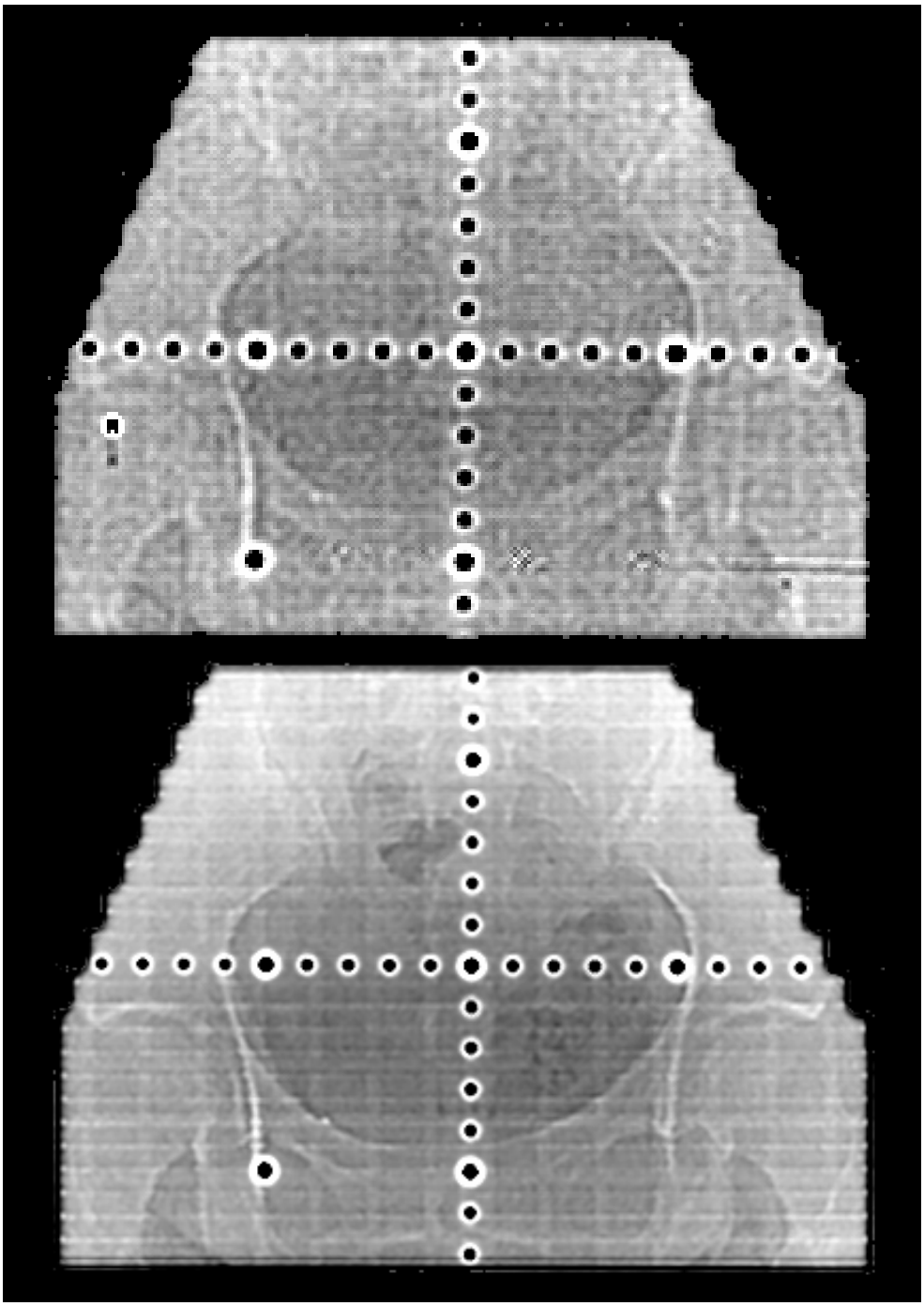
InterACTIONS

CANADIAN MEDICAL PHYSICS NEWSLETTER
Le BULLETIN CANADIEN de PHYSIQUE MÉDICALE



Flat Panels Arrive

COMP OCPM

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LE COLLÈGE CANADIEN DES PHYSICIENS EN MEDECINE

46 (2) avril/April 2000

Flat Panels Arrive

The Vancouver Cancer Centre is currently beta testing an amorphous silicon flat panel electronic portal imaging device (EPID). The PortalVision aS500 was installed in mid-February on a Varian 2100 EX dual energy linear accelerator. This involved replacing the existing liquid ion chamber cassette with the new amorphous silicon detector. Installation and initial acceptance testing were performed over a weekend, demonstrating the "plug and play" compatibility of the new imager with the existing imaging system. The cover photo shows two images of the same 38 year old female being treated for cancer of the cervix; both images were acquired at an energy of 18 MV. The upper image, which was acquired using the liquid ion chamber EPID and a 12 mu irradiation, shows the image quality typical of this device. The lower image, which was acquired using the amorphous silicon EPID and a 8 mu irradiation, shows the improvement in contrast resolution possible when using flat panel imagers. This is especially noticeable in the area around the pubis and the obturator foramen – at the bottom of the images. [Note, that both images have been processed using a morphological filter to maximise the displayed information. The dots are the projection of a graticule placed above the patient.] The lower image is not free from artefacts – it suffers from regularly spaced horizontal lines. These are most likely caused by imperfect synchronisation between the sampling of the amorphous silicon device and the pulsing of the linear accelerator. Different sampling schemes are expected to eliminate this artefact. Overall, the improvement in image quality suggests that electronic portal imaging may finally become a routine clinical activity, after a decade of disappointing clinical acceptance.

Images courtesy of Kurt Luchka, Physicist, Vancouver Cancer Centre

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, and advertising submissions can be made to:

P. Munro, London Regional Cancer Centre
790 Commissioners Road East
London, ON N6A 4L6
(519) 685-8500 x53317;
FAX (519) 685-8658
peter.munro@lrcc.on.ca

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.

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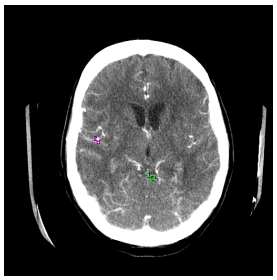


CT Functional Imaging……71
Ting Lee

Message from the COMP Chair:

Those of you ... will be well aware of the changing landscape that features the Canadian Institutes of Health Research. … COMP joined a number of other interested parties in suggesting that an institute of medical physics and biomedical engineering be included.

With the pressures of his "real" job, the peak of basketball season, and the ironclad deadlines of the newsletter editor, your chair is squeezed for time. I trust members will forgive me if I forgo my usual elegant prose (cough, cough) and resort to bullets to bring you up to date on the activities of your executive and a number of initiatives I have previously mentioned in this column:

- **Executive Director:** A search committee consisting of Paul Johns, Gino Fallone, John Schreiner and myself as chair has been formed to recruit a new executive director. Please refer to the advertisement on page 84 of this issue of the newsletter and encourage qualified individuals to apply.

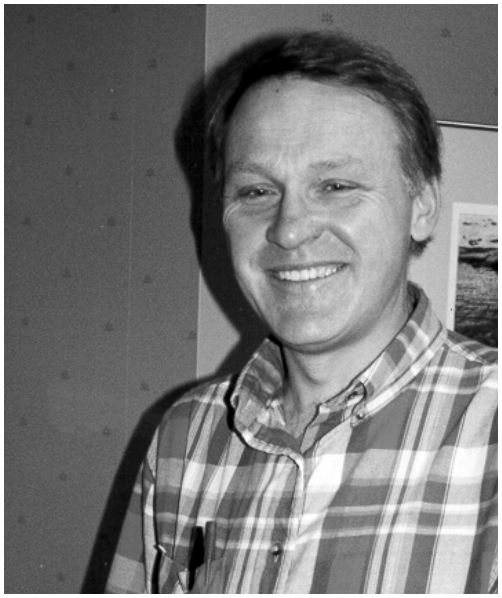
- **WC2000:** Many of you will have submitted papers to the World Congress in Chicago and are making your own plans to attend. I just want to mention the COMP reception to be held on Tuesday, July 25. This will be a great opportunity to mingle with your compatriots and compare notes on the Windy City. We have secured some corporate sponsorship for the reception, but Chicago is an expensive place and it will be necessary to levy a modest charge for admission to the reception. For more detail, see the notice on page 83 in this issue of *Interactions.*

- **Future conferences:** As you know, we are set for 2001 in Kelowna and 2002 in Montreal. We anticipate that in Chicago the members will be asked to approve plans to hold the 2003 meeting in Edmonton.

- **CIHR:** Those of you who are used to begging the Medical Research Council of Canada for money to support your research will be well aware of the changing landscape that features the Canadian Institutes of Health Research. The number and nature of these institutes has not yet been announced. COMP joined a number of other interested parties in suggesting that an institute of medical physics and biomedical engineering be included. This is a long shot, but the suggestion will at least give us some profile in the discussions.

- **NSERC:** I have written a letter to the President of NSERC bemoaning the fragmentation of NSERC-funded medical physics research and suggesting that the discipline code be amended to include medical physics, and that all such applications be directed to a single grant selection committee.

- **AECL/RPB:** I have written a letter to the Assistant Deputy Minister of Health supporting the proposal to incorporate the existing Radiation Biology and Health Physics group of AECL into the Radiation Protection Branch of Health Canada.



- **AECB QA:** My understanding is that AECB has contracted with a number of our numbers to write specific documents concerned with the quality assurance of radiation therapy equipment.

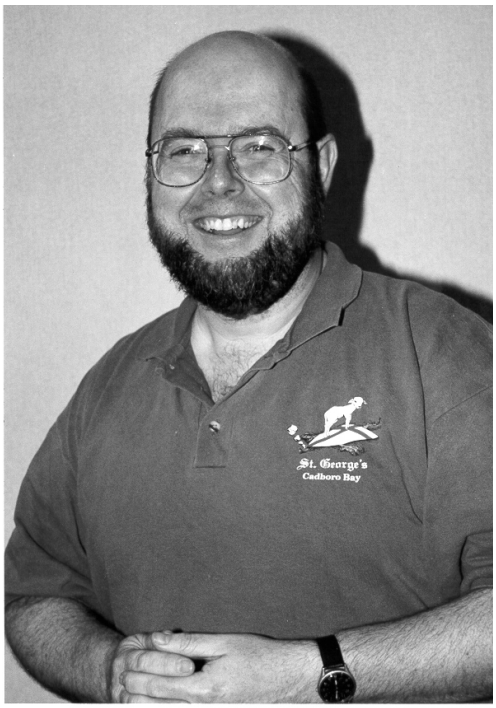
- **TG51:** Many of you know that the RPC in the US has converted to this new dosimetry protocol. Unfortunately our own committee on TG51 has not yet submitted its final report. I hope that it will be available for the July newsletter.

I apologize for the quick message…now, what channel was that Gonzaga game on?

Mike Patterson

Message from the CCPM President:

Well, winter is over and life and the College continue to march forward with the seasons. There is not much that is new in the Board's efforts, as most of the work continues along the lines discussed in the last issue of Interactions. Our main efforts have been devoted to completion of the dosimetry training guidelines and the first CCPM policy and procedures manual, and to establishing stronger



contact with other organizations, in particular, CAMPEP. A close to penultimate draft of the dosimetry document has been sent out of the physics community, and we have had some very good comments from radiation oncologists and cancer agency administrators across Canada. We continue to solicit comments, but are planning to complete the document this summer. A working draft of the College's policies and procedures has been finished, and the Board is now reviewing the document. This manual will help orient new people joining the Board and will establish the documentation that is now expected of organizations. The Board of CAMPEP has recommended that the CCPM be accepted as a sponsoring body and is soliciting approval from the original three sponsoring bodies. It is expected that this should come soon.

Given the time of year, the examination has been an important preoccupation for the Board. We are reviewing again some of the questions, primarily in the radiation oncology specialty. Some changes have been recommended, particularly to bring questions up to date with respect to recent task groups reports and documents. Our desire is to maintain the high quality the examination booklet achieved under Ervin Podgorsak, Terry Peters and Gino Fallone. If you have any particular concerns or suggestions, I would be very happy to hear them.

I have taken on a new joint COMP/CCPM role recently. I represent medical physics on the Human Resources Planning Working Group of the Canadian Strategy for Cancer Control (formed by Health and Welfare Canada, the Canadian Cancer Society, and the Canadian Association of Provincial Cancer Agencies). The group is analyzing the personnel difficulties experienced by the various professions involved in cancer care throughout Canada. Many of the issues that we have long been advocating for in terms of staffing levels, training of qualified medical physicists, staff recruitment and retention are being discussed by the working group. I will try to keep you informed on any developments.

That pretty well says where we are at. We are trying to continue to advance medical physics as have all the Boards since the College's inception. As we take on this work, I must say that I have one concern. In my past messages, and in discussions with members and fellows, I have asked for feedback and suggestions to help me and the Board focus our resources as we do our work. I am sad to say that, to date, I have received very little feedback. Before I made it to the Board I often heard people suggest that the College didn't do this or that. It was also suggested that the College was a closed shop with a Board not open to comments from the membership. I do not believe this perception to be correct and in my short time as president very few comments have been forthcoming. I hope that you feel the Board is receptive to your concerns and I would welcome any comments that I receive from the membership.

L. John Schreiner

I represent medical physics on the Human Resources Planning Working Group of the Canadian Strategy for Cancer Control … The group is analyzing the personnel difficulties experienced by the various professions involved in cancer care throughout Canada.

Unions and Collective Agreements - Therapy Physicists Enter the New Millennium

By Joanna Cygler, Andrew Kerr and Katharina Sixel

There are few issues that spark heated discussions and controversy the way unions and unionization do. Individuals otherwise known for formulating rational arguments and reasoning, fall back on statements such as "I don't like Unions" as though they were ice cream, or else counter with descriptions of coal miners working twelve hour days for pennies. However, the whole concept of unionization in a professional environment is not quite so black and white. How does the meaning of a traditional labour union meld with a white collar, academic world? How do we define exploitation and profit when the taxpayer foots the bill? These are the kinds of questions and concerns medical physicists working within Cancer Care Ontario (CCO) were faced with a few years ago. And yet, greater than the philosophical arguments, were the real practical issues that we had to deal with.

Prior to 1998, the CCO physicists were part of an association (OMPA) with an executive elected by all physicists within CCO and had negotiated terms of employment and salary scales directly with our employer. The last time such an agreement had been formulated was in the early 1990 pre Ontario government social contract days. However, as we have discovered, negotiating an agreement as an association is not quite the same as negotiating a contract as a bargaining unit. In fact, there are two very distinct differences. An agreement is not protected by law – it does not form a legal, binding document and therefore does not offer protection when the terms of the agreement are not met. Secondly, there is no legal obligation on the part of the employer to engage in the negotiations. As a non-bargaining unit, one cannot force the employer to the table and is therefore dependent on the employer agreeing to meet.

After the Ontario social contract ended in 1996, we approached our employer to discuss a new agreement. In the past, these discussions had been held with the head of CCO provincial human resources and had applied to all medical physicists employed by our agency, including department chiefs. Much to our surprise, when we came to the table, we found that the responsibility for negotiations had been delegated to CCO's chief bargaining negotiator. This individual negotiates all union contracts for CCO and is well versed in the rough and tumble world of collective bargaining. We felt a bit like fishes swimming with the sharks. Then, the first item of business was a question of representation. We were told that the executive of the association no longer represented chief physicists. This unilateral split of our professional group was unacceptable to all, including the chiefs. However, the question of recourse was difficult. We were entering into a realm of negotiations and confrontation without legal council. How were we to counter the claims of Head Office, navigate through the language of a contract, and more importantly, how were we to find the time to adequately represent our group. One option, of course, was to hire a lawyer directly. However, at $300 an hour this was hardly feasible for a group of 45 people. The other option was to join a larger group and negotiate within a collective. In other words, join a union. The problem was to select the union that would best represent our professional status.

By the fall of 1997 we reached the final decisions. The physicists of Cancer Care Ontario held a vote to certify and join the Professional Institute of the Public Service of Canada (PIPSC). PIPSC is a union that represents the scientists of the Federal Government research institutions, as well as other professional groups. We were confident to have affiliated ourselves with an organization that understood and respected the nature of our work. Our proposal was to regain full unity of our group, so that all medical physicists, chief physicists and medial physics residents working within Cancer Care Ontario would be included as part of a single bargaining unit. We felt strongly that the professional ties of these job categories were greater than any managerial relationships. Foremost, we were all medical physicists. Head Office disagreed, and contested union membership with the Ontario Labour Board. After a long year of hearings, the OLB ruling agreed with Head Office. Department heads and managers were excluded from the Union. However, physics residents and senior physicists were included. Once the eligible ballots were counted, 40 out of 44 votes were in favour of certification. The Cancer Care Ontario Medical Physicist Group of PIPSC was formed.

Our first task was to give formal notice to CCO that we wished to negotiate a first collective agreement, which we did on December 24, 1998. Almost one year later, December 17, 1999 a tentative settlement was reached. This contract was ratified at the end of January 2000 and now articulates all working conditions for Medical Physicists in Cancer Care Ontario. It is worthwhile to note that the entire cost of certification and negotiation processes was sustained by PIPSC. Our union dues clicked in only after the contract ratification date. It would be hard to find more generous support!

The bargaining process introduced us to a world very different from that of calibrations and chart checking. It is a very formalized process, with strict rules of conduct and a language all its own. Even seating arrangements around the table are calculated in advance. On our side, the bargaining team consisted of Joanna Cygler, Andrew Kerr and Dan Rafferty, our PIPSC legal representative, with Katharina Sixel as an alternate. Sitting opposite from us was the CCO chief negotiator, three chief physicists and a senior CCO administrator. The negotiations themselves were a strange mix of tedium, indignation and tit-for-tat. (In our view, the 'collective' of collective bargaining is a misnomer.) Proposals and clauses were presented by one side or the other. They were subsequently reviewed by each group on its own, and then countered at the next joint session.

(Continued on page 63)

Unions and Collective Agreements ... *(Continued from page 62)*

Navigation through the legal jargon, choosing words such as 'shall' versus 'may', ensuring that all potential circumstances are addressed – these all represent points where Dan Rafferty's guidance was essential. For us, besides the initial motivation of wanting a legal contract negotiated in a timely fashion, there were several key points that had to be captured by the agreement. First and foremost, the professional nature of our work and our work environment had to be reflected in the contract. Secondly, a reasonable salary scale was needed. No one working in Ontario should feel like a fool for not going south. But when the salary differential compared to other available jobs doubles and triples, something has to give. The contract had to address this point.

At the end of it all, we have, hopefully, a contract, which gives us a good framework within which to operate. Much of the text is based on existing CCO policies and procedures, with some key differences. Flexibility in working hours is recognized to accommodate clinical measurements done outside of normal operating hours. In addition, where clinical load and staffing shortages do not allow for lieu time, a provision for a limited overtime bank exists. Recognition is given to our professional certification processes, such as the Ontario Peer Review system, as well as the national CCPM. Provisions for attendance at conferences, continuing education and self-development are all included, as is a professional allowance to help support these endeavours. Many sections use consultative language so that decisions affecting the profession and the workplace can be made jointly. And, finally, the contract gives Ontario Medical Physicists a significant salary increase. Staying within CCO now becomes a viable alternative for those of us who would choose to make our lives here. (For details, see a job posting near you!)

Collective bargaining does not come without costs (besides union dues). Often, sacrifices are made on one issue for gains achieved elsewhere. Balance between the needs of individuals, the needs of the collective and professional requirements must be found. In addition, the emotional costs of collective bargaining should not be underestimated.

In context of the achievements made, the bargaining team would like to publicly express our special gratitude to Dan Rafferty. We came to appreciate Dan's intelligence and highly professional qualities. His knowledge of labour law is superb and he learned quickly about the world of medical physics and the nature of our work. On the personal side, his wit and sound objectivity helped us to preserve our sanity when the light was hardly seen at the end of the tunnel. Special appreciation should also go to Rob Barnett, the past president of OMPA (the predecessor of CCOMP) for his hard work on behalf of our group during the certification process.

Now, that we have finally been reborn in this new form, we will have to see how it serves us. Next round of bargaining is scheduled for June 2001. Any volunteers?

There are few issues that spark heated discussions and controversy the way unions and unionization do. .... How does the meaning of a traditional labour union meld with a white collar, academic world? How do we define exploitation and profit when the taxpayer foots the bill?

Treatment Crisis In Quebec

Ervin B. Podgorsak

Last summer the Bouchard government announced drastic measures to ease the severe crisis in Quebec radiotherapy. But seven months later, despite the government's good intentions, the situation has not improved.

Early cancer diagnosis and timely treatment are the best guarantees for recovery, and in the developed world a waiting period of more than two to three weeks between cancer diagnosis and treatment is considered unacceptable. In Quebec, hundreds of cancer patients currently wait more than three months for their therapy.

In summer of 1999, Health Minister Pauline Marois made two sensible decisions. Four cancer-therapy linear accelerators were to be purchased and installed immediately - three in Montreal and one in Quebec City - at a cost of $3 million each. In addition, the most urgent cancer patients were to be sent to the USA for treatment at an average cost of $14,000 each, compared to a $3,500 average in Quebec.

Since then, more than 300 Quebec patients have been treated in U.S. cancer clinics. The extra cost of more than $3 million for these treatments should be a strong incentive for the government to make every effort to improve the situation at home, if for no other reason than to save $10,000 per patient treated.

Unfortunately, while the treatments in the U.S. were organized with a minimum of red tape, Marois decreed that the purchase and installation of the four linear accelerators must comply with all applicable government rules, regulations, evaluations, studies and procedures. These involve countless government bureaucrats; as a result, seven months later, the four linear accelerators have yet to be delivered. So far, only one of the four machines has been ordered, orders for the other three continue to be entangled in the quagmire of government bureaucracy.

In comparison, the cancer clinic in Plattsburgh, N.Y., which was on the verge of closure last summer because of a shortage of patients, is now building a new bunker to install a new linear accelerator in response to the patient demand from Quebec. Thus, rather than solving the crisis at home, Quebec is building cancer-treatment facilities in the U.S. and is exporting not only cancer patients but also jobs and taxpayers' money.

The current waiting list for cancer therapy in Quebec results from a severe shortage of trained personnel and modern cancer-therapy equipment. Both shortages were produced by years of bungling and poor planning, not only by the Bouchard government but also by previous government administrations.

The shortage of radiation oncologists, medical physicists and radiotherapy technologists is caused mainly by government-decreed pay scales. These are not competitive in North America and make recruitment and retention of professionals extremely difficult. The equipment shortage, on the other hand, results from an expensive, extremely cumbersome and notoriously slow planning process that is tightly controlled by bureaucrats of regional health boards and the Health Department.

Making salaries and benefits of Quebec professionals competitive with the rest of Canada and transferring the decision-making and planning process from government bureaucrats to hospital-based professionals are obvious solutions to the Quebec cancer-therapy crisis in particular and Quebec health-care crisis in general. Unfortunately, these solutions clash with the government's goal of a balanced budget and its obsession with controlling every facet of life in Quebec.

This is by no means a call for abolishing the publicly funded medicare system; it is a plea for curtailing the costly, meddlesome and unproductive government bureaucracy and returning the decision-making power to hospital-based professionals.

Cancer therapy is a perfect example. If the government is prepared to pay $14,000 for a patient's treatment in the U.S., why could it not pay $4,000 to Quebec cancer clinics for each patient they treat? This amount would cover all operating costs including salaries and benefits for professionals as well as equipment maintenance. In addition, it would allow the clinics to purchase and replace equipment as required, without the cumbersome interference from the government bureaucracy. Moreover, it would allow a cancer clinic to operate like a business, not for profit, of course, but for the maximum benefit of patients. It would also encourage the cancer clinics to adjust to increased patient volume, plan for their future and offer competitive salaries to attract the best and most competent professionals.

The current cancer-therapy services in Quebec are in a very precarious condition. The Bouchard government should have the courage to implement innovative changes before it becomes too late. Quebec cancer patients deserve no less.

Editors Note: The article caused quite a stir in Quebec, with a large number of health professionals and patients agreeing with its contents. On the other hand, certain circles predictably were very upset by the article. It may be a pure coincidence that the McGill University Health Centre received government funding for a fast track expansion of its Radiation Oncology department, including two new high energy linac bunkers. The expansion is expected to be completed by the end of 2000.

Le traitement du cancer en crise au Québec

Dr. Ervin Podgorsak

L'été dernier, le gouvernement Bouchard a annoncé des mesures radicales pour résoudre la situation critique qui affecte la radiothérapie au Québec. Sept mois se sont écoulés et malgré les bonnes intentions du gouvernement, la situation ne s'est pas améliorée.

Il est reconnu qu'un diagnostic précoce et des traitements appliqués dans un délai raisonnable sont les meilleures garanties de guérison d'un cancer. Dans les pays développés, une période d'attente de plus de 2 à 3 semaines entre le diagnostic de cancer et l'initiation du traitement est jugée inacceptable. Or, au Québec, il y a présentement des centaines de patients atteints de cancer qui attendent plus de 3 mois pour leurs traitements.

L'été dernier, la ministre de la Santé Pauline Marois a pris deux décisions judicieuses. Quatre accélérateurs linéaires utilisés pour traiter le cancer devaient être achetés et installés immédiatement, soit trois pour la région de Montréal et un pour la région de Québec, au coût de 3 millions de dollars chacun. De plus, les patients ne pouvant plus attendre pour leurs traitements devaient être traités aux Etats-Unis à un coût moyen de 14,000$ par patient comparé au coût moyen de 3,500$ pour les mêmes traitements reçus au Québec.

Pendant les derniers sept mois, plus de 300 patients du Québec ont été traités dans les cliniques américaines. Le coût supplémentaire de plus de 3 millions de dollars que le gouvernement a dû débourser pour ces traitements devrait fortement inciter ce dernier à redoubler d'effort pour améliorer rapidement la situation actuelle au Québec, ne fût-ce que pour économiser plus de 10,000$ par patient traité.

Malheureusement, bien que les traitements pour les patients devant se rendre aux Etat-Unis furent organisés efficacement, la ministre Marois a décrété que l'achat et l'installation des quatre accélérateurs linéaires devaient procéder en respectant toutes les règles, règlements, évaluations, études et procédures en vigueur. Cela signifie l'implication d'innombrables bureaucrates du gouvernement avec le résultat que sept mois plus tard, les quatre accélérateurs n'ont pas encore été livrés. Jusqu'à présent, un seul des quatre accélérateurs a été commandé. La commande pour les trois autres accélérateurs demeure empêtrée dans le bourbier bureaucratique gouvernemental.

À titre de comparaison, la clinique du cancer de Plattsburg, New York, qui était menacée de fermeture l'été dernier par manque de patients, s'affaire maintenant à construire une salle blindée qui recevra un accélérateur linéaire afin de répondre au besoin créé par la venue des patients du Québec. Par conséquent, plutôt que de résoudre la situation de crise qui sévit dans les départements de radio-oncologie du Québec, le gouvernement québécois investit dans la construction d'installations utilisées pour le traitement du cancer aux Etat-Unis et exporte ainsi, non seulement des patients atteints de cancer, mais aussi des emplois et l'argent des contribuables québécois.

La liste d'attente actuelle au Québec pour les patients atteints de cancer resulte d'une grave pénurie de personnel spécialisé et d'équipement moderne de radiothérapie. Ces pénuries sont le résultat des nombreuses années d'incompétence et de manque de planification provenant non seulement du gouvernement actuel mais aussi des administations gouvernementales antérieures.

La pénurie de radio-oncologues, de physiciens médicaux et de technologues en radio-oncologie est causée principalement par les échelles salariales décrétées par le gouvernement. Ces échelles salariales ne sont pas du tout compétitives dans le marché nord-américain et rendent le recrutement de ces professionnels et le maintien de leur nombre extrêmement difficiles. D'autre part, la pénurie d'équipement est le résultat d'un processus de planification extrêmement lent, extrêmement encombrant et coûteux, étroitement contrôlé par les bureaucrates des Régies régionales de la Santé et du Ministère de la Santé et des Services Sociaux.

Il est évident que pour résoudre la crise qui affecte la radiothérapie en particulier et tout le système de la santé du Québec en général, il est nécessaire d'aligner les salaires et les bénéfices des professionnels québécois avec ceux du reste du Canada et de transférer le processus de planification et de décision des bureaucrates de l'Etat aux professionnels à l'emploi des centres hospitaliers. Malheureusement, les solutions proposées se heurtent aux objectifs du gouvernement d'obtenir un budget équilibré et à son désir de vouloir contrôler toutes les facettes de la vie au Québec.

Il ne s'agit aucunement ici d'une demande d'abolition du régime d'assurance-maladie financé par des fonds publics mais plutôt d'un appel lancé pour diminuer l'ampleur d'une bureaucratie gouvernementale coûteuse, envahissante et improductive et pour redonner le pouvoir décisionnel aux professionnels du milieu hospitalier.

Le traitement du cancer est un exemple parfait. Si le gouvernement est prêt à payer 14,000$ par patient traité aux Etats-Unis, pourquoi ne pourrait-il pas remettre aux départements de radio-oncologie du Québec un montant de 4,000$ pour chaque patient traité? Ce montant couvrirait tous les coûts de fonctionnement, c'est-à-dire les salaires et bénéfices marginaux pour les professionnels ainsi que les frais reliés à l'entretien des équipements. De plus, ce montant permettrait à ces départements de procéder à l'achat et au remplacement des équipements au moment requis sans l'ingérence de la bureaucratie gouvernementale. Ceci permettrait aussi aux départements de radio-oncologie de fonctionner sur le modèle d'une entreprise, sans but lucratif bien sûr, mais pour le plus grand bénéfice des patients. Ils pourraient faire les ajustements nécessaires lorsque le nombre de patients augmente, planifier pour leurs besoins futurs et offrir des salaires compétitifs afin d'attirer les professionnels les plus compétents.

Les services offerts actuellement au Québec aux patients atteints de cancer sont dans une situation très précaire. Le gouvernement Bouchard devrait avoir le courage de mettre en marche des changements novateurs avant qu'il ne soit trop tard. Les québecois atteints de cancer n'en méritent pas moins.

New Diagnostic X-ray Regulations in Canada

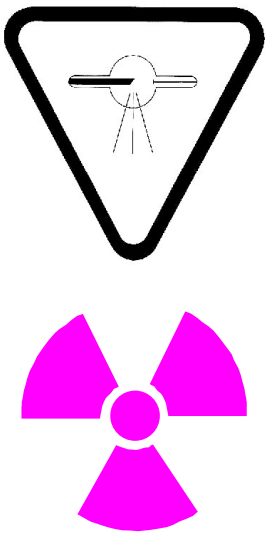
By John Aldrich, Vancouver

The diagnostic x-ray regulations that are currently in place were originally written in 1978 and are part XII of the Radiation Emitting Devices or RED Act. Safety Code 20A was written in 1981 and is a more general overview of safety in diagnostic x-ray and includes shielding calculations and reference doses. From our point of view it includes a very nice justification for the place of the medical physicist in the diagnostic radiology department,. The Act defines the standards of construction and functioning of x-ray equipment sold in Canada. Several provinces also use the Act for the definition of performance standards for routine testing. In BC as of April 1998 the Workers Compensation Board also regulates radiation as one of the hazards in the workplace and now uses the various Radiation Protection Bureau (RPB) Safety Codes to define performance.

For the last two years a new version of the Act has been circulating for comment and it has now been published in the Canada Gazette Part 1, which means it is about to become law. The new Act has drawn heavily on the International Electrotechnical Commission documents (IEC 601-1) and has made some changes to reflect changes in equipment in the US (CFR 1020.30).

So what changes are we going to see with these new regulations?

1. Firstly, some new definitions to confuse us. They have decided to use *radioscopic* instead of fluoroscopic, and *radiogram* instead of radiograph.
2. All radiation units are now in terms of grays and sieverts (with old units in parentheses).
3. Much to the delight of many of us the unique RPB x-ray sign (the x-ray tube in a rounded triangle) is no longer required, so the standard international radiation warning sign, the trefoil, is now accepted as a means of warning that radiation may be produced by the equipment.
4. Although many of us do check automatic exposure controls (AECs) on radiographic equipment, as this helps in clinical use, there have never been any federal standards. RED 2000 changes this. The AEC system now has to control the optical density of the film (oops, sorry – radiogram!) so that there is less than 0.15 OD change over the whole kVp range for a constant phantom thickness, and less than 0.2 OD change for constant kVp but changing phantom thickness. This actually is not as easy as it sounds, and it will take some work by the x-ray companies to achieve this. Of the last 10 radiographic units I recently tested half would have failed this test.
5. The focal spot indicator now only needs to indicate the position of the focal spot to an accuracy of 2 cm, when before 4 mm seemed easy enough to achieve.
6. KVp accuracy to 10% is required now rather than the previous 5%
7. Exposure time accuracy is now 10% +01 ms, although timer accuracy is seldom a problem these days.
8. For radioscopy (remember what that is?) there are new patient 'entrance dose limits'. The maximum air kerma rate is now 100 mGy/min (11.5 R/min, previously 10R/min) for standard automatic brightness controlled fluoroscopy units. There is also a new limit for units with *high level control* – 150 mGy/min (17.5R/min). These maximum air kerma rates are defined at specific distances for different types of fuoroscopic equipment – 1 cm above the table for undertable tubes, 30 cm from the image receptor at minmum SID for overtable tubes, 30 cm from the image receptor for a C-arm system, and 1 cm from the end of the beam limiting device for the high level control. It is difficult to know what this would mean for a typical angiography machine with high level control. For standard use the air kerma rate is limited to 100 mG/min at about 60 cm from the focus (30 cm from the IA); for high level use the air kerma rate is limited to 150 mGy/min at about 31 cm from the focus, or 40 mGy/min at 60 cm. I am told by the Radiation Protection Bureau that the final version will clarify this by removing the definition of the measurement point for high level use.
9. Compact C-arm systems commonly used in orthopaedics ('mini-c-arms') are now covered by the Act. The air kerma rate at any accessible point is restricted to 50 mGy/min (5.75R/min).
10. Lastly, there appears to be no requirement now for an audible indicator that 5 minutes of fluoroscopy has been completed, just a meter showing the total time.



I am told by the Radiation Protection Bureau that a new version of SC-20A is planned for 2001. Many of you will now that a new version of SC-20A came out in 1999, but with the current (viz 1978) RED Act as an addendum (you can download this from the RPB website at http://www.hc-sc.gc.ca/ehp/ehd/rpb/index.htm – search for "Safety Code 20A").

SPIEing on Imaging Physics

By James Mainprize with Peter Munro

The SPIE Medical Imaging conference 2000 was held in San Diego at the Town & Country Hotel February 12th - 17th 2000. The conference consisted of seven sessions held in parallel, with three sessions held at the beginning of the week (Image Display and Visualisation, Physics of Medical Imaging, Physiology and Function from Multidimensional Images) and four sessions starting in the middle of the week (Image Processing, PACS Design and Evaluation, Image Perception and Performance, and Ultrasonic Imaging and Signal Processing). Over 500 authors presented in oral or poster form. More details of the program are available at: http://www.spie.org/web/meetings/programs/mi00/conferences.html.

What used to be an intimate conference, which included poolside luncheons and numerous hot tub discussions, has ballooned into a much larger meeting. The largest increase has occurred in the Image Processing session, which had 183 papers this year. Session organisers are considering various alternatives to handle the increase in numbers, such as accepting a smaller fraction of proffered abstracts (currently ~65% are accepted) or creating an entirely separate meeting for the Image Processing session.

The key trend in the image processing, which deals with image segmentation and image registration, is to thoroughly evaluate the algorithms that have been developed. In a special workshop, Dr. Robert Haralick from the University of Washington in Seattle outlined a highly mathematical, conceptual framework by which algorithms could be tested. This framework included the development of a model (i.e., image) to be used for testing, testing the algorithms over all parameter space, and perturbing the model (e.g., adding noise) to examine the robustness of the algorithms. It is clear that this area of research is rapidly increasing in importance – the US National Institutes of Health is setting aside $10-20 million to set up a chest radiograph database and to test algorithms that can segment these radiographs.

The Physics of Medical Imaging session focussed primarily on x-ray detector development including amorphous silicon, amorphous selenium, lead iodide, mercuric iodide and cadmium zinc telluride. Detector designs included microstrip detectors, CCDs and flat-panel arrays. If you like to discuss MTFs and DQEs this session was for you! Talks also included several other fields including CT, tomosynthesis, functional imaging, optical and microwave imaging. One interesting presentation described an x-ray lens made from 2 phonograph albums!

One of the more novel image receptors was a system being developed by J. Ostling, A. Brahme and their colleagues from the Royal Institute of Technology and the Karolinska Institute in Sweden. Designed to operate at both kilovoltage and megavoltage energies, the imaging system relies on something called a gas electron multiplier (GEM), which is a planar gaseous detector recently developed at CERN by Fabio Sauli and his colleagues. The GEM consists of a gas ionisation region and a kapton sheet with 50 micron holes in it that has been plated with conducting electrodes. [The holes are apparently easy to manufacture using laser machining.] Photons interact in a converter upstream of the GEM (different converters are used for kilovoltage and megavoltage receptors), the gas is ionised, and then the ions are swept through the holes in the kapton sheet. Since the electric field is concentrated in the holes, a large (1000 x) amplification occurs. The amplified ion stream then reaches a readout plate, which will consist of a two-dimensional array of 1x 1 mm^2 individual pixels with each pixel connected to a charge-sensitive amplifier. While the device has a long way to go before it is clinically usable, it presents a very interesting design that can, in principle, handle kilovoltage radiography, megavoltage radiography, and possibly kilovoltage fluoroscopy as well!

Fluoroscopy with flat panels was also a hot topic at the meeting. One of the more controversial talks was given by Dylan Hunt (a student of John Rowlands from Sunnybrook and Women's College Hospital) on the possibility of amplifying signals in amorphous selenium. If one creates a large enough electric field in amorphous selenium (~10^8 V/m) then avalanche multiplication occurs to the electron-hole pairs created by the x-ray interaction. This is the basis of the HARPICON camera, a high-gain camera developed by NHK (the Japanese national broadcaster). However, making a large-area device that does not suffer from voltage breakdown is a tremendous fabrication challenge and many people in the audience were sceptical of the feasibility of this approach.

One of the real joys of the SPIE conference is the opportunity to be exposed to areas not normally encountered. The plenary session was given by Dr. Britton Chance a noted researcher who is currently the Director of the Institute for biophysical and biomedical research of the University City Science Center (Philadelphia) specialising in functional imaging with near infrared. Near infrared is undergoing the same transition that nuclear magnetic resonance underwent as applications switched from spectroscopy to imaging. There are now near infrared systems being developed to examine brain function, to detect breast cancer, and to study muscle function. Indeed, Dr. Chance discussed the concept of wearable near infrared systems.

As always Canadians can be proud of their showing at this meeting. Nearly 17% of the oral presentations had Canadian authors.

National Survey of the Training of Canadian M.Sc. and Ph.D. Graduates in Medical Physics

By William Que
Ryerson Polytechnic University

The supply and demand of medical physicists in Canada is a topic that is currently of great interest to the Canadian medical physics community. While recently it has been clear that there is a shortage of clinical medical physicists in cancer centres across Canada, there has been no published national data that address this issue in a quantitative and scientific way.

In the period of January to February 2000, I conducted a written survey, on behalf of Ryerson Polytechnic University, on the training of M.Sc. and Ph.D. graduates in medical physics in Canada. This survey is motivated by Ryerson Polytechnic University's interest in establishing a medical physics graduate program with emphasis on radiation therapy physics. (Ryerson currently has three medical physics faculty members and the fourth one will be hired in August 2000.) The results of the survey provide a partial understanding of the supply and demand issue. I would like to thank all those who responded to this survey, and in particular to Dr. Ervin Podgorsak of McGill University and Dr. Ellen El-Khatib of B.C. Cancer Agency for being very supportive of this effort.

The survey form (reproduced in the text box) was sent to the 13 medical physics graduate programs listed on the COMP website. They are: McGill University, University of British Columbia (B.C. Cancer Agency), Carleton University, University of Western Ontario, University of Toronto, University of Montreal, Dalhousie University, University of Manitoba, Laurentian University, McMaster University, University of Calgary, University of Alberta, and University of Saskatchewan. The results are presented in the table below.

The first four numbers in the last row are calculated by taking the current number of M.Sc. or Ph.D. students in each program, divided by the average number of years to complete the degree in each program, and then adding up the total.

Among the 13 programs, the program at Dalhousie University in conjunction with Nova Scotia Cancer Centre has not operated for several years and there is no plan to revive the program. Shortage of manpower and funding limitations at Nova Scotia Cancer Centre are cited as reasons for the situation. Laurentian University, McMaster University, University of Calgary, University of Alberta, and University of Saskatchewan did not respond to the written survey. However, these programs are believed to be either relatively small in size or do not have a radiotherapy physics component.

The results indicate that the number of Ph.D. level graduates in radiotherapy physics in the next few years will be very small. While the total number of Ph.D. students in medical physics has increased slightly from 14.6 per year to the current 16 per year, the number of Ph.D. students in the radiotherapy physics area has actually dropped almost 30% from 4.6 per year to the current 3.3 per year. In the next few years to come, there will be only 3-4 Ph.D.level graduates in radiotherapy physics per year entering the Canadian job market for radiotherapy physicist (residency) positions, assuming they choose not to leave Canada for better paid positions south of the border.

Current enrollment of Master's level students suggests that annually in the next few years there will be about 10 Masters degrees awarded in the area of radiotherapy physics. Of these, 3 to 4 likely will enter the Ph.D. program, so only about 6 to 7 will enter the job market. The total number of M. Sc. and Ph.D. graduates in radiotherapy physics will be about 10 per year. Assuming that the brain drain factor will remain the same as in the past five years (35%), the survey indicates that Canadian universities will contribute annually a total of 6.5 M. Sc. and Ph. D. level graduates in radiotherapy physics to the Canadian job market.

Ph.D. level medical physics graduates trained in areas other than radiotherapy physics may add to the pool of applicants for clinical radiotherapy physicist positions. However, it is not clear what proportion of them are interested in changing their career path to radiotherapy physics. Cancer centres must compete with universities, research institutes, industry and hospitals for those graduates.

This survey has only answered one side of the supply and demand equation. Is 6.5 radiotherapy physics graduates a year sufficient to meet the need for radiotherapy physicists in the long term? According to Dr. Tom McGowan, Coordinator of Radiation Treatment Program of Cancer Care Ontario, the long term need in Ontario alone is about 10 radiotherapy physicists a year. There is definitely a need to make a scientifically sound projection for the demand for ra-

(Continued on page 69)

The Survey

1. Current number of M.Sc. level graduate students in your program.
 (a) In all areas of medical physics
 (b) In radiation therapy physics
2. Average number of years to complete the M.Sc. degree.
3. Current number of Ph.D. level graduate students in your program.
(a) In all areas of medical physics
(b) In radiation therapy physics
4. Average number of years to complete the Ph.D. degree (beyond Master's portion).
5. The number of Medical Physics Ph.D. degrees awarded in the past five years
 (a) In all areas of medical physics
 (b) In radiation therapy physics
6. The number of Medical Physics M.Sc. degrees awarded in the past five years (Not including those who went into a Ph. D. program immediately afterwards).
 (a) In all areas of medical physics
 (b) In radiation therapy physics
7. Percentage of graduates leaving Canada immediately after graduation.

University	Number of M.Sc. Students		Average Number of years to complete M.Sc.	Number of Ph.D. Students		Average Number of years to complete Ph.D.	Ph.D. Degrees Awarded - Last 5 Years		M.Sc. Degrees Awarded - Last 5 Years		% Leaving Canada
	All areas	Radiation Therapy		All areas	Radiation Therapy		All areas	Radiation Therapy	all areas	Radiation Therapy	
McGill	17	13	2.25	4	4	3.5	8	6	26	23	16
Montreal	1	0	2	1	0	4	1	0	3	0	0
UBC	1	1	2	4	4	4	3	3	2	2	10
Toronto	21	2	2.7	18	0	4	7	1	18	0	32
Dalhousie	0	0	2	NA	NA	not offered	NA	NA	1	1	0
Western	17	1	2	32	3	4	37	5	34	0	60
Carleton	15	2	2.2	3	0	6	11	7	5	1	0
Manitoba	4	2	2	3	2	5	6	1	1	1	0
Total/year	33.65	9.43		15.99	3.29		14.6	4.6	18	5.6	

diotherapy physicists in Canada. Thus, there exists an opportunity for COMP/ CCPM to partner with Ryerson to conduct a national survey of cancer centres. I believe COMP/CCPM involvement is essential to ensure appropriate development of the survey and to promote the participation of cancer centres. We note that recently AAPM has formed a Medical Physicist Workforce subcommittee to look at the supply and demand issue in the U.S. It is of the best interest for our profession to make sure that future demand for medical physicists can be met by suitably trained personnel. The recent shortage of radiotherapy physicists has led to some tasks and positions that are the territory of medical physicists being taken over by other professionals. If we don't want our professional territory to be encroached upon further we must address the supply and demand issue.

On behalf of the Medical Physics Program Committee at Ryerson Polytechnic University, I would like to thank again all of you who cooperated with the survey. I would also like to encourage those programs that did not respond to the survey to do so in the next little while to make the survey data more complete. Your cooperation is appreciated.

I would also like to thank faculty members at Ryerson, particularly Professor Bill Whelan, who helped me to prepare this report.

Varian and GE Medical Systems Join in Marketing Agreement

By Deb Keep

Varian Medical Systems and GE Medical Systems recently announced an North American marketing, sales, and product development alliance. What does that mean for COMP members and cancer centres in Canada? As part of the alliance, GE Medical Systems' computed tomography (CT), nuclear medicine [including the Hawkeye functional anatomical mapping and positron emission tomography (PET) device], and other diagnostic imaging products will be made available to North American radiation oncology customers exclusively through Varian Medical Systems marketing and sales channels.

Perhaps of more significance to COMP members is that Varian Medical Systems and GE Medical Systems will also collaborate on future technology developments. The alliance is expected to lead to faster development of fully integrated systems, which should simplify their use in the clinical environment. One example, is that this alliance should provide significant improvements in connectivity. Currently, both companies use DICOM RT to transfer planning information between their systems. Although DICOM RT is a universal standard, the transfer of vital information is not always seamless. Starting with the Vision 6.0 products from Varian, the two companies are assuring their customers that the transfer of information between different pieces of equipment will be seamless and effortless. More importantly, as new and innovative technologies are developed, the two companies are committed to maintaining this seamless connectivity. Thus, upgrading one company's product will not disrupt the existing connectivity.

The two companies are optimistic that this alliance will lead to more effective marketing of products, to new products that will simplify clinical activities, and eventually, to improved treatment outcomes.

Book Review: The Modern Technology of Radiation Oncology:

A compendium for Medical Physicists and Radiation Oncologists by Jake VanDyk

Review by: B.G. Fallone
Cross Cancer Institute

This rather lengthy volume (1072 pages) represents a comprehensive compendium detailing (a) the design of various technologies in radiation oncology, and (b) procedures to implement into a clinical setting, and (c) the associated quality assurance (QA) procedures to maintain the technologies at acceptable levels. The book describes the technologies that are common in most radiation oncology centers, as well as, some more specialized technologies that would be available at specific centres. There are fifty-six expert contributors to this book resulting in twenty-five distinct chapters. Because the book addresses timely issues that are not easily found in a regular literature search, the book fills a big void in the medical physics literature, and should therefore be considered an important addition to the library of any medical physicist. Furthermore, if there would be a book (in addition to Johns and Cunnigham) that would fulfill most of the study requirements for the CCPM Membership and Fellowship examination in Radiation Oncology Physics, this is it.

The first two chapters of the book are general in nature. The book starts with an overview of radiation oncology, tissue response to radiation, dose accuracy achievable and that recommended, and nicely describes the responsibilities of all professionals involved with Radiation Oncology. Chapter 2 is rather unique, in that it is probably the only published book chapter that deals with general QA concepts, manufacturer's rather enhanced QA procedures, and total quality management, in general, and in radiation oncology in particular. A list of national societies, clinical trials groups, codes of practice, guidelines and reports are also given. This chapter is especially recommended because the information contained is not usually conveniently available.

Chapters 3 to 13 discuss basic clinical technologies of radiation oncology. These are respectively, patient immobilization techniques, projection simulators, CT-simulators, simulator-CTs, general imaging technologies, computerized treatment planning systems, kilovoltage x-ray systems, Co-60 teletherapy, medical accelerators, intensity modulation, and megavoltage radiography. Chapters 14 to 19 discuss more specialized techniques such as tomotherapy, stereotactic radiosurgery, total body irradiation and brachytherapy. Chapters 20-25 contains descriptions of specialized therapies that are limited to a restricted number of centers, many of which are undergoing clinic trials: proton and neutron therapy, hyperthermia and photodynamic therapies.

In summary, this book represents a comprehensive review of all technologies involved in conventional and state-of-the art radiation therapies, with extensive references at the end of each chapter for further study. … It is highly recommended for all university medical libraries and for all medical physics and radiation oncology departments.

There are some minor concerns with the book. (Reviewers of books must find concerns to complete their tasks). They involve (1) the content and (2) the form of the book.

For content, I find that the level of detail between different chapters is not consistent. The discussion in some chapters is very detailed and this is appropriate for this type of book, while some chapters give brief overviews. Furthermore, QA worksheets or the equivalent are not available for all chapters. The same level of description and detail should be implemented throughout the book for consistency.

For form, there are some minor issues:

(1) Grey-scale images are very poor throughout the book, and not appropriate for this type and price of book;

(2) Chapter headings and sub-chapter headings are in gray. This is distracting, perhaps the use of conventional bold would be more appropriate;

(3) Since the book is a compilation of various contributors, and as is commonly done for books that are edited, the names of contributors should be included on the headings of each chapter page. This facilitates the task of readers when searching for authors.

(4) Chapters should be re-arranged a little differently. Chapter 15 on Tomotherapy describes a very new technique that is not commercially available. It would have been more appropriately placed towards the end of the book where merging technologies are discussed rather than between chapters on radiosurgery and information systems. Chapter 19 which describes basic tools required for all radiation-delivery technologies, should have been placed immediately after Chapter 2 or Chapter 3.

In summary, this book represents a comprehensive review of all technologies involved in conventional and state-of-the art radiation therapies, with extensive references at the end of each chapter for further study. It was certainly a pleasure "flipping" through the pages of this superb reference compendium. It is highly recommended for all university medical libraries and for all medical physics and radiation oncology departments. It would be indispensable for graduate medical physics students, and particularly useful for the practitioner and researcher in medical physics and radiation oncology.

For readers who are interested, a chapter by chapter description of the book for Chapters 3 and beyond is available on the COMP web site at http://www.medphys.ca.

CT Functional Imaging

By Ting Lee
Lawson Research Institute,
Robarts Research Institute, and
University of Western Ontario

Editors note: This is the second of a series of articles examining changes that can be expected in the field of medical physics in the new millennium.

Introduction

CT scanning has usually been regarded as a 'mature' imaging modality for which further improvements would only lead to small incremental improvements rather than significant new directions in the field of medical imaging. However, since the 1980's several technical advancements have revolutionized CT scanning so that it has, once again, become an area of active imaging research. The technical advancements include: first, the introduction of slip-ring technology that permits rapid continuous scanning; second, the increase in image reconstruction speed from 15-20 s to 1 s for a 512 x 512 image; third, the development of multi-rows of detectors which facilitates more realistic 3D imaging because of the multi-slice capability. In this article, I will concentrate on one particular aspect of current research interest in CT imaging – CT Functional Imaging - which is the direct result of the fast scanning capability of current CT scanners.

What is CT Functional Imaging?

CT Functional Imaging or CTFI is the imaging of physiologic (functional) processes in a living biological tissue using CT scanning techniques. Since CT scanners measure linear attenuation coefficients, which depend on physical rather than physiological properties of a tissue, contrast media have to be injected to derive functional information with CT. A common imaging protocol is to use cine scanning after the injection to 'track' the bolus of contrast media as it passes through the tissue. Cine scanning is uninterrupted (continuous) CT scanning at the same couch position in contrast to helical (spiral) scanning where the couch moves continuously during uninterrupted scanning so that the X-ray beam follows a helical path on the surface of the subject being scanned. With current slip-ring CT scanners, the image acquisition rate with cine scanning can range from 1 to 2 images per second. This level of temporal resolution is sufficient to track the bolus of contrast media even in tissues with high blood flow such as the brain, kidneys and the liver.

Since contrast media are transported to the tissue by blood flow, contrast enhanced cine CT scanning can be used to measure blood flow, blood volume, and mean transit time in the tissue of interest. [See the text box for definitions of these quantities.]

The relationship between the values in the text box can be illustrated using an electrical analogy. If blood flow is equivalent to current, blood volume to the reciprocal of resistance, and mean transit time to the reciprocal of potential difference, then just as the Ohm's Law in electricity, we have the corresponding Central Volume Principle:

Blood flow = Blood Volume/Mean transit time.

Method

A cerebral blood flow study on a human subject will be used to illustrate how a CT functional imaging study is performed, the type of data acquired and the method for the calculation of blood flow image, blood volume image and mean transit time image.

In the study, the CT scanner was set up to scan at 80 kVp, 10 mm thick slice, 190 mAs per image and one image per second for 45 s, with reconstructions at 0.5 intervals, resulting in a total of 99 images. Contrast media at the dose of 300 mg/kg body weight (of iodine) was injected at the rate of 4 ml/s and started at the same time as the cine scanning. Fig. 1 shows an image from the set of acquired images when the concentration of contrast media in the brain is at its maximum. Fig. 2 shows the contrast concentration versus time curve in an arterial region ($C_a(t)$) and a tissue region ($Q(t)$) in the brain. Contrast concentration in both the arterial and tissue region is measured in Hounsfield Units (HU) and can be easily obtained as the increase (enhancement) in the mean CT number before and after contrast media is injected. The calculation of blood flow, blood volume and mean transit time from the measured arterial and tissue concentration curve is dependent on the concept of the impulse residue function, R(t). R (t) is the tissue concentration curve measured for the special case when the arterial concentration curve is a delta function normalized by blood flow such that an unit amount of contrast media is deposited in the tissue at time zero. R(t) can be directly measured only when contrast media is injected into the arterial input of the tissue, which, for most tissues, is very difficult to achieve non-invasively. For instance, in the case of the brain, direct measurement of R(t) will require injection into the internal carotid artery. By the principle of linear superposition, the tissue concentration curve for the case when the arterial concentration curve is

(Continued on page 72)

Definitions

Blood flow ($ml.min^{-1}.100g^{-1}$) – volume flow rate of blood through 100 g of tissue

Blood volume ($ml.100g^{-1}$) – volume of blood in 100 g of tissue. Most tissues in the body are autoregulated such that blood flow is maintained at a constant level even when arterial pressure fluctuates within a certain range. This is usually accomplished by dilation or constriction of the resistance blood vessels or arterioles leading to increase or decrease in blood volume respectively. In this sense, blood volume is inversely related to the vascular resistance of the tissue.

Mean transit time (s) – this measures the average time for blood (contrast media) to traverse the tissue from the arterial inlets to the venous outlets. The higher the linear velocity of blood flow the shorter the mean transit time and vice versa. In this sense, mean transit time is inversely related to the pressure head or perfusion pressure that is driving blood through the tissue.

an arbitrary function is the convolution of the arterial curve and the impulse residue function, i.e.

$$Q(t) = F\, C_a(t) * R(t)$$

where: F is the blood flow and * is the convolution operator. Since Q(t) and C_a (t) are measured using cine CT scanning, deconvolution between them would yield FR(t), or the blood flow scaled impulse residue function (Cenic et al 1999). The significance of FR(t) is that its maximum height and area gives blood flow and blood volume respectively. By the Central Volume Principle, mean transit time is then maximum height divided by area of FR(t) (Cenic et al 2000).

Fig. 3a shows the blood flow image corresponding to Fig. 1 calculated by the deconvolution method described above. The color scale shows the range of blood flow (0 – 60 $ml.min^{-1}.100g^{-1}$) represented by the different colors. Fig. 3b is the corresponding blood volume image for blood volume in the range (0 – 60 $ml.1000g^{-1}$).

Application of CT Functional Imaging in Stroke

The brain has an intricate system of control to maintain cerebral blood flow (CBF) within normal limits when cerebral perfusion pressure decreases. Dilation of the resistance blood vessels, i.e. the arterioles, reduces cerebral vascular resistance and increases the cerebral blood volume (CBV). This autoregulation of cerebral blood flow can be used to advantage when diagnosing the injuries created by a stroke. For ischemic but viable tissue, autoregulation would lead to increased cerebral blood volume, which in turn would lead to an increased mean transit time (MTT). [Remember that by the Central Volume Principle, mean transit time is the ratio of cerebral blood volume and cerebral blood flow and thus, if cerebral blood volume increases (and cerebral blood flow is held constant) mean transit time must increase.] On the other hand, for ischemic but nonviable tissue, autoregulation is abolished so that both cerebral blood volume and cerebral blood flow are reduced. In this situation, mean transit time may remain normal or only slightly elevated.

In summary, knowledge of cerebral blood flow, cerebral blood volume and mean transit time can distinguish between salvageable and infarcted tissue using the criteria outlined in the table below. And CT Functional Imaging allows us to measure cerebral blood flow, cerebral blood volume and mean transit time, quantitatively.

It is important to realize that it is the **mismatch** between cerebral blood flow and cerebral blood volume that discriminates between salvageable and infarcted tissue. Measurement of cerebral blood flow alone will **not** reliably differentiate between viable and non-viable ischemic tissue. To more accurately diagnose impending ischemic problems, the classical test of 'vascular' reserve evaluates the change in cerebral blood flow in response to increases in pCO_2 (partial pressure of CO_2) in brain tissue induced either by increasing inspired air concentration of CO_2 or by intravenous administration of a drug, Diamox (Nakagawara et al 1994). For normal brain, raised pCO_2 in tissue will induce a large increase in cerebral blood flow. For ischemic tissue, where autoregulation is still intact, because cerebral blood volume is already activated, the increase in cerebral blood flow will be attenuated. Thus, tissue with a positive reserve is viable whereas that with little or no reserve left is at risk of infarction.

Fig. 3 illustrates the above considerations in a patient who has a completely occluded left internal carotid artery. Fig. 3(a) and Fig. 3(b) are the cerebral blood flow and cerebral blood volume images before administration of Diamox. There is mismatch in cerebral blood flow and cerebral blood volume in the left hemisphere. After administration of Diamox, Fig. 3(d) shows that the asymmetry in cerebral blood volume between left and right hemisphere is reduced, and Fig. 3(c) shows that whereas cerebral blood volume in the right hemisphere increases that in the left hemisphere decreases. Fig. 3(e) is the difference between Fig. 3(c) and (a). Positive increases in cerebral blood flow are displayed in red colors and negative decreases in blue colors. Instead of an increase there is actually a decrease in blood flow in the left hemisphere, after Diamox. Similarly Fig. 3(f) is the difference between Fig. 3(d) and (b). There is also a paradoxical decrease in blood volume in the affected hemisphere after Diamox administration. These results suggest that this patient has exhausted the vascular reserve in the left hemisphere and is thus prone to ischemia attacks. This is corroborated by transient ischemic attacks (right-sided paralysis) which appear to be associated with activities such as transferring from a sitting to standing position.

Conclusions

CT Functional Imaging can be implemented using regular CT scanners. The fact that the study procedure is similar to routine contrast enhanced CT scanning makes it very simple and straightforward to introduce into clinical use. In the future, given the easy, around-the-clock accessibility of CT scanners, CT Functional Imaging may play an important and useful role for the treatment of stroke and cancer, where functional information could significantly alter the treatment of the patient.

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Ischemic Tissue Type	CBF	CBV	MTT
Viable	--	+	++
Infarcted	--	-	-/+

Fig. 1. CT image of the brain at maximum contrast enhancement together with an arterial region (2) and a tissue region (1)

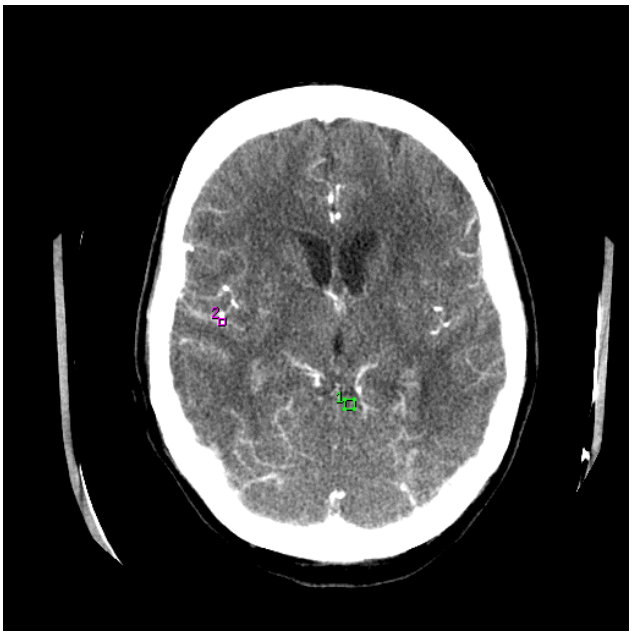
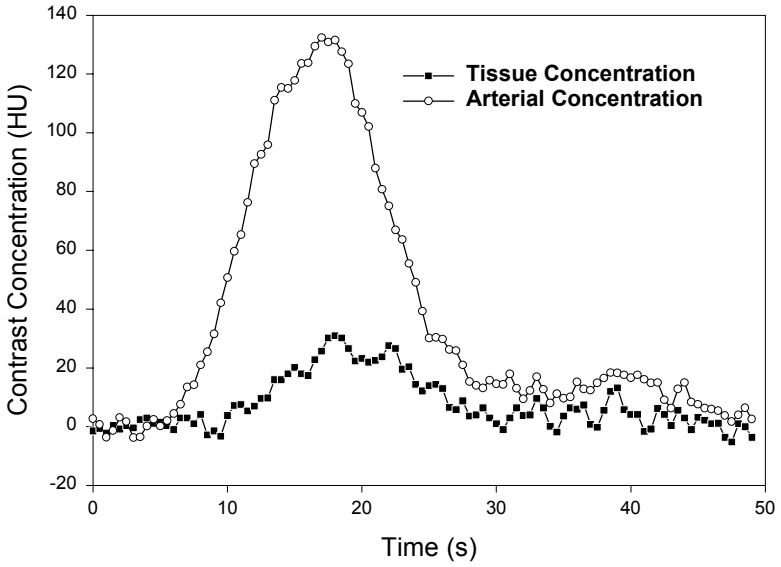


Fig. 2. CT derived concentration curves



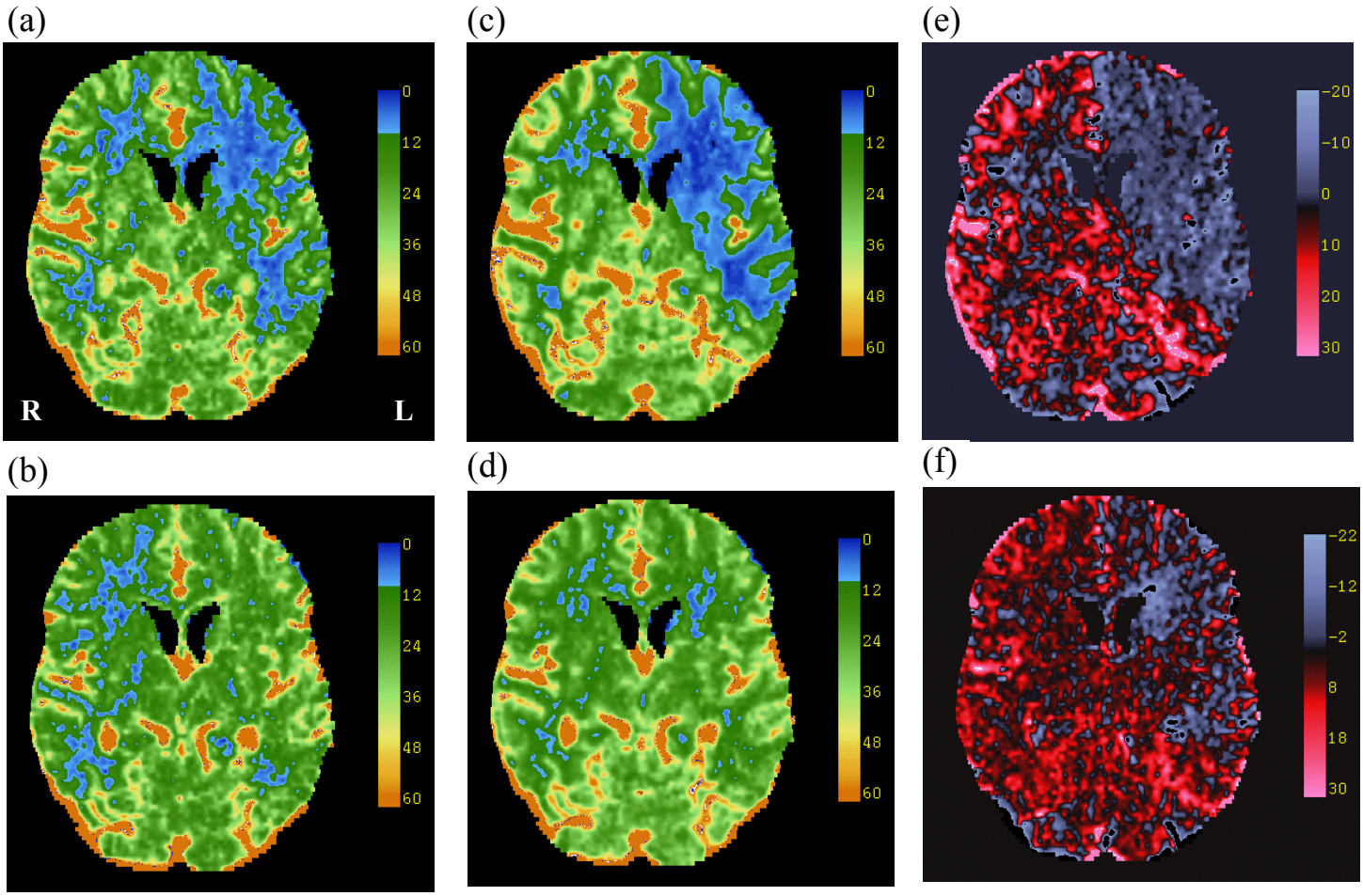


Fig. 3. Functional images of a patient with a completely occluded left middle cerebral artery. (a) CBF (b) CBV before diamox, (c) CBF (d) CBV after diamox, (d) CBF difference image, and (e) CBV difference image.

In Brief

W1K at McGill

The Medical Physics department at McGill University logged its 1000th consecutive weekly administrative meeting on January 25, 2000. While this may not be a milestone in scientific endeavor, it is a testament to the leadership and tenacity of **Dr. E.B. Podgorsak** over the last 20 plus years. Our service group (distinct from the academic group) comprises some 30 professionals including physicists, engineers, dosimetrists, machinists and clerical staff who provide service to radiation oncology, diagnostic radiology and radiation protection at three hospitals in the McGill system. Of the staff present at meeting number 1000, 5 remain from meeting number 1, a remarkable achievement considering the current funding crisis in our radiation oncology clinics. Despite the many problems over the years, the group has managed to support each other both personally and professionally, and will continue to meet once a week so as to address the day-to-day problems of medical physics (while trying not to take ourselves too seriously!).

Michael Evans

Stauffer Award

Bob Nishikawa has continued his award-winning publication record having recently co-authored a paper that has been given the Stauffer Award - the best paper published in Academic Radiology in 1999, in the basic science category. The award includes a prize of $1,500 US. The complete citation is: Jiang Y, Nishikawa RM, Schmidt RA, Metz CE, Giger ML, and Doi K. "Improving breast cancer diagnosis with computer-aided diagnosis", Academic Radiology **6:**22-33 (1999). The paper describes the benefits of an algorithm that uses the characteristics of micro-calcifications seen on mammograms to generate a percentage estimate of the likelihood of malignancy. The study used a set of 104 mammograms where the diagnosis had been confirmed by biopsy. On average, each observer recommended 6.4 additional biopsies for cases with malignant lesions and 6.0 fewer biopsies for cases with benign lesions, when assisted by the

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Quebec Medical Physics Gets a Boost

Michael Evans
Montreal, QC

The 2nd Annual Meeting of the Association Québécoise des Physiciens Médicaux Cliniques (AQPMC) took place on Saturday January 22, 2000 at the Montreal General Hospital. The association has approximately 45 members who are primarily employed as radiotherapy physicists. Considering the weather (minus 42 with wind chill) the meeting was well attended by about 30 physicists from Montreal, Quebec City, Trois-Rivières, Sherbrooke and Chicoutimi.

The business meeting in the morning dealt with professional issues concerning staffing and salary. The current president of the AQPMC, Jean-Pierre Bissonnette, was able to report on the contacts he had made with members of various government ministries, as well as the Quebec Hospital Association. A provincial task force was formed by the Ministry of Health and Social Services to look at the status of medical physicists, as well as predict staffing requirements for the next ten years. Since, on average, more physicists leave the province than enter, it was recognised that retention measures must be implemented, and that the salary issue would have to be addressed. There was cautious optimism that the salary crisis was receiving some attention, and that medical physicists were beginning to show up on government "radar-screens". Efforts regarding the formation of a professional order of clinical medical physicists are progressing slowly, since the Quebec Professions Office is undergoing a complete reform. The association attracted several new members in the preceding 12 months, and now represent the professional interests of most clinical medical physicists in the province.

The meeting was followed by a winter school entitled: "Modern Radiotherapy Technology and Techniques" organised by the New Technologies Committee of the AQPMC. This was the first year that a scientific session was added to the business meeting, and the effort was well received by the membership. The following six talks were presented:

1 Techniques avancées de simulation virtuelle (Advanced techniques with virtual simulation) Horacio Patrocinio, Centre de Santé de l'Université McGill

2 Optimisation de la dose par implants permanents (Dose optimization for permanent implants) Carl Côté et Nicolas Varfalv, Centre Hospitalier Universitaire de Québec

3 Reconstruction tomographiques et leurs applications aux traitements de curiethérapie interstitielle à haut débit (CT reconstruction and applications for interstitial HDR) Maryse Mondat, Centre Hospitalier de l'Université de Montréal

4 Implantation d'un réseau de données et d'images dans une nouvelle clinique de radiothérapie. (Implementation of a record-and-verify and PACS network in a new radiotherapy clinic). Daniel Michaud, Centre Hospitalier Régional de Trois-Rivières

5 L'irradiation pan corporelle par intensité modulée (An intensity modulation technique for TBI) Mario Chrétien, Centre Hospitalier Universitaire de Québec

6 Modulation d'intensité, planification inverse et leurs applications en radiothérapie (IMRT, inverse planning and their applications in radiotherapy) William Parker, Centre de Santé de l'Université McGill.

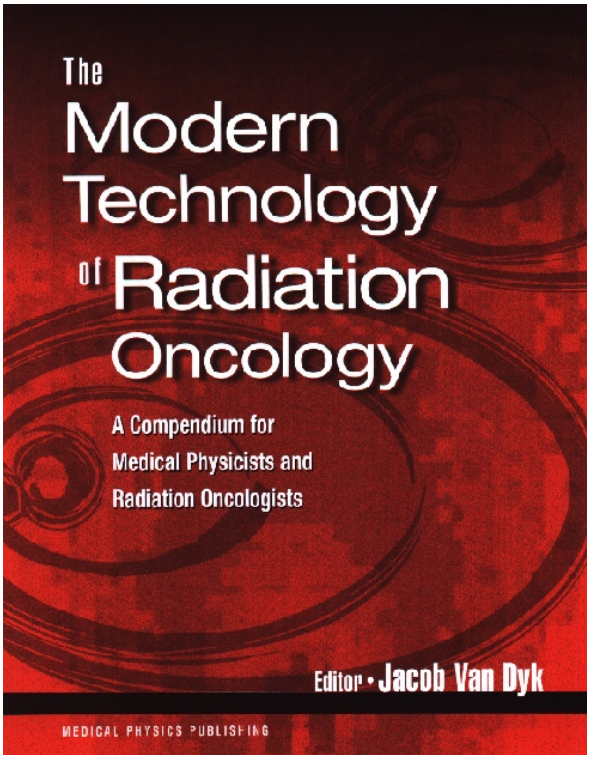
The meeting ended with numerous hands-on demonstrations of boosting car batteries, following which everybody dispersed across the province.

The Story Behind the Book

By June Johnson and Sherry Conners

Publication of **The Modern Technology of Radiation Oncology** was a real *tour de force* both by the book's editor, Jacob Van Dyk, and Medical Physics Publishing's (MPP's) editor, Betsey Phelps.

The contract for this 1,072-page book was finalized in April 1998. At that time, MPP expected to produce a book that would be about 500 pages in length and had set a finish date of July 1999. This date was chosen to coincide with the annual meeting of the American Association of Physicists in Medicine (AAPM).



Through considerable hard work and excellent organizational skills, Jake was able to send part of the manuscript to MPP as early as March 1999. Within a month, MPP editor Betsey Phelps had finalized the book design and had begun copy editing the manuscript. The length of the book ultimately exceeded the intended 500 pages by more than 100%, making the original late July deadline unattainable. However, with Herculean effort, Betsey, was able to produce several "prepress" copies of the book (which were about 90% complete) in time for the July meeting.

Final copy was turned over to the printer in mid-August, softcover books were available in October and hardcover books followed in early December—less than 18 months from contract date. It is regretable that, due to the printer's error, several graphics did not reproduce well. This will be corrected if sales warrant a second printing.

Review copies of the book have been sent to major reviewers in the US, Canada, Europe and Australia. A special promotion will be made in February to members of the European Society for Therapeutic Radiation Oncologists. Other special promotions are in early planning stages.

Publication of **The Modern Technology of Radiation Oncology** represents the largest single publishing endeavor – both in size and financial commitment – that MPP has engaged in during its nearly 15 years of publishing. MPP is indebted to Tomas Kron, Chief Physicist, Newcastle Mater Misericordia Hospital, Waratah, Australia, for suggesting the topic and for recommending Jake Van Dyk as the book's editor.

In Brief *(Continued from page 74)*

computer algorithm. This was the first study to show that "an automated classification scheme could improve radiologists' ability to distinguish calcifications associated with benign and malignant processes".

Editor's note: In case you do not remember, Bob Nishikawa was the first person to win the Sylvia Fedoruk Prize in Medical Physics.

Peter Munro

Cancer Care Ontario Physicists Ratify Contract

Physicists working for Cancer Care Ontario (CCO) ratified their first contract on 28 January 2000. The tentative settlement, which was reached on 17 December 1999, was the result of almost one year of bargaining - initiated on 24th December 1998 with a request to the employer to start collective bargaining. Since this was the first collective agreement between the CCO Medical Physicists (somewhat confusingly known as CCOMP) and Cancer Care Ontario, the negotiations were quite lengthy because they had to cover all conditions of employment. As well as establishing conditions of employment the collective agreement includes a substantial salary increase. However, details of the settlement remain confidential. [And you thought CSIS could keep secrets!] For more details of the negotiating progress please see the article on page 62.

Peter Munro

Emigrations …

Despite the salary increases recently awarded the physicists working for Cancer Care Ontario, two of these physicists have decided to pursue opportunities in the USA. **Ken Chu**, a physics resident at the London Regional Cancer Centre, has decided to join the group headed by Larry Reinstein at SUNY Stoney Brook on Long Island. Despite the best efforts of the staff in London to encourage Ken to stay, better salaries, improved lifestyles, and easier access to research money and equipment all helped attract him to the USA. And **Bruce Faddegon**, from the Toronto-

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In Brief *(Continued from page 75)*

Sunnybrook Regional Cancer Centre, has left for UCSF (University of California San Francisco) where he has accepted a position as an Associate Professor in the radiation oncology department there. Increased salaries and better opportunities for research funding were the prime considerations. The difficulty of obtaining funding for radiation oncology research in Canada had been especially frustrating for Bruce and was probably one of the major factors in his decision. At UCSF Bruce joins **Jean Poulliot**, the former head of medical physics in Quebec City who emigrated to UCSF in late 1999.

… and Immigrations

In an example of the reverse brain drain, **Richard Frayne**, an MR physicist who trained in London (and who spent time at PMH as a summer student) returned to Canada from the University of Wisconsin, Madison in September, 1999. Richard has joined the staff of the Seaman Family Magnetic Resonance Research Centre, which is affiliated with the University of Calgary. Once again access to research dollars may have played a key role. The Alberta Heritage Foundation for Medical Research is flush with cash and has helped develop a very strong infrastructure in magnetic resonance imaging in the province.

Peter Munro

New Head at PMH

Dr. Michael Sherar was appointed Head of the Clinical Physics group at Princess Margaret Hospital on 11 January 2000. Dr Sherar, who was a Ph.D. student under **Stuart Foster** at PMH and at the former Sunnybrook Health Science Centre**,** has been part of the PMH clinical physics group since the early 1990's. Since that time he has concentrated on research activities. He is now responsible for all of the clinical and research activities of PMH Clinical Physics group.

Peter Munro

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Book Review: Justification in Radiation Protection Editors: K Faulkner and D Teunen

Review by: Walter Huda
SUNY Upstate Medical University

This publication contains written versions of nine papers presented at a November 1997 meeting entitled "Justification in Radiation Protection", which was organized by the British Institute of Radiology in conjunction with the European Commission. The concept of "justification" in radiation protection practice was defined by the *International Commission on Radiological Protection* (ICRP) in Publication 60 by the statement that "No practice involving exposure to radiation should be adopted unless it produces sufficient benefit to the exposed individual, or to society, to offset the detriment it causes." In the European Union, a recently issued Medical Exposure Directive emphasizes the importance of this "justification" principle to ensure good radiation protection practice. It is of interest to note that Directives are binding on member states , and countries within the European Union are required to implement this Directive into national legislation by May 2000.

The European approach to radiation protection in medicine clearly reflects current ICRP philosophy. There are no specific dose limits for patient exposures *per se*, with a major emphasis being directed towards the elimination of all unnecessary exposures. Presentations in this publication cover topics such as medical exposure, pregnancy, room design, repeat films, theft detection, interventional radiology and research. These topics range from the abstract (e.g., legislative approaches to "justification") to more specific cases (e.g., how much lead shielding to put into a given x-ray room). It is of interest to see how it is possible to apply the principle of "justification" to specifying the amount of lead required for x-ray room shielding. The optimal amount of lead shielding in the UK would appear to range between 1.3 mm and 2.7 mm Pb, which reflects well on the 1.6 mm Pb that is recommended for most North American x-ray rooms.

This is a broad ranging and very useful publication on a topic given that will be of increasing importance in the 21st century. In the UK, for example, only 4% of radiological examinations are CT studies, but this imaging modality accounts for a staggering 40% of the collective dose from medical examinations. With the advent of multi-slice CT, utilization of this imaging modality will increase significantly, as will the corresponding individual and collective patient doses. As to be expected, the materials presented in these proceedings reflect a Eurocentric view of Radiation Protection in Medicine. Nonetheless, this timely publication would be a useful addition to anyone with a serious interest in this important topic.

Radiological Accident in Thailand

By Peter Munro

Editors Note: More information about the accident can be found at http://www.nationmultimedia.com/. My thanks to Andrea Gregoire of MDS Nordion for information about the AECL ^{60}Co unit and for directing me to the nationmultimedia web site.

About 12:00 noon on 18th Feb. 2000 the Thai government's Office of Atomic Energy for Peace (OAEP) was alerted by Samut Prakarn Hospital, located about 10 km south of Bankok in Samut Prakarn province, that victims of acute radiation exposure had been hospitalised. Within an hour, health physicists from OAEP had visited the hospital and confirmed that symptoms were indeed consistent with exposure to high levels of radiation. The patients had actually been exposed on or after 1 Feb. 2000 and had been hospitalised between 15-17th Feb. 2000, but it had taken until 18th Feb. for the symptoms of acute radiation exposure to be identified. [Somewhat ironically, on 1 Feb. 2000, the IAEA Director General - Dr. Mohamed ElBaradei - was addressing an IAEA-sponsored "Regional Public Information Seminar" in Bangkok, on the development of nuclear energy at the beginning of the 21st century and the importance of technology, safety and safeguards.]

The OAEP immediately established a recovery team, which discovered what turned out to be an unshielded, 750 Ci, ^{60}Co source located at a scrap dealer's shop. Radiation levels varied from 0.3 mSv/hr (30 mR/hr) in the general area to 30 Sv/hr (3000 mR/hr) in the immediate vicinity of the source. The OAEP immediately secured the area and on the 19th Feb. they started the recovery operation. A lead wall, 5 cm thick, 1 metre wide, and 2 metres high was constructed. With the aid of search lights, TV cameras, and remote manipulators, the source was located (the source location had not been identified visually because of the high radiation levels) and was transferred to a shielded container. The task took 8-1/2 hours to complete.

The next day the OAEP located three other source containers on an unused plot of land near Bangkok owned by Kamol Sukosol Electric Co, a distributor of imported radiotherapy equipment. Chaweng Suwannarat, manager for medical equipment of Kamol Sukosol Electric Co told Reuters that the four canisters had been in his company's care and were stolen for sale to scrap yards. The four ^{60}Co treatment units included a Toshiba device, devices from defunct vendors in France and the United Kindom, and an AECL Model 78 treatment machine. Initial reports suggested that the source had been removed from the AECL unit, but MDS Nordion was later informed by the OAEP that the Model 78 unit was intact. MDS Nordion has now offered to pay all expenses to ship the unit to Ottawa for decommissioning.

On 9 March 2000, Nipon Panthukhan, 18, died from his radiation exposure. He was a worker at the scrap yard who cut open the treatment unit with a welding torch .

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In Brief *(Continued from page 76)*

IAEA Releases Tokaimura Report

For those who want more details than those provided in the last issue of Interactions, the International Atomic Energy Association has released its report describing the events leading up to and following the accident at Tokaimura. This report, which contains an excellent description of the accident and its aftermath, includes numerous diagrams and photographs to complement the descriptions. The report is available at: http://www.iaea.org/worldatom/Press/P_release/1999 /jap_report.shtml.

Peter Munro

Canada, eh?

In case you did not notice, the December 1999 issue of Medical Physics World [Vol. 15 (2) pp. 16] contains an article written by Peter Dunscombe and Mike Patterson about COMP and CCPM. One of the things not mentioned in the article is the difference in the spending habits between Canadian and American medical physics organisations. The AAPM annual budget is $3.5 million US while the entire COMP/CCPM income (according to the 1999 budget statement) is $49 thousand CND. Taking into account exchange rate differences (assume 1.47), and realising that the AAPM has 2653 full members (4397 total members), the AAPM **per capita** spending is 10.9 times higher than COMP/CCPM, which has 275 full members (348 total members). Therefore, to maintain enough services to make COMP an attractive organisation, I believe that COMP will have to consider several options, including increasing membership fees, actively encouraging more corporate ties, or actively recruiting members to volunteer their services. COMP/CCPM have always been low budget organisations. Is it time to spend a little more to ensure their continued success?

Peter Munro

UHN Update

On the 20 March 2000 the accelerator personnel at the University Health Network (i. e., PMH) were allowed to resume their duties by the AECB, following verbal ap-

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In Brief *(Continued from page 77)*

proval given on the 15 March. The development of the safety program is still incomplete, but the AECB is "very pleased" with the progress so far. The service group has created a Service Policy and Procedure manual, with radiation safety as a major component. The group is also starting to define the role of Accelerator Service Technologists and what the minimum standards of training should be. New staff who start in the group will now have reduced responsibilities until they complete training in electronics, radiation safety, electrical safety, etc. While the AECB actions may have created some major short problems, some long term benefits may come from the UHN difficulties. Tom Feuerstake of the UHN is trying to start an Accelerator Service Technologists group to improve the communication between the individuals and groups within Canada. In future, this may lead to even higher standards for accelerator service.

Peter Munro

Brighid McGarry

We are sorry to announce that Brighid McGarry has resigned her position of Executive Director of COMP and CCPM because of health reasons. We will miss working with Brighid. In her roles as Secretariat and then as Executive Director, she provided much needed continuity to both organisations and she was always a helpful and cheerful presence at the COMP/CCPM Office. We respect her request that this transition occur quietly and wish her the best in her ongoing endeavours.

Mike Patterson, Chair COMP
L. John Schreiner, President CCPM

Radiological Accident (Continued from page 77)

In total, up to 29 people may have been exposed to ^{60}Co radiation. A total of 824 people in the vicinity of the scrap yard received blood tests and 29 have exhibited low white cell counts. Of these, 19 are being monitored and 10 have been hospitalised. Four of these are not in danger but five are in critical condition. Of the five people in critical condition, two are still in danger. And one person has already died as a result of the accident. On 9 March 2000, Nipon Panthukhan, 18, died from his radiation exposure. He was a worker at the scrap yard who cut open the treatment unit with a welding torch .

The incident has created serious repercussions. The OAEP has charged Kamol Sukosol Electric Co. with recklessly storing its ^{60}Co treatment units, as well as failing to inform OAEP that the units had been moved away from their indicated storage location. [Kamol Sukosol Electric Co. had recently moved the units to a new warehouse without informing the OAEP.] And after the death of Nipon Panthukhan, the company has also been charged with negligence causing death. In turn, Kamol Sukosol has accused four scrap-metal dealers of theft and police are considering charges. Finally, the Thai public's confidence of the OAEP has been shaken. When the radiation accident become public knowledge, the OAEP could not identify the number or location of ^{60}Co units in Thailand and early reports revealed very poor compliance by the agency with its own inspection policies. It was only a week after the accident that the OAEP was able to account for the 39 ^{60}Co units in Thailand.

This incident highlights a growing problem with unsafe storage and handling of radioactive sources, especially in countries experiencing economic upheavals. Since 1997, the IAEA has been asked to provide assistance relating to the loss of control over radiation sources in Bangladesh, Georgia, Ghana, Peru, Turkey and Venezuela - some resulting in severe injuries.

Canadian College of Physicists in Medicine Examination Schedule 2000

Membership Examination:

Applications due: 21 January 2000
Examination date: 15 April 2000

Fellowship Examination:

Applications due: 28 April 2000
Examination date: 20, 21 or 22 July 2000 (in Chicago)

Note: Fellowship applicants writing the membership examination should confirm their fellowship application and pay the fee within one week of receiving the membership examination results.

For further information, application kits, and membership examination study guides, contact the Registrar, Dr. Alistair Baillie, at:

Dr Alistair Baillie
The Registrar/ Le Registraire, CCPM
c/o Cancer Centre for the Southern Interior
399 Royal Avenue
Kelowna, BC, V1Y 5L3

Graduate Theses 1998 (continued)

By Darcy Mason

In the January 2000 issue of Interactions, graduate theses for 1998 were published. I indicated at the time that I knew of some that were missing from that collection. Here are the missing theses, and I hope that this will complete the 1998 collection. In future, a complete list will be available at http://www.medphys.ca.

McGill University

Automatic Thalamic Labeling for Image Guided Neurosurgery

Clonda, Diego, MSc; Adviser: Evans, A.C.

In the treatment of Parkinson's disease some cases require the ablation of a specific region in the basal ganglia. The accurate localization of this region inside the patient's brain is essential and because direct visual anatomical information for such deep brain structures is not available, the surgeon has to rely on other sources of information such as MRI, CT and x-ray of the patient's brain. However these imaging techniques do not provide sufficient anatomical information, requiring the use of a subcortical brain atlas book to assist in the localization of the different structures. This way of proceeding is cumbersome and results in a certain lack of accuracy in the localization of the different brain structures.

We developed a method that aids the surgeon to obtain the sufficient anatomical information in a simpler and more accurate manner. We provide him with a segmentation of the patient's MRI scan based on the Schaltenbrand and Wahren subcortical atlas. To achieve such segmentation a volumetric version of the atlas was obtained and was then mapped to a model brain MRI using landmark matching. Using an automated tool for the three-dimensional registration of two MRI volumes the deformation transformation between the model brain MRI and the patient's brain MRI was obtained. By applying this same transformation to the volumetric atlas, we obtain a superposition of a volumetric subcortical atlas onto the MRI of the patient's brain in the stereotactic space. This method results in a more accurate localization of the surgical lesion, thus reducing the number of additional interventions which are often necessary when the results of the first procedure are shown to be unsatisfactory. The whole guidance system is now used routinely at the Montreal Neurological Institute and is part of the standard surgical procedure.

Delivery and Verification of Intensity-Modulated X-ray Beams in Radiotherapy

Curtin-Savard, Arthur, PhD; Adviser: Podgorsak, E.B.

In modern radiotherapy, 3D conformal dose distributions are achieved using several beam ports each having pre-calculated planar distributions of photon beam intensity. The intensity matrix for a given beam port is generated by independent motion of the leaves of a multileaf collimator (MLC). In this thesis, we have used the *step-and shoot* approach to intensity-modulated beam delivery, the safest and most popular approach at the moment. The first component of this thesis was to write a leaf sequence algorithm to control the MLC fitted to our Clinac 2300 C/D linear accelerator. Our algorithm is more efficient than other published *step-and-shoot* type algorithms, and takes into account the MLC transmission, MLC penumbra, and change in scatter conditions with field size.

Although sophisticated means to calculate and deliver these spatially-modulated beams have been developed by our group as well as by other medical physics research centres, means to verify their actual delivery are definitely the most problematic at the moment, making, equipment and treatment quality assurance difficult to enforce. The second (and major) component of this thesis has been to investigate the use of a new portal imaging device for dosimetric verification purposes. We show that an electronic portal imaging device of the scanning liquid ionization chamber type yields images which, once calibrated from a previously-determined calibration curve, provide highly-precise planar maps of the incident dose rate distribution. For verification of an intensity modulated beam delivered in the segmented approach with an MLC. a portal image is acquired for each subfield of the leaf sequence. Subsequent to their calibration, the images are multiplied by their respective associated monitor unit settings. and summed to produce a planar dose distribution at the measurement depth in phantom. The excellent agreement of our portal imager measurements with calculations of our treatment planning system and measurements with a one-dimensional beam profiler attests to the usefulness and relative simplicity of this method for the planar verification of intensity-modulated fields, which are produced in the segmented approach on a computenzed linear accelerator equipped with an MLC.

Radiosensitization Of A Mouse Tumor Model (RIF-1) By Bromodeoxyuridine (BrdU) Using Biodegradable Polymer Implants As A Controlled Drug Delivery System Hydroxyl Radical Scavengers And Antioxidants In Radiation Protection (Melatonin)

Doiron, Annie, MSc; Adviser: Lehnert, S.M.

To increase the effectiveness of conventional radiotherapy in the treatment of cancer, different drugs can be administered. The aim of this project is to investigate biodegradable polyanhydride carrier matrices (PCPP-SA; 20:80) as a localized slow release delivery system for halogenated pyrimidines, in our case Bromodeoxyuridine (BrdU). Our *in vitro* experiments show that RIF-1 cells which have incorporated BrdU into their DNA over 4 doublings show significant increase in the initial slope (-value) of their radiation cell survival curves, indicating an increase in radiosensitivity. To investigate the radiosensitization potential of BrdU *in vivo*, biodegradable BrdU/polymer combinations (20% w/w) were prepared and implanted directly into RIF-1 tumors, grown

subcutaneously on the backs of C3H/Km mice.
Clonogenic/excision assays were done with these tumors exposed to BrdU/polymer implants for several cell cycles before irradiation *in situ* to determine the extent of radiosensitization on the basis of cell survival. Tumor growth delay (TGD) measurements were also used as an index of tumor control following different treatments (single dose or fractionated doses) with and without the drug/polymer implants. All results indicate that BrdU, combined with radiation, increases TGD, while having no effect on non-irradiated tumors. The extent of substitution of thymidine by BrdU in DNA were also determined. This project was supported by the National Cancer Institute of Canada.

Development of Techniques for Optimization and Verification of Radiation Treatments

Hristov, Dimitre, PhD; Adviser: Fallone, B.G.

Algorithms for optimization and verification of radiation treatments have been developed. The first one, an *active set algorithm* for inverse treatment planning employs a conjugate gradient routine for subspace minimization in order to achieve a higher rate of convergence than the widely used constrained steepest descent method at the expense of a negligeable amount of overhead calculations and storage. The active set algorithm is found to be superior to the constrained steepest descent in terms of both its convergence properties and the residual value of the cost functions at termination. The active set approach can significantly accelerate the process of inverse treatment planning, by decreasing the number of time consuming dose calculations.
The second algorithm employs a *continuous penalty function method* to solve approximately a large-scale constrained minimization problem which reflects the goal of sparing healthy tissues as much as possible while delivering the necessary tumorcidal dose. The performance of the continuous penalty function method is optimized by a numerical investigation of a few integration schemes and a pair of weighting functions which influence the performance of the method. Clinical examples are presented that illustrate possible applications of the techniques in the context of multi-objective optimization.
An image correlation based algorithm for automatic registration of pairs of portal images has also been developed. Accounting for both in-plane translations and rotations, the algorithm uses fast-Fourier-transforms and a sequential approach to speed up the registration without degrading the accuracy of the match. The technique has also been applied to the automatic registration of portal images to digitally reconstructed radiographs (DRRs) which have been modified to resemble megavoltage images. The results indicate the feasibility of this approach as a tool for treatment setup verification.

The role of Glutathione in Cisplatin and ^{60}Co γ-radiation resistance in A2780 and A2780^{CP} cells.

English, Michael, MSc; Adviser: Lehnert, S.M.

A Cisplatin-resistant subline of a Human Ovarian cancer cell line, A2780CP also exhibits cross resistance to Co γ-radiation. Cellular Glutathione (GSH) levels were measured by the Tietze Spectrophotometric method. GSH levels in A2780 CP cells were approximately three times that of the parental A2780 cells. In cells depleted of GSH by L-Buthionine Sulfoximine (BSO), Cisplatin resistance was significantly decreased in both cell lines. BSO had no effect on the radiation resistance of either cell lines. However treatment of cells with a combination of BSO and Dimethyl Fumarate (DMF) significantly decreased the radio-resistance in A-2780 CP cells. The combination treatment had no effect on the radio-response of the parental cells. Ethacrynic acid (EA), an inhibitor of Glutathione S-Transferase (GST) activity had no effect on cellular GSH levels nor did it affect the Cisplatin or radiation resistance in either cell line. These results suggest that GSH levels are involved in Cisplatin and radiation resistance in these cells. However the mechanism of GSH involvement in radiation and Cisplatin-resistance appears to be different in the cell lines studied.

Viability of an Isocentric Cobalt-60 Teletherapy Unit for Stereotactic Radiosurgery

Poffenbarger, Brett, MSc; Adviser: Podgorsak, E.

An isocentric teletherapy cobalt unit provides a viable alternative to an isocentric linac as a radiation source for radiosurgery. An isocentric cobalt unit was evaluated for its potential use in radiosurgery in three areas: (1) the physical properties of its radiosurgical beams, (2) the quality of radiosurgical dose distributions obtained with 4 to 10 non-coplanar arcs, and (3) the accuracy with which the radiosurgical dose can be delivered. In each of these areas the 10 MV beam of a linear accelerator served as a standard for comparison.
The difference between the 80%-20% penumbras of the radiosurgical fields of the cobalt-60 and 10 MV photon beams is remarkably small, with the cobalt-60 beam penumbras on the average only about 0.7 mm larger than those of the linac beam. Differences between the cobalt-60 and 10 MV plans in terms of dose homogeneity within the target volume and conformity of the prescribed isodose volume to the target volume are also minimal, and therefore of limited clinical significance. Moreover, measured obtained isodose distributions of a radiosurgical procedure performed on the isocentric cobalt unit agreed with calculated distributions to within the ±l mm spatial and ±5% numerical dose tolerances which are generally accepted in radiosurgery. The viability of isocentric cobalt units for radiosurgery would be of particular interest for centers in developing countries where cobalt units, because of their relatively low costs, provide the only megavoltage source of radiation for radiotherapy, and could easily and inexpensively be modified for radiosurgery.

Computer Guidance for Thalamotomy and Pallidotomy

St-Jean, Philippe, MSc; Adviser: Peters, T.M.

Thalamotomy and pallidotomy constitute the two principal neurosurgical treatments for Parkinson's disease. Both the thalamus nuclei and the internal globus pallidus structures are found very close to the internal capsule, a critical structure that must be avoided in performing the lesion. This forces the lesion of parts of the thalamus and the globus pallidus mediale to be achieved with a spatial precision on the order of 2mm. The leukotome is a neurosurgical tool consisting of a 20cm rigid shaft with a thin metallic wire attached to its tip that can be taken in and out of the body of the shaft. It is used as a knife to perform the excision.
Some critical basal ganglia structures show no anatomical differences at all on MRI scans, even though they have different functionality. In order to provide the neurosurgeon with this missing information, we have developed a deformable volumetric atlas of the basal ganglions from the cryogenic slices atlas of Shaltenbrand and Wahren. The atlas can be non-linearly deformed to fit a patient's MRI.
We have developed a visualization platform for pre-operative and intra-operative utilization of the atlas and of the MRI datasets. Any number of datasets can be superimposed (MR1, atlases, virtual lesions...). Merging of datasets with different extents and different resolutions is supported, The plat form includes 3D visualization tools as well. Graphical tools allow the neurosurgeon to see projections of the leukotome from any point of view over the MRI data and the atlas. The software is able to create models of lesions that can be compared with the MRI data and the atlas. It can also suggest an operation protocol (how to use the leukotome) if a target volume is given. This target volume can easily be drawn on the atlas by the neurosurgeon.

3-D Automatic Anatomy-based Image Registration in Portal Imaging

Sirois, Luc, MSc; Adviser: Fallone, B.G.

A three dimensional, automatic, anatomy-based system for portal verification has been developed based on an FFT implementation of Pearson's correlation coefficient (PCC). The PCC requires no anatomy or point-pair identification, is robust when encountering changes in scaling and shifts in image amplitudes and requires no priori knowledge of the anatomy, which makes it an ideal candidate for portal-to-DRR image registration Features for matching are selected from orthogonal portal images and compared to the corresponding megavoltage DRR. The position of the highest correlation value is then converted into beam-to-patient geometry and compared with the actual patient setup. By continuously generating DRRs, the system is capable of verifying translation errors, in-plane rotation and out-of-plane rotation errors. The mean accuracy of translation and rotation registrations tests were 0.58 mm and 0.79˚ respectively for DRR-to-DRR matching, and 1.22 mm and 1.31˚ respectively for portal-to-DRR matching.

McMaster University

Quantification of the Detection Capabilities of A Gamma Radiation Survey System

Clement, Christopher, MSc; Adviser: Kennet, T.K.

The Low-Level Radioactive Waste Management Office of Atomic Energy of Canada Limited has developed a computer assisted surface gamma radiation survey system. The primary objective of this work is to quantify the detection capabilities of this system. Specifically, the probability of detection for a point source of radium 226 plus progeny in equilibrium buried in soil is determined. Monte Carlo photon transport simulation is used to determine the detector response, and further computer simulation is used to generate simulated field data. These data are analyzed by a proprietary algorithm, and the performance of the simulated system is observed. A primary result is the activity of point radium sources having a 50% probability of detection. Assuming that the sources are buried at an unknown depth within the top x cm of soil, the activity (in units of kBq) is given by (148/x)(exp (0.094x)-1). For example, given a source buried within the top 0-15 cm of soil, there is a 50% chance of detection for a source having an activity of 31 kBq radium 226 (with all progeny in equilibrium).

Human Lead Metabolism: Chronic Exposure, Bone Lead and Physiological Models

Fleming, David, PhD; Adviser: Webber, Colin and Chettle, David

Exposure to lead is associated with a variety of detrimental health effects. After ingestion or inhalation, lead may be taken up from the bloodstream and retained by bone tissue. X-ray fluorescence was used to make *in vivo* measurements of bone lead concentration at the tibia and calcaneus for 367 active and 14 retired lead smelter workers. Blood lead levels following a labour disruption were used in conjunction with bone lead readings to examine the endogenous release of lead from bone. Relations between bone lead and a cumulative blood lead index differed depending on time of hiring. This suggests that the transfer of lead from blood to bone has changed over time, possibly as a result of varying exposure conditions. A common polymorphism in the -aminolevulinate dehydratase (ALAD) enzyme may influence the distribution of lead in humans. Blood lead levels were higher for smelter workers expressing the more rare $ALAD^2$ allele. Bone lead concentrations, however, were not significantly different. This implies that a smaller proportion of lead in blood is distributed to tissue for individuals expressing the $ALAD^2$ allele.

The O'Flaherty physiological model of lead metabolism was modified slightly and tested with input from the personal exposure histories of smelter workers. The model results were consistent with observation in terms of endogenous exposure to lead and accumulation of lead in cortical bone. Modelling the calcaneus as a trabecular bone site did not reproduce observed trends. Variations in lead metabolism between different trabecular sites may therefore be significant. The model does not incorporate a genetic component, and its output did not reflect observed differences in this respect. This result provides further support for the influence of the ALAD polymorphism on lead metabolism. Experimental trials with a digital spectrometer revealed superior energy resolution and count throughput relative to the conventional X-ray fluorescence system. The associated reduction in the uncertainty of lead measurement has the potential to benefit future surveys and modelling efforts.

Dual Wavelength Time Resolved Reflectance Measurements For The Determination of Hemoglobin Oxygenation in Tissue

Hunter, Robert, MSc; Adviser: Patterson, Michael

The aim of this work was to develop and test a system to measure the optical properties of tissue *in vivo*, with the specific goal of monitoring tissue oxygenation. Since it is desirable to determine these properties noninvasively, it is necessary to use the information retained in the light that is scattered out of the tissue, i.e. the reflectance, to estimate values for the scattering and absorption coefficients of the tissue. It is possible to use these properties to study many physiological functions, including hemoglobin saturation and tissue metabolism.

Methods for the indirect measurement of tissue optical properties fall into three categories: continuous wave (cw), frequency domain and time domain techniques. Regardless of which technique is used to measure the reflectance, a suitable model of light transport is needed to provide the best estimates of the optical properties of the medium investigated. The diffusion equation has been shown to have good agreement with both phantom measurements and Monte Carlo simulations.

This thesis discusses a two wavelength system which operates in time-correlated single photon counting mode to measure noninvasively the optical properties of tissue. By exploiting the known differences in absorption between oxyhemoglobin and deoxyhemoglobin at 750 nm and 810 nm, this system will be used to monitor hemoglobin saturation. However, prior to performing oxygenation measurements, the performance of the system was compared to a continuous wave (cw) and a frequency domain system in our lab. This thesis will outline the instrumentation of the time-resolved system, results from fitting Monte Carlo data and the results of various measurements which investigate the response of the system to different factors. The two main experiments study the ability of the system to predict variations in either the scattering or the absorption coefficient. Following the success of the system in predicting optical properties of tissue simulating phantoms, *in vivo* measurements were performed on the palm of the hand. The system proved sensitive enough to reflect changes in oxygenation induced in the tissue.

Calibration of Health Physics Instruments

Niven, Erin, MSc; Adviser: Harvey, J.

Several methods have been used to determine experimentally the absolute activity of radioisotopes. Coincidence counting (β-γ and γ-x-ray) was the 'primary' method for determining the absolute activity of ^{24}Na, ^{60}Co, and ^{125}I sources. These isotopes, as well as ^{3}H, ^{14}C, and ^{41}Ar sources, were subsequently used through 'secondary' methods in the calibration of an LS 600 Liquid Scintillation System from Beckman Instruments, Inc., 2B proportional counters, hand and foot monitors, McMaster Nuclear Reactor particulate and radioiodine monitors, a

gamma spectrometer, and an argon chamber.

An Accelerator Based *In Vivo* Measurement of Aluminum in Human Bone by Neutron Activation Analysis

Pejović-Milić,Ana, MSc; Adviser: Chettle, David

Aluminum is a neurotoxin and has been recognized as a causative agent for dialysis encephalopathy and renal osteodystrophy, as well as possibly being related to Alzheimer's disease. General public exposures to aluminum have increased in the modern, industrial age stimulating scientists to inquire into the degree of risk associated with such widespread use of aluminum.

Aluminum is thought to be stored in bone, therefore, development of an *in vivo* method for the determination of aluminum in human bone, suitable for routine monitoring of patients and population is the goal of this study.

Using neutron activation analysis, low-energy neutrons are produced on the KN accelerator inducing the $^{27}Al(n,\gamma)^{28}Al$ reaction in an irradiated site. Two different shapes (cylindrical and flat) of aluminum doped tissue equivalent phantoms, simulating both bone and soft tissue, have been built. Calibration lines, detection limits and doses delivered with the different shapes of phantom have been discussed, and compared to the previously published results. Two detection systems, an assembly of two large NaI(Tl) detectors and a hyperpure germanium detector, have been compared as well.

The results achieved suggest that this technique may provide an alternative choice to painful bone biopsy for the *in vivo* monitoring of aluminum intoxication from long-term exposure.

University of Toronto

The Effects of Dynamic Optical Properties During Interstitial Laser Photocoagulation

Iizuka, Megumi N., MSc; Adviser: Sherar, M.

Lasers can be used to heat and destroy cancer cells by delivering light via fiber directly into a tumour, in a novel and promising procedure called Interstitial Laser Photocoagulation (ILP). Thermal lesion formation during ILP is a dynamic process involving many heat induced alterations of tissue such as changes in optical properties and blood perfusion. However, the effects of these changes on the outcome of lesion formation are not well understood. Therefore, thermal models are being developed to investigate the importance of the effects on predicting treatment outcomes. These models are essential for the successful planning of thermal therapy treatments of ILP to achieve complete tumour destruction while sparing normal tissue and avoiding the deleterious effects of vapourization and charring.

The aim of our work is to propose and validate a model which incorporates heat induced changes of optical properties due to coagulation by solving the nonlinear bioheat equation. The dynamic effects axe modeled based on the Arrhenius damage formulation which describes thermal damage as an irreversible rate process. The validity of the model assumptions was investigated experimentally by developing novel opto-thermal phantoms with properties similar to those of tissue. An albumen based phantom was used to represent the case when optical properties change with heat. Polyacrylamide phantoms, designed with static optical properties, were used to illustrate the difference in temperature rise when dynamic optical properties are not taken into account. The influence of these changing optical properties on fluence, temperature and damage predictions were then examined theoretically for the case of ILP of the liver.

Temperatures measured during ILP in the two phantoms agreed well with theoretical predictions. The experimental results confirmed both the conventional static model and the Arrhenius damage formulation used to describe the dynamic coagulation process. The model demonstrated that changes in optical properties, namely an increase in scattering due to heat, causes a sharper temperature gradient and increases the peak temperature close to the optical source. Consequently, a sudden increase in the rate of temperature rise occurs, at the onset of coagulation which was confirmed experimentally in the albumen phantom. Hence, vapourization begins earlier in time than predicted by conventional static models which is an important consideration in order to avoid charring of the fiber tip.

The thermal lesion is both smaller and requires less optical power to produce than that predicted assuming native optical properties when the peak temperature is limited at the end of the therapy for the two cases. However, the size of the lesion is approximately the same as that predicted by the static case with coagulated optical properties. This suggests that the simpler static model with coagulated optical properties, can be used instead of the nonlinear model to predict final damage outcome. However, the laser power requirements, as well as the thermal histories, are considerably different between the static and nonlinear models.

In general, the temperature, fluence and damage profiles are highly dynamic during lesion formation due to the coagulation process. This establishes the need for theoretical models to account for changing optical properties during ILP. Furthermore, the Arrhenius damage formulation can be used to quantify accurately the effects of dynamic changes in optical properties in these models.

A 100-200 MHz Ultrasound Biomicroscope

Knapik , Donald, MSc; Adviser: Foster, S.

Clinical ultrasound imaging systems capable of producing real-time, economical, cross sectional images of soft tissue are in widespread use. The resolution of these systems is not sufficient for certain specialised applications. A 100-200 MHz ultrasound system providing resolution from 14-35 mm has been produced. Transducers were custom built using a novel design. The properties of two transducers, one at 100 MHz and the other at 200 MHz, have been characterised and they compare well with theoretical values. A minimum insertion loss of 18 dB has been measured. Real-time images have been obtained at 100 MHz. At 200 MHz higher quality images were created with a slower, zone focus scan. Adequate contrast and penetration are shown in images of ocular tissue, superficial skin and a coronary artery. These examples show the potential for clinical utility of this system in assessing superficial conditions such as corneal disease, melanoma and atherosclerosis.

CCPM/COMP MEETINGS

World Congress 2000 Chicago July 21-28th

Since COMP and CCPM will be meeting in Chicago with the World Congress, the following meetings have been scheduled at our Headquarters Hotel, the Chicago Days Inn Lakeshore. If you haven't registered yet, more information can be obtained from the conference website: http://www.wc2000.org/

World Congress 2000 DATES TO REMEMBER

May 15, 2000	Registration Deadline to receive Discounted Registration Fees. Deadline for payment of $50 abstract fee for accepted abstracts.
May 26, 2000	Chicago 2000 Scientific Program available on wc2000.org
June 19, 2000	Deadline for advance meeting registration.
June 23, 2000	Deadline for housing reservations.
July 1, 2000	Deadline for registering for Canadian Reception.

COMP/CCPM Schedule at Days Inn Lakeshore

July 21-22	8 am - 5pm	CCPM Fellowship Exams	Michigan Room, 19th floor
Sunday July 23	8 am - 12 pm	COMMITTEE Meetings	19th floor meeting rooms
Tuesday, July 25th			
	5:30 pm - 6:30 pm	CCPM Annual General Mtg.	Ground floor Erie/Ontario Rms
	6:30 pm - 7:30 pm	COMP Annual General Mtg.	Ground floor Erie/Ontario Rms
	7:30 pm - 9:30 pm	Canadian Reception	Pinnacle Restaurant

CANADIAN RECEPTION

The Canadian COMP/CCPM Reception will be partially subsidized by our corporate members in the Pinnacle Lounge, Chicago's first revolving restaurant. Attendees will be treated to a grazing buffet of Chicago specialties high atop the Days Inn Hotel looking out over Navy Pier and Lake Michigan. Members and guests must purchase reception tickets by mailing a cheque made out to COMP and this form to the COMP/CCPM office by June 23rd. Receipts will be sent by mail but tickets will be distributed on site. More information will be posted on the COMP website closer to the date.

ORDER FORM

Canadian Reception tickets

Tuesday July 25th, 7:30 pm,
Pinnacle Room, Days Inn Lakeshore Chicago

NAME:_____

Mailing Address for Receipt: _____

_____

_____

Tickets: $25 Canadian Dollars per person X _____ (number of tickets) = $_____

Make cheque out to **COMP**: Mail to Post Office Box 39059, Edmonton AB T5B 4T8 **by June 23rd.**

COMP OCPM

CANADIAN COLLEGE OF PHYSICISTS IN MEDICINE

LE COLLÈGE CANADIEN DES PHYSICIENS EN MEDECINE

Applications Invited for Contract Position

The Canadian Organization of Medical Physicists (COMP), in conjunction with the Canadian College of Physicists in Medicine (CCPM), seeks to contract a part-time

Executive Director

With the growth of the COMP to over 400 members, with over 150 physicists now certified for clinical practice by the CCPM, and with the increasing profile and scope of our annual scientific meeting and professional activities, an essential support person for both organizations is an Executive Director.

Reporting to the Chair of the COMP, the Executive Director is responsible for the management and administration of all operations and programs of the COMP and of the CCPM.

The Executive Director supervises the COMP Secretarial Assistant, and is responsible for many of the logistics of the annual scientific meeting. He/she is also responsible for corporate liaison, acts as a research resource for all committees of the COMP and the CCPM, and ensures that the administrative services of the COMP and the CCPM respond to changing business and communication technologies. The successful candidate will have prior experience in a managerial position. Experience working *as* a professional medical physicist, or experience working *with or for* a professional medical physicist, in a clinical or research setting, would be an asset. At least a minimal proficiency in both official languages would be an asset.

In the short term, a time commitment of 1 day per week, averaged over the year, is required. The workload is greater in the three months prior to the Annual Scientific Meeting, and is less in the late summer and early fall. The position will be filled by one-year contract, renewable, with salary determined by negotiation.

Interested individuals should submit a resume before 31 May 2000 to:

Dr. Michael S. Patterson,
Chair, COMP/CCPM Search Committee
Department of Medical Physics
Hamilton Regional Cancer Centre
699 Concession Street
Hamilton, Ont. L8V 5C2
Tel: (905) 387-9711 x67005
Fax: (905) 575-6330
E-mail: mike.patterson@hrcc.on.ca

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:

The Registrar / Le Resistraire
CCPM
c/o Cancer Centre for the Southern Interior
399 Royal Avenue
Kelowna, BC, V1Y 5L3

The deadline for applications for the next award is **May 1, 2000**. The award will be announced at the 1999 CCPM Annual General Meeting in Sherbrooke.

La date limite pour les demandes du prochain concours est le **1er mai 2000**. Le récipiendaire de la bourse sera annoncé à la rencontre annuelle de 1999 du CCPM à Sherbrooke

Past recipients:

Récipiendaire anterieur:

1990 Dr. L. John Schreiner, Montreal
1991 Ms. Moira Lumley, Kingston
1992 Dr. Donald Robinson, Edmonton
1993 Dr. Yunping Zhu, Toronto
1994 Dr. Brendan McClean, Edmonton
1995 Dr. George Mawko, Halifax
1996 M. Alain Gauvin, Montreal
1997 Dr. Katherina Sixel, Toronto
1998 Mr. Horacio Patrocinio, Montreal
1999 Mr. Craig Beckett, Regina

Members of the COMP and/or CCPM can make a donation to fund by volunteering to increase their 2000 membership dues.

Les membres du COMP et\ou OCPM peuvent faire un don à la cotisation de 2000 un montant additionel de leur choix.

New Products

MDS Nordion
Science Advancing Health

THERAPLAN Plus Image Based Brachytherapy Planning

THERAPLAN Plus Version 3.5 will soon be released. It will introduce exciting features and enhancements to facilitate prostate implant brachytherapy planning.

These new features focus on preplanning, post planning, and importing images.

- The ability to import ultrasound images either via a frame grabber card or over the network (TIFF image import) for laptop and desktop configurations.
- For preplanning, the ability to select from several loading routines including peripheral loading, uniform loading, or modified uniform loading.
- Fast multi-planar reconstruction (MPR) for visualizing and editing dose distributions in either a sagittal or coronal view.
- For post planning, the tools have also been improved and the user may now automatically identify the seed position based on CT number and seed size. Potential duplicate seeds are detected and removed based on user defined search parameters.
- The ability to import the pre-contoured CT images into the THERAPLAN Plus system through the use of DICOM RT from a CT simulator.

MDS Nordion
Science Advancing Health

Helax-TMS Version 5.0 released and 510(K) cleared

The new features in this version of Helax-TMS software mark the latest milestone in MDS Nordion's software development.

Inverse planning: An optimization tool allows the physician to specify the dose-volume constraints to targets and critical structures that are then used to optimize the dose distribution. The tool can be used to create plans intended for Segmented IMRT treatment delivery.

Integrated sequencer: Provides the choice of sending either the individual field segments or the intensity map to the treatment unit.

The collapsed cone algorithm: Fully implemented with Version 5.0. The combination of the collapsed cone with the Helax-TMS full head scatter model provides the ability to model the energy fluence from the treatment head, in addition to the energy deposition in the patient, resulting in unprecedented accuracy.

Extension of DICOM Export of RT Plan and RT Image DICOM objects to DICOM Storage Service Class Providers and the improved support for record & verify systems and laser marking systems (IMPAC's Access, Varian's VARIS, LAP and Gammex).

Stereo module for PIPSpro

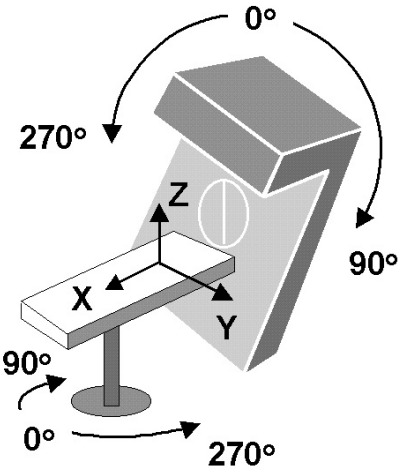
Masthead Imaging releases the **Stereo** module for PIPSpro v3.2

Stereo is an image analysis tool to assist in determining the optimal position of the stereotactic head frame in a 3-dimensional coordinate system. A small radio-opaque ball marker is mounted on the head frame to define the center of the target volume, and eight images are acquired on film for different gantry and couch angles over the range to be used during treatment. Each image shows the circular radiation beam and the shadow of the ball marker, which may be offset from the beam center for different gantry and couch angles. Stereo computes the 3-D offsets from the optimal location of the target center, and the results are used to shift the head frame to the correct position

Stereo is available as a module in PIPSpro v3.2 or as a stand-alone program.

Masthead Imaging Corporation
Nanaimo, B.C.
Fax: (250) 755-7711

Email: shlomo@telus.net



New DRR module for PIPSpro

Masthead Imaging releases the **DRR** module for PIPSpro v3.2

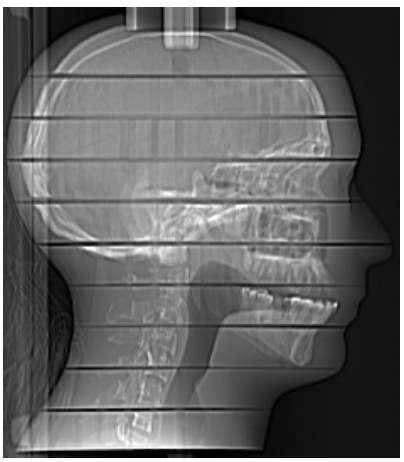
DRR is a fast and versatile module for computing digital reconstructed radiographs from CT data sets and provides precise simulation of any clinical setup. Configuration options include gantry and couch angles, reconstruction quality (DRR, DPRR or DRMRI), center slice, isocenter location, and SDD. MLC field patterns can be imported as an overlay or custom fields can be specified and displayed. Re-slicing is available for coronal and sagittal reconstructions.

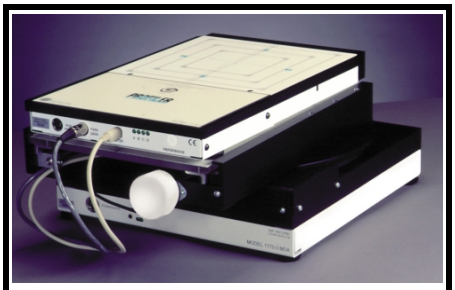
The module is available as part of the PIPSpro system, so that the computed DRR may be used as a reference image for portal imaging. **DRR** is also available as a stand-alone program.

A demo CD is available from:

Masthead Imaging Corporation
Raincoast Executive Centre
201 Selby St. Nanaimo,
B.C. V9R 2R2
Fax: (250) 755-7711

Email: shlomo@telus.net





Utilizing state-of-the-art electronic design and proprietary solid-state detectors, the PROFILER offers performance and features not available in any other single instrument. The PROFILER generates a real time graphic image of the accelerator output. The image is a trace of 46 individual data points at 5mm spacing, and is updated once per second.

Any number of profiles may be captured and stored. Stored profiles may be retrieved and compared to either another stored profile or a real time image. In this way, reference images may be captured and compared to the current profile in a matter of minutes.

A reference profile can be obtained at zero gantry angle and compared, in real time, with the beam image as the gantry is rotated. Dynamic and virtual wedge routines can be viewed in real time. The shape of the wedge can be viewed, stored and compared. Output measurements can be collected, stored, compared and trended, all within the PROFILER software.

The optional PROFILER, Motor Drive Turntable provides three major functions:

- The MDA automates the PROFILER calibration procedure.
- The MDA allows remote rotation of the PROFILER to angular positions within the beam.
- The MDA can rotate the PROFILER such that the detector array is used to scan the entire beam in a single rotation. The scanned data is displayed in three dimensional format with the X and Y axis being the plane of the PROFILER, and the Z axis the beam intensity throughout that plane. Isodose lines can also be displayed from the beam's eye view.

PRIMUS Mid-energy

The Oncology Care Systems Group of Siemens Medical Systems has recently introduced a new addition to the PRIMUS family of linear accelerators. Requests from the radiotherapy community helped in the development of the PRIMUS Mid-energy as a cost-effective linac capable of delivering the complete range of radiotherapy treatments.

Based upon the advanced technologies and compact design of the original PRIMUS Hi-energy accelerator, the PRIMUS Mid-energy can be configured as a single or dual photon accelerator with an energy range of 6 - 15 MV, with or without electrons up to 14 MeV. The PRIMUS Mid-energy is a cost effective accelerator with all of the advanced features and capabilities that provide proven clinically useful solutions for IMRT and productivity.

For further information, please contact:
M. Dean Willems
Manager Oncology Systems
Siemens Canada Limited
Medical Systems Division
2185 Derry Road West
Mississauga, Ontario
L5N 7A6
Phone:905-819-5747
Fax:905-819-5884
Cell:416-453-8821
dean.willems@siemens.ca
www.sms.siemens.com/ocsg

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ADAC Laboratories
540 Alder Drive
Milpitas, CA 95035
Phone: (408) 321-9100
Fax: (408) 577-0907
Email: tschopik@adaclabs.com
Website: www.adaclabs.com
Contact: *Mr Harry Tschopik*

Argus Software, Inc.
2221 Broadway, Ste 212
Redwood City, CA 94063
Phone: (650) 299-8100
Fax: (650) 299-8104
Email: rstark@argusqa.com
Website: www.argusqa.com
Contact: *Mr Richard Stark, President*

Canadian Scientific Products
1055 Sarnia Road, Unit B2
London, ON N6H 5J9
Phone: (800) 265-3460
Fax: (519) 473-2585
Email: sgensens@csp2000.com
Website: www.csp2000.com
Contact: *Mr Steve Gensens*
Sales Manager

CNMC Company, Inc.
2817-B Lebanon Pike
PO Box 148368
Nashville, TN 37214-8368
Phone: (615) 391-3076
Fax: (615) 885-0285
Email: CNMCCo@aol.com
Website: www.cnmcco.com
Contact: *Mr Ferd Pusl*

Donaldson Marphil Medical Inc.
3465 Cote des Neiges, Ste 602
Montréal, QC H3H 1T7
Phone: (514) 931-0606
Fax: (514) 931-5554
Email: donaldson.marphil@qc.aibn.com
Website:
Contact: *M. Michel Donaldson*
President

G. E. Medical Systems
2300 Meadowvale Boulevard
Mississauga, ON L5N 5P9
Phone: (905) 567-2158
Fax: (905) 567-2115
Email: deborah.keep@med.ge.com
Website:
Contact: *Ms Deborah Keep*

Hilferdine Scientific Inc.
85 Denzil Doyle Court
Kanata, ON K2M 2G8
Phone: (613) 591-5220
Fax: (613) 591-0713
Email: hilferdine@sympatico.ca
Website: www3.simpatico.ca/hilferdine
Contact: *Dr. Joseph Baskinski*

Kodak Canada Inc.
3500 Eglinton Ave W
Toronto, ON M6M 1V3
Phone: (416) 766-8233
Fax: (416) 760-4487
Email: gollaher@kodak.com
Website: www.Kodak.ca
Contact: *Mr Bob Gollaher*

Landauer, Inc.
2 Science Road
Glenwood, IL 60425
Phone: (708) 755-7000
Fax: (708) 755-7016
Email: sales@landauerinc.com
Website: www.landauerinc.com
Contact: *Mr William Megale*
National Sales Manager

Masthead Imaging Corporation
The Raincoast Executive Centre
201 Selby Street
Nanaimo, BC V9R 2R2
Phone: (250) 755-7721
Fax: (250) 755-7711
Email: shlomo@telus.net
Website: www.go-pips.com
Contact: *Dr. Shlomo Shalev*
President

MDS Nordion
447 March Road
Kanata, ON K2K 2B7
Phone: (613) 592-3400
Fax: (613) 592-6937
Email: sales@mds.nordion.com
Website: www.mdsnordion.com
Contact: *Mr Ron Dunfield*
Regional Mgr for Canada

Mentor Medical Systems Canada
1333 Boundary Rd, Unit 10
Oshawa, ON L1J 6Z7
Phone: 1-800- 525-0245
Fax: 1-805-681-6057
Email: joejag51@aol.com
Website: www.mentorcanada.com
Contact: *Mr Joseph Lawrence*

Multidata Systems International Corp.
9801 Manchester Road
St. Louis, MO 63119
Phone: (314) 968-6880
Fax: (314) 968-6443
Email:
Website: www.multidata.systems.com
Contact: *Ms Patricia Roestel*

Nucletron Corporation
7080 Columbia Gateway Drive
Columbia, MD 21046
Phone: (410) 312-4127
Fax: (410) 312-4126
Email: yerge@nucusa.com
Website: www.nucletron.com
Contact: *Ms Nina Yerge, Marketing Mgr*

PTW-New York Corporation
201 Park Avenue
Hicksville, NY 11801
Phone: (516) 827-3181
Fax: (516) 827-3184
Email: ptw@ptwny.com
Website: www.ptwny.com
Contact: *Mr Steve Szeglin*
General Manager

Siemens Canada Ltd.
2185 Derry Road West
Mississauga, ON L5N 7A6
Phone: (905) 819-5747
Fax: (905) 819-5884
Email: dean.willems@siemens.ca
Website: www.siemens.com
Contact: *Mr Dean Willems*
Oncology Systems Manager

Thomson Nielsen
25E Northside Road
Nepean, ON K2H 8S1
Phone: (613) 596-4563
Fax: (613) 596-5243
Email: tnelec@thomson-elec.com
Website: www.Thomson-elec.com
Contact: *Ms Mairie Miller*
Marketing Manager

University of Calgary/Tom Baker Cancer Centre

Research Postdoctoral Fellow Position available

The Tom Baker Cancer Centre Department of Medical Physics of the University of Calgary Department of Oncology, has an immediate opening for a Postdoctoral Fellow. This is a new position funded for 1 year, with the expectation of a 2nd year. This is intended to be a 100% research position, but this is negotiable for a suitable candidate. Research will be primarily in breathing control and Normal Tissue Complication measurements. The NTC measurements will be mainly with Radiation Therapy patients, using Dynamic CT, SPECT and MRI. The images will be correlated with 3D dose distributions. Patient breathing control is being pursued using both Active Breathing Control and RPM Respiratory Gating. There will be frequent patient interaction. Candidates should have a Ph.D. in Medical Physics, Physics or a related field, with a strong programming background in C and Unix. Imaging experience is desirable. Facility with written and spoken English is important.

The Tom Baker Cancer Centre is a state-of-the-art facility with 6 Varian linacs and 1 cobalt-60 machine, with a 7th linac to be installed later this year. Most of these machines are equipped with MLC and EPI. For 3D Treatment Planning, we have Pinnacle-3, GRATIS, PlUNC and X-Knife. There are 2 Picker AcQSim CTs in the Medical Physics Department and access to MRI and SPECT in the host hospital, the Foothills Medical Centre.

Interested candidates should submit their curriculum vitae and a statement of their research interests by April 30th to:

David P. Spencer, Ph.D., MCCPM, DABR
Senior Medical Physicist
Department of Medical Physics
Tom Baker Cancer Centre
1331 29th St NW
Calgary, Alberta T2N 4N2

Fax: 403-670-2327
E-Mail: david.spencer@cancerboard.ab.ca

Hôpital Maisonneuve-Rosemont
Centre affilié à l'Université de Montréal

L'Hôpital Maisonneuve-Rosemont est un centre hospitalier d'enseignement et de recherche du réseau de l'Université de Montréal qui dispense une gamme complète de soins, de la médecine familiale aux soins secondaires et tertiaires. Établissement d'avant-garde, il offre un milieu de travail stimulant et dynamique centré sur la clientèle.

OFFRE D'EMPLOI

Physicien médical

L'Hôpital Maisonneuve-Rosemont recherche un(e) physicien(ne) pour combler un poste de physicien médical au département de radio-oncologie. Le ou la candidate joindra l'équipe de sept physiciens, un technicien en électronique et un technicien en génie mécanique du service de radiophysique. La personne retenue participera aux activités suivantes :

- **dosimétrie et planification des traitements**
- **contrôle de qualité des appareils de traitement et de mesure**
- **étalonnage des appareils de traitement**
- **radioprotection**
- **projets de recherche visant l'amélioration de techniques actuelles et le développement de nouvelles techniques de traitement**
- **travail en soirée occasionnel**
- **service de garde pour les urgences radiologiques**

Notre département est équipé de cinq accélérateurs linéaires (dont deux avec MLC), deux appareils de cobalt, un appareil de HDR, un appareil d'orthovoltage, un laboratoire de radio-isotopes, trois chambres spécialement blindées et aménagées pour la curiethérapie, deux simulateurs, un tomodensitomètre et deux systèmes de dosimétrie : cinq stations CadPlan pour la radiothérapie externe et une station PLATO pour la curiethérapie. Notre département est doté d'un réseau informatique qui relie nos appareils de radiothérapie, nos stations de dosimétrie et nos ordinateurs personnels.
Présentement nous traitons environ quatre mille patients par année. Parmi les techniques spécialisées utilisées nous retrouvons : l'irradiation pancorporelle (TBI), l'irradiation du mi-corps (HBI), thérapie conforme avec modulation d'intensité (IMRT), HDR interstitiel et gynécologique, thyroïde avec I 131, intra-synoviale avec Y 90, métastases avec Sr 89 et syndromes prolifératifs avec P 32.

Pour obtenir ce poste, le ou la candidate doit :

- posséder une maîtrise en physique médicale avec un minimum d'un an d'expérience en radiothérapie ou
- posséder une maîtrise en physique avec une expérience en radiothérapie jugée équivalente
- être fonctionnel en français

L'échelle salariale varie de $35 376 à $67 066, selon l'échelon, avec bonification additionnelle pour les certifications du Collège Canadien des Physiciens en Médecine (CCPM).

Si vous êtes intéressés à joindre notre équipe, faites parvenir votre C.V. à l'attention de :

Wieslaw Wierzbicki
Service de Radiophysique
Hôpital Maisonneuve-Rosemont
5415, boulevard de l'Assomption
Montréal (Qué) H1T 2M4
Tél. : (514) 252-3400 poste 4071
Fax : (514) 252-3556
Courriel : wieslaw.wierzbicki@ssss.gouv.qc.ca

(Nous respectons l'équité en matière d'emploi)

Saskatoon Cancer Centre, Saskatoon, SK
Medical Physics Position

The department of Medical Physics at the Saskatoon Cancer Centre invites applications for a full time position either at the level of a Medical Physicist or a Junior Medical Physicist. The Radiation Oncology program at the Saskatoon Cancer Centre treats about 1200 new patients annually using three linear accelerators, two simulators, an ortho-voltage unit and a Selectron LDR. The program also includes an interstitial brachytherapy program and I-131 treatments. The department of Medical Physics is presently staffed with three senior medical physicists, two dosimetrists, two electronics engineers, two mould room technicians, one physics assistant and a secretary.

This position has become available due the expansion of our radiation oncology program. The expansion includes an ADAC Pinnacle 3D treatment planning system and a Varian Clinac 21EX platinum with 120 leaf MLC, a-Si based portal imaging system and advanced dynamic treatment mode. The program has also received a research grant to develop and implement IMRT treatments.

The successful candidate at the level of Medical Physicist will be expected to participate in all clinical, educational and research activities of the Medical Physics department. Clinical activities include acceptance testing and commissioning of new equipment, calibration, quality assurance, treatment planning and support in radiation safety program. The educational and research activities include teaching and supervision of Medical Physics graduate students and participation in the Radiation Therapy training program. Due to a relatively smaller size of our radiation oncology program, the candidate at the level of Junior Medical Physicist will have great opportunity to gain clinical experience in all the aspects of clinical radiation oncology physics and prepare for the certification exam.

The candidates for the Medical Physicist position must be fully trained with preferably postgraduate or graduate degree and a minimum of two years of post training experience in clinical radiation oncology physics. Membership in the Canadian College of Physicist in Medicine or equivalent certification is highly desirable. Opportunities exit for an academic appointment in the department of Physics and Engineering Physics at the University of Saskatchewan for an appropriately qualified candidate. The candidates seeking position at the level of Junior Medical Physicist must have a graduate or post graduate degree in Medical Physics. Please indicate which position is being applied for.

We offer a competitive salary and benefits package.

In accordance with the Canadian Immigration requirements, priority will be given to the Canadian citizens and permanent residents of Canada. Please submit curriculum vitae and the names of three referees by April 28, 2000 to

Narinder Sidhu, Ph.D., FCCPM, DABMP
Director Medical Physics, Saskatoon Cancer Centre

The University of Alberta Department of Oncology and

The Cross Cancer Institute Invite Applications for

MEDICAL PHYSICIST

An academic medical physicist position (Assistant or Associate Professor) is available through the University of Alberta (Department of Oncology, Division of Medical Physics) at the Department of Medical Physics, Cross Cancer Institute (CCI). The applicant should have a Ph.D. in medical physics or a closely related discipline, and a minimum of two years experience in Radiation Therapy Physics. Preference will be given to applicants with CCPM certification or the equivalent (ABR, ABMP).

The CCI is a free-standing comprehensive cancer centre that serves the population of Edmonton and northern Alberta, providing tertiary level diagnostic and treatment services, conducting cancer research and participating in professional education.

The facilities of the CCI include seven Varian linear accelerators, a cobalt unit, an orthovoltage x-ray machine, a CT-simulator, three conventional simulators, in-house developed and Helax treatment planning systems; comprehensive diagnostic, CT, MRI and SPECT imaging systems. The brachytherapy program includes: MicroSelectron HDR, Selectron LDR, two MicroSelectron LDRs, and an NPS brachytherapy treatment planning system. A cyclotron and PET facility for oncological applications will be built starting in June 2000, and a prototype helical tomotherapy system will be installed in early 2001. There exists extensive computer, electronic, and mechanical facilities in the department.

Scientific research in Medical Physics includes work on intensity modulation planning, delivery, and verification; brachytherapy planning, and image-guided adaptive radiotherapy. Clinical research includes participation in 3D conformal radiotherapy clinical trials of the RTOG. Teaching responsibilities are within the medical physics graduate program, the radiation oncology residency training program, and the in-house radiation therapist training school.

The candidate will be expected to establish an independent research program. The level of the appointment and the amount of guaranteed research time will be commensurate with the qualifications of the candidate.

In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Please submit a resume with the names of three referees to B. Gino Fallone, Ph.D., FCCPM, ABMP; Medical Physics, University of Alberta, Cross Cancer Institute, 11560 University Avenue, Edmonton, AB, T6G 1Z2, Tel. 780 432-8522, FAX 780 432-8615, Email gino.fallone@cancerboard.ab.ca.

CHUM

Le Centre hospitalier de l'Université de Montréal

recherche
deux physicien(ne)s pour son service de physique et génie biomédical
(postes à temps complet en radio-oncologie)

La radio-oncologie au CHUM

Plateau technique (sur deux sites) :

- 2 accélérateurs Elekta SL25 (6 & 25 MV + électrons) dont un avec collimateur multi-lames
- 1 accélérateur Siemens Mevatron (4 MV)
- 3 appareils de Cobalt Theratron 780
- 3 simulateurs Philips
- 1 appareil de curiethérapie à haut débit de dose Microselectron de Nucletron
- Traitement de la thyroïde par iode 131
- 7 consoles de planification de traitement Theraplan Plus (dont deux pour la visualisation)
- 1 console de planification de radiochirurgie XKnife
- 2 accélérateurs Elekta SL75 (6 MV)
- 1 appareil de Cobalt Theratron 1000
- Système d'imagerie portale à tous les accélérateurs Elekta
- Tomodensitomètre de planification Philips SR6000
- Équipement de radiochirurgie Philips SRS-2000
- Traitement des mélanomes oculaires par iode 125
- 1 console de planification de la curiethérapie à haut débit de dose Plato
- 3 explorateurs de faisceaux Wellhöfer

L'installation d'un nouvel accélérateur (Elekta Precise, 6 et 18 MV, avec IMRT) est prévue pour le printemps 2000. Les candidats s'intégreront à une équipe déjà en place de 9 physicien(ne)s (7 M.Sc. et 2 Ph.D.) dédiés à la radio-oncologie. Nous cherchons des candidats de formation, d'expérience et d'engagement.

La physique et génie biomédical au CHUM

Des technologies et des ressources humaines :

L'équipe de physique et génie biomédical regroupe toutes les forces de physique médicale (17), de génie biomédical (5) et de techniciens biomédicaux (20) avec une mission commune de planifier, acquérir, mettre en service et assurer l'utilisation sûre et efficace de tous les équipements médicaux. Cela inclut la participation au diagnostic et au traitement.

Le CHUM compte 7 tomodensitomètres (CT), 4 imageurs par résonance magnétique, 22 caméras gamma, environ 40 équipements d'échographie, 4 salles d'hémodynamie et environ 30 salles de radiologie, en plus des équipements spécifiques à la radio-oncologie, aux 30 salles d'opérations, et aux 60 lits de soins intensifs tous équipés de l'anesthésie ou du monitoring appropriés. Un projet PACS est également en voie de réalisation afin de passer d'une production traditionnelle d'images radiographiques (1,5 millions de films par année) à une production entièrement numérique.

Outre notre mission clinique, nous participons à l'enseignement des résidents, à la formation de stagiaires et d'étudiants gradués, et nous participons régulièrement à des projets de recherche.

Pour tout renseignement et pour adresser vos Curriculum Vitae, veuillez S.V.P. contacter :

The London Regional Cancer Centre

POSITION: **MEDICAL PHYSICS RESIDENT**
LOCATION: London, Ontario, Canada

Our Cancer Centre is committed to providing leadership in cancer treatment, research, and education and is affiliated with the University of Western Ontario. Current treatment resources include 9 high-energy treatment machines, some with MLC and EPID, 2 simulators, a CT-simulator, HDR, LDR, and programs in prostate brachytherapy, stereotactic radiosurgery, and TBI. Leading-edge medical physics research is underway in projects related to 3-D conformal radiation therapy, megavoltage imaging, dose optimization, 3D gel dosimetry, and outcome prediction with radiobiological modeling. The successful candidate will join a very active and dynamic Medical Physics team with a full range of dosimetrist, computer and engineering support. The candidate will benefit from "on-the-job" experience and will participate in all aspects of clinical physics related to radiation treatment including radiation dosimetry, treatment planning, brachytherapy, and quality assurance of all radiation therapy equipment. Courses in radiation physics and radiation biology at the University of Western Ontario are also offered during the tenure of this position. While the primary intent is to provide the candidate with a practical foundation in clinical physics, participation in a research project will occupy about 20% of the time. The duration of the training is two years and the training period will end with the Cancer Care Ontario Peer Review A clinical certification process.

QUALIFICATIONS

- M.Sc. or Ph.D. in Physics or a related field. Preferred entry requirement is a Ph.D. in Physics or a related subject. Minimum entry requirement is a M.Sc. in Medical Physics.
- Good verbal and written communication skills.
- Strong interest in working in interdisciplinary medically-related area.
- Some basic knowledge in radiation physics.

Application deadline is 29 February 2000. We thank all those who apply; however, only candidates chosen for interview will be contacted. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada. Cancer Care Ontario is an equal opportunity employer.

CONTACT: Ms. Susan Vande Sompel, Human Resources Administrator
London Regional Cancer Centre
790 Commissioners Road East
London, Ontario N6A 4L6
Telephone: (519) 685-8665 Fax: (519) 685-8726
Website: http://www.lrcc.on.ca/

Ryerson Polytechnic University
Tenure-Track Appointment

The Department of Mathematics, Physics and Computer Science invites applications for one tenure-track appointment starting August 1, 2000.

Candidates should have or be near completion of a Ph.D. in Medical Physics or a related field, possess a strong commitment to undergraduate teaching and agree to develop and conduct an active and continuous research program. The successful candidate is expected to be able to attract external research funding and help in the development of undergraduate and graduate level education. Salary is dependent upon qualifications and experience in accordance with the Ryerson Collective Agreement.

Applicants should submit a curriculum vitae with the names of three referees to:

Dr. C.C. Alexopoulos, Chair
Department of Mathematics, Physics and Computer Science
Ryerson Polytechnic University
350 Victoria Street
Toronto, Ontario, M5B 2K3

The closing date for applications is April 28, 2000.

In accordance with Canadian immigration requirements, this advertisement is directed toward Canadian citizens and permanent residents of Canada.

Ryerson Polytechnic University encourages applications from all qualified individuals including women, members of visible minorities, aboriginal people, and people with disabilities.

From the Editor:

As you can see there have been some changes in the appearance of this issue of Interactions – all based on the judicious removal and addition of colour. For the longest time I have been given printing proofs that have been printed on bright, white paper. The results have been high quality, high contrast proofs. However, for some time I have been quite disappointed with the version that gets sent out to members, because the reproduction quality does not seem to match the quality of the proofs. Nevertheless, up until now, I have felt bound by tradition to maintain the use of the "ivory" paper, which has been in use for at least the past decade. Recently, however, I started to rethink this tradition. The reason for the use of coloured paper was so that the stapled sheaf of papers that members used to receive could be distinguished from other documents. With the current layout of Interactions, I no longer believe that coloured paper is necessary to make the publication stand out. So I have decided to use a better quality of paper that can better reproduce the material. Furthermore, you will see that for the first time, the newsletter has used colour reproduction for one of its articles. While colour printing is quite expensive, its selective use can make a big improvement in the attractiveness of Interactions.

I am also pleased to say that I may have almost finished compiling a complete set of newsletters. I was contacted by Karen Breitman, who, as it turns out, was the first editor of the Canadian Medical Physics Newsletter, when she was working in Winnipeg. The first publication was October 1981. She was able to send me the October 1981 issue and the May 1982 issue. This means, that apart from 1982-1983, we now have all of the back issues of the newsletter. If anyone has issues from the missing era, please let me know. And perhaps only someone who has been an editor might find this interesting, but I noted from reading the first two issues of the Canadian Medical Physics Newsletter that the role of the editor (i.e., begging for contributions) has remained unchanged for the past 19 years.

Talking about begging for contributions, it is useful to remind everyone that my tenure as editor ends after the next issue. While I have made a concerted effort to find a replacement, and to figure out ways of dividing up the duties, (and even to arrange for content for future issues) I am not sure that anyone will come forward to take all of the responsibility that I do. Even more worrisome, is that the publication is becoming (at least from my vantage point) more and more a solo effort, which is something to think about since the soloist is about to depart. With notable exceptions (and I am **very** grateful to those people) most of the content is cajoled from members, or created by the soloist. [I am just lucky that I hear about so many things happening in Canada.] It is not clear that the next editor will be as proactive in attracting submissions as I am, which may signal a change in the fortunes of Interactions. Since Interactions is one of the few tangible benefits of joining COMP, it is well worth preserving. At the next COMP Annual General Meeting (during World Congress 2000) I hope to bring forward to the members one possible approach to ensure the continuity of Interactions – getting outside help. The current proposal will not generate any content, but it may attract enough advertising revenue that the publication will pay for itself, with a much higher publication quality. It will then be up to us, as members, to use this communication vehicle. So if you want to help decide what will happen to Interactions, you can come to the Annual General Meeting of COMP and vote with your arms. Or even better, vote with your key boards and send (or keep sending) me, and my eventual replacement, contributions. And of course, if you are interested in becoming the Editor or have suggestions on how you could contribute to Interactions, I most certainly would like to hear from you.

… the publication is becoming … more and more a solo effort, which is something to think about since the soloist is about to depart.