhere.

	Excellent	Very Good	Good	Fair	Poor	N/A
Online registration process	41%	43%	6%	6%	3%	1%
Onsite registration	23%	29%	6%	0%	0%	42%
Conference Materials	30%	48%	20%	1%	0%	0%
Accommodations	35%	45%	16%	3%	0%	1%
Cost of Accommodations	9%	33%	41%	14%	0%	3%
Coffee Breaks and Lunches	41%	35%	17%	4%	3%	0%
Value for the registration fee	39%	42%	14%	1%	1%	1%
Ice Breaker Reception	23%	55%	14%	1%	0%	6%
Public Lecture	33%	41%	19%	1%	0%	10%
CCPM Symposium	23%	51%	14%	1%	0%	10%
Scientific Sessions	16%	70%	13%	0%	0%	1%
Vendor Exhibits	7%	55%	25%	9%	0%	4%
Poster Session	1%	51%	30%	13%	1%	3%
Gold Medal Awards Ceremony	64%	29%	4%	1%	0%	1%
Final Banquet	49%	33%	9%	3%	1%	4%
CLS Tour	9%	23%	22%	9%	3%	35%



The preferred month for the Meeting is June (72.5% of respondents)

To the question: "If the COMP/CCPM meeting was scheduled close to the AAPM meeting, would you be more likely to attend?"; 65.2% said the COMP/CCPM meeting, 23.2% said the AAPM Conference, and 11.6% said both.

To the question: "What is your preferred venue for the Annual Scientific Meeting?"; 63.8% said a downtown hotel or conference centre, 21.7% said a University campus and 14.5% said a Resort facility.

To the question: "Would you attend a COMP/CCPM meeting if it took place outside of Canada?"; 73.9% of respondents said Yes with 26.1% saying No.

To the question: "Would you like to see plenary speakers invited to start each scientific session?"; 63.8% of the respondents said Yes with 36.2% saying No.

To the question: "Overall, what did you like best about the Saskatoon meeting?"; the Gold Medal Award Ceremony was mentioned in glowing terms by a number of respondents. The respondents also noted the quality of the scientific papers and sessions, and in general the opportunity to network with colleagues and reacquaint themselves with old friends.

To the question: "Overall, what did you like best least the Saskatoon meeting?"; a number noted that the seating arrangement at the conference hall was less than adequate. Other respondents noted that the food was either of a poor quality or the portions were too small.

To the question: "What would improve your conference experience?"; the respondents noted that there could be more plenary lectures/scientific sessions or perhaps continuing education sessions. They also thought that it would be helpful for COMP-CCPM to organize hotels and flights so as to reduce cost.

We would like to thank you once again for participating in the survey. We will use the information gathered as we prepare for the 2007 meeting. If you would like to see the full results of the survey, please contact Nancy Barrett at 613-599-1948 or nancy@medphys.ca.

The Night/Wipe out @ the AAPM !

Submitted by:
Milton Woo, Toronto-Sunnybrook Cancer Centre, Toronto, ON

The AAPM night-out almost became a wipe-out. There was a police incident near Universal Studio involving a car with 3 men which rammed into a police officer. Two were arrested but one got loose and escaped into the area, which was full of trees, bushes, and, worst, lots of tourists. A huge manhunt was launched, with helicopters and tens of cruisers, blocking many intersections and streets in the area. Our buses from the hotels to the Universal Walk were snarled in traffic. We were thinking by the time we got in it would be time to turn back. Luckily, the bus drivers somehow managed to inch toward the entrance, and most buses managed to arrive around 8:30pm, after leaving the hotels around 6pm. The party was extended from 9pm to 10:30pm, so not all had been lost ! Food was aplenty and the liquor was flowing fast, and music was everywhere. At some venues people were up and salsaing away. A good time was had by all.

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in the loop and to ensure that we employ sound business practices throughout the organization. To obtain a good cross-section of ideas, we will invite some members from outside of the executive to take part in the strategic planning exercise and will survey the membership to obtain your input. Your input is important to us. Please respond.

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and choose from them wisely so that we can maintain the advantages of a close-knit community while playing a meaningful role both nationally and internationally." A formal strategic planning process will help us as we move forward.

As always, your feedback and suggestions are welcome at any time.

Wishing you all the best,

Nancy Barrett
Executive Director
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613-599-1948

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with no easy means of verification except during beam-on. This was rather surprising considering the immanent first installation of the new unit in Marseille, France.

Overall, the conference was a wonderful opportunity to learn from other users, dialogue with the vendors, and to experience some Korean culture. We were pleasantly surprised to hear that the next Gamma Knife® conference in 2008 will be in Canada in historic Quebec City. Hopefully we will have a large Canadian representation.

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significantly to enhancing molecular imaging with dual radionuclide SPECT.

Conclusion

In light of the significant amount of research done to date, it is clear that regenerative therapy using cell-based approaches in damaged myocardium has further to go. Successful pre-clinical models have fueled the excitement leading to premature clinical evaluation with mixed results. Despite the existing hurdles in myocardial stem cell therapy, this creates the need for evaluation in large animals using clinically available imaging techniques to non-invasively determine the efficacy of therapy under many experimental conditions. Furthermore, molecular imaging techniques which combine concepts of molecular and cellular biology with medical imaging allow us to study molecular aspects of transplanted cells in vivo, either for tracking purposes or for interrogating various features of cellular function. Key issues in developing molecular imaging techniques will be specificity in reporter probe design for detecting changes on the cellular or molecular level as well as the degree of signal amplification with respect to the reporter gene. On the imaging side, MRI and PET edge out SPECT with respect to resolution and sensitivity, but looking at the overall picture, hybrid SPECT/CT imaging has multi-spectral capabilities, which may largely benefit myocardial stem cell therapy. The advantage here lies in the ability to simultaneously image parameters of the underlying tissue such as viability, molecular imaging with respect to transplanted cells, and acquiring high-resolution anatomical information with CT all within one imaging session. As the innovation behind hybrid imaging continuously develops, the future of stem cell therapy will be bright.

For additional information, contact:
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References

Kong H, Merrifield PA, Wells RG, Sykes J, Thornhill R, Wisenberg G, Zabel P, Blackwood KJ, Kovacs MS, Fathmiani M, Noonan L, Jin Y, Prato FS. Myocardial stem cell therapy in an autologous canine model of myocardial infarction: a multi modality approach to stem cell tracking and therapy evaluation using PET/CT and MRI. J Nucl Med. 2004; [Abstract] 45:215P.

Wells RG, Kong H, Blackwood KJ, Merrifield PA, Wisenberg G, Sykes J, Noonan L, Jin Y, Kovacs MS, Zabel P, Prato FS. Towards myocardial stem cell therapy: tracking autologous mesenchymal bone marrow cells labeled with 111-In-tropolone in a canine model of myocardial infarction. J Nucl Med. 2004; [Abstract] 45:59P.

Blackwood KJ, Kong H, Stodilka RZ, Kovacs MS, Wells RG, Sykes J, Jin Y, Noonan L, Dhanvantari S, Merrifield PA, Wisenberg G, Prato FS. Multi isotope SPECT to track autologous canine bone marrow cells transplanted into infarcted myocardium in vivo. J Nucl Med. 2004; [Abstract] 46:258P.

Stodilka RZ, Blackwood KJ, Kong H, Prato FS. Method for quantitative cell tracking using SPECT for the evaluation of myocardial stem cell therapy. Nucl Med Comm [In Press].

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Department Of Physics & Atmospheric Science

The Department of Physics & Atmospheric Science, Dalhousie University invites applications from outstanding candidates for a tenure-track faculty position, beginning July 1, 2007. The successful candidate will have a PhD, a strong background in physics, demonstrated research excellence in biological or medical physics, and the ability to teach effectively. Ideal candidates would demonstrate strong funding potential from CIHR, CFI, and NSERC. Our priority is excellence and all researchers in biological physics (**theory or experiment**) or medical physics are encouraged to apply and will be seriously considered.

Our Department (see www.physics.dal.ca) is vibrant and research-intensive with an emphasis on materials science, medical and biological physics, and atmospheric science. Our many new faculty members have all obtained significant CFI and NSERC funding to support their research programmes. Dalhousie, with 17,000 students (3,800 graduate), is a major research and teaching university with an excellent Faculty of Medicine. Halifax is the largest city in Atlantic Canada, is on the coast, and offers an outstanding quality of life.

Applicants should submit a current CV and statements of both proposed research directions and teaching interests, and should arrange for at least three letters of reference to be sent to us directly. The review process will begin **October 15, 2006** but applications will be accepted until the position is filled. For specific inquiries, phone 902-494-6852 or email physics@dal.ca. Please send application materials to:

Chair of the Search Committee
Department of Physics and Atmospheric Science
Dalhousie University
Halifax, Nova Scotia CANADA
B3H 3J5
fax: 902-494-5191

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. Dalhousie University is an Employment Equity/Affirmative Action employer. The University encourages applications from qualified Aboriginal people, persons with a disability, racially visible persons and women.

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