COMP/OCPM
CANADIAN ORGANIZATION OF MEDICAL PHYSICISTS
ORGANISATION CANADIENNE DES PHYSICIENS MEDICAUX

CANADIAN COLLEGE OF PHYSICISTS IN MEDICINE
LE COLLEGE CANADIEN DES PHYSICIENS EN MEDECINE

CANADIAN MEDICAL PHYSICS NEWSLETTER / Le BULLETIN CANADIEN de PHYSIQUE MEDICALE

December / Decembre 1991

From the editor:

Although this is a busy time of year we Canadian medical physicists have managed to get a second newsletter out of Montréal in 1991. This is mainly because of the excellent response to my request for submissions of newsletter articles. Thank you for this response and keep up the good work.

This issue of the newsletter contains the type of articles I hope we will see in all future issues. Walter Huda, Milton Woo and Peter Dunscombe give reports on three medical physics meetings in Great Britain, Canada and the USA (pages 2 and 3). There are a few news items. Peter reports on the recent visit of the Princess of Wales to the Northeastern Ontario Regional Cancer Centre (page 4). There are three preliminary reports on an accident in the radiotherapy department in Zaragoza, Spain which have been passed on to us by John Aldrich (page 5). Martin Yaffe and Gord Mawdsley present the results of an investigation of x-ray protective garments (page 8). I encourage you all to submit clinically relevant reports of this nature to the newsletter. John Aldrich has also forwarded to the newsletter a policy statement on medical physics staffing from the Institute of Physical Sciences in Medicine (page 10). Peters Duscombe and McGhee also present a study indicating that physicists are perhaps not the most astute financial planners (page 16). Finally an extensive report of recent activities of the executive committees of both the COMP/OCPM and the CCPM is given by Ellen El-Khatib and Jake Van Dyk (page 18).

I would like to thank all those who submitted material for this issue. I also thank J.-P. Bissonnette, Micheline Gosselin and Pierre Courteau for the French translations and Michael Evans for helping set-up the newsletter.

Finally, I would like to take this opportunity to wish you all the peace of this holiday season and the best for the new year.

John Schreiner

De l'éditeur:

Malgré cette période de l'année très occupée, nous Physiciens Médicaux Canadiens, avons réussis a expédier de Montréal un deuxième bulletin en 1991. Ce succès est principalement dû à l' excellente réponse à mon appel pour des articles. Merci pour votre excellente participation et continuer de soumettre du matériel pour votre bulletin.

Ce bulletin comprend des articles résumant diverses rencontres de Physiciens Médicaux, des sujets d'intérêt général et une discussion sur les résultats d'une étude portant sur les vêtements de protection contre les rayons-x. Je vous encourage tous à soumettre ce genre d'article a caractère clinique pour le bénéfice du bulletin. Ce sont des articles du type apparaissant dans ce numéro, qui j'espère paraîtront dans les numéros a venir. Aussi inclus, "A policy statement on medical physics staffing" de l'Institute of Physical Sciences in Medicine et un rapport indiquant que peut être les physiciens ne sont pas les financiers les plus astucieux. Finalement on présente un rapport élaboré portant sur les activités du Conseil d'Administration du CCPM et de l'Exécutif de l'OCMP

J'aimerais remercier tous les auteurs qui ont contribués à ce numéro. J'aimerais aussi remercier J.-P. Bissonnette, Micheline Gosselin et Pierre Courteau pour la traduction française et Michael Evans pour son aide dans l'assemblage du bulletin.

Pour terminer, j'aimerais profiter de cette occasion pour vous souhaiter de joyeuses fêtes ainsi qu'une bonne et heureuse année.

John Schreiner

Be part of the Christmas rush. Pay your 1992 membership dues now.

HOSPITAL PHYSICISTS ASSOCIATION INSTITUTE OF PHYSICAL SCIENCES IN MEDICINE

The 48th annual meeting of the HPA/IPSM was held at Exeter University (Devon) on 11-13 September 1991. The attendance included about 150 medical physicists, with participation from all areas of medical physics including radiotherapy, diagnostic radiology, MR/US, radiological protection and physiological measurement. There were about 10 formal sessions each consisting of four 30 minute "review" talks on various topics including Ultrasound in Cardiology, NMR, Technological advances in clinical rehabilitation, QA in brachytherapy, Urodynamics and Radionuclide blood flow measurement. An additional 50 poster presentations were available for review in an adjacent hall. The undoubted highlight of the conference was the Douglas Lea Lecture which featured an excellent talk on "Current Advances in Radiobiology" by Juliana Denenkamp, the present director of the Gray Laboratory at Mount Vernon Hospital outside London.

The commercial exhibit boasted a total of about 40 commercial displays, covering the entire field of medical physics and medical bioengineering. An active social programme included visits to the local cathedral and a formal banquet held at the University. At the end of the meeting, attendees had an opportunity to inspect the (diverse) activities of the University and Hospital medical physics activities.

Comparison of the HPA/IPSM meeting with Canadian/US gatherings is difficult. Most active research groups in the UK prefer to attend "specialty" meetings (e.g. MR, Ultrasound, or radiation protection) where there is a "critical mass" of active participants. On the whole, the oral review sessions were of a high quality, and often offered the opportunity of becoming acquainted with "non-traditional" areas of medical physics. The poster sessions were VERY diffuse, and also of rather variable quality. The domination of radiotherapy physics that is evident at the AAPM was totally absent; the presence of non-ionizing radiation topics such as physiological measurements and bioengineering is a reflection of the importance of these areas in most academic and clinical British medical physics departments.

Walter Huda
University of Florida

13th CLINICAL CANCER RESEARCH CONFERENCE of the ONTARIO CANCER TREATMENT and RESEARCH FOUNDATION

The Clinical Cancer Research Conference of the Ontario Cancer Treatment and Research Foundation is held once every two years at the scenic Lake Couchiching YMCA conference centre in Orillia, Ontario. In conjunction with the main conference there is a meeting of the medical physicists of the OCTRF and OCI (Ontario Cancer Institute). This year's physics meeting on October 7th was well attended by over 50 representatives from all the centres.

In the scientific part of the meeting there were 16 papers presented, covering a variety of topics in the therapy area as well as in the imaging area. Specifically, there were presentations on hyperthermia, radiobiology, high dose rate brachytherapy, dosimetry topics on tissue compensators, breast planning, patient translation technique for TBI, and linac output factors; instrumentation topics on parallel plate ion chambers and on a plastic scintillator system; and two papers on treatment field uncertainties. There were 2 papers on imaging, one on portal imaging using amorphous selenium and another on two-dimensional transducer arrays for ultrasound imaging. Finally, two papers discussed the study of tissue optical properties using pulsed photothermal radiometry.

A special feature of this year's physicists meeting was a symposium sponsored by Philips Medical Systems, with two distinguished invited speakers, Dr. Peter Almond and Dr. Peter Williams. Dr. Almond spoke on the selection, acceptance and performance of the Philips SL25 linear accelerator, and Dr. Williams described the experience of conformal therapy and portal imaging using the SL25 with multileaf collimator at the Christie hospital.

The physicists meeting closed successfully with the usual 'Happy Hour' in the evening.

Milton K. Woo
Toronto-Bayview Regional
Cancer Centre

Current Perspectives in CT Simulation for Radiotherapy Treatment Planning.

The University of Iowa: 16th and 17th September 1991

This meeting, which received educational grant assistance from Theratronics, attracted around 200 participants although Canadian representation was uncharacteristically poor. A well known faculty had been assembled to discuss various aspects of the topic. Several, by their own admission, did not know what CT Simulation was and elected to focus their presentations on other topics such as 3-D Treatment Planning.

The correct definitions of the terms currently in use in this area appear to be:
CT Simulation - use of a CT scanner in conjunction with a treatment planning computer to design treatment portals.

CT Simulator - a device which performs CT simulation <u>and</u> incorporates an optical system for marking the field outline on the patient. (Hence, you don't need a CT Simulator to do CT Simulation).

Simulator CT - use of the rotational capabilities of a conventional simulator in conjunction with either the II or some other radiation detector and an external computer to generate transaxial images.

The most important points to arise from the day and a half meeting for this correspondent were:

1. Whenever CT Simulation was practiced it was felt necessary to confirm the planned portal by a conventional simulation prior to treatment. Whether this approach reflects conservatism amongst the Radiation Oncology community or a lack of confidence in the clinical implementation of CT Simulation was unclear.

2. The need to incorporate Digitally Reconstructed Radiographs into the Beam's Eye View facility available with treatment planning systems was stressed by several speakers. Presumably this advance would not only facilitate the evaluation of a planned portal but it would also permit the accurate comparison of the planned portal with a digital image of the actual treated field.

3. Simulator CT had progressed to the stage where image quality now approached that of a conventional CT scanner. As this could be achieved without restricting any of the simulator's usual capabilities Simulator CT was emerging as a flexible and cost effective approach to the production of CT data for treatment planning.

In conclusion, the meeting was well organized, included a few thought provoking presentations and being fairly focussed assisted participants in developing a clearer understanding of CT Simulation and its likely future clinical role.

Peter Dunscombe
Northeastern Ontario Regional Cancer Centre

HER ROYAL HIGHNESS, THE PRINCESS OF WALES VISITS THE NORTHEASTERN ONTARIO REGIONAL CANCER CENTRE

On 24th October 1991 the Northeastern Ontario Regional Cancer Centre was honoured with a visit from Her Royal Highness, the Princess of Wales. Following the official welcome to Ontario and a brief tour of Science North Her Royal Highness made the short trip across Ramsey Lake Road to spend 45 minutes with the staff and patients of NEORCC. Having been open for only a year the Centre was still in a good state of repair and only minor cosmetic touches to the decor were required. Disruption prior to the visit was largely restricted to meetings with the Ministry of Intergovernmental Affairs Protocol Officers and three practice runs of the visit itself. On the day all those closely involved knew their roles and, under the circumstances, appeared relaxed.

The tour was planned to show Her Royal Highness the main areas of clinical activity within the Centre and commenced with Radiotherapy where she unveiled a plaque officially opening the radiation suites. It was during this part of the tour that your humble correspondent - a staunch and unabashed monarchist - had the opportunity to meet Her Royal Highness. Along with the heads of Radiation Oncology (Dr. Randy Bissett) and Radiation Therapy (Ms. Jane Palmer) your correspondent assisted in introducing the Princess to the medical, scientific and technical considerations involved in the treatment of breast cancer. Her Royal Highness spent some time conversing with one of our patients and her physician (Dr. Barbara Lada). When the press had left the treatment room the patient was placed in her shell, correctly positioned and a wedge and lung shielding block inserted into the treatment head. Her Royal Highness then left the room with the Therapists and watched the actual treatment being delivered from the console.

As part of the machine purchase the Centre had ordered Beamview® - an on line portal imaging system - although installation of this accessory was scheduled for early 1992. As soon as the Royal Visit was confirmed the installation was brought forward so that Her Royal Highness could be shown a truly state of the art facility. The Beamview® components arrived in Sudbury less than a week before the visit. It was installed and functioning on the Saturday prior to the visit thanks largely to local expertise and experience with this system. On 24th Her Royal Highness was able to see not only the monitor units incrementing as the treatment progressed but also the moving anatomy encompassed by the treatment portal.

In retrospect, the inclusion of an actual patient treatment with on line portal imaging in a tightly scheduled and highly publicised visit seems a rather risky undertaking. On the day everything went exactly to plan and your correspondent - an aging romantic as well as a monarchist - along with all the staff and patients of NEORCC had participated in an unusual and very positive experience for cancer patients and those who contribute to their care.

Dr. Peter B. Dunscombe
Northeastern Ontario Regional Cancer Centre

Radiation Accident at Zaragoza

Reports have appeared in the media in a number of countries concerning an accident in a radiotherapy department in Zaragoza, Spain. A fuller report on the accident must, obviously, await the conclusion of the official inquiries at present in progress. At present, our best information comes in a report prepared for the Spanish Society for Medical Physics, SEFM, by Dr. Pedro Andreo. This is reproduced below, with the permission of SEFM. In her preface to the report, Montserrat Ribas, President of SEFM writes:

> The Spanish Medical Physics Society has prepared a report about the malfunction of the Electron Linear Accelerator, Model Sagittaire, installed in 1976 in the Clinical Hospital of Zaragoza. See copy opposite.
>
> Since the matter is *sub judice*, no more information can be given at this moment.

Also reproduced below are the brief reports on the incident published by two EFOMP member organisations: an English translation of the report of the French society, SFPH and the Notice published by IPSM in Britain. Once the official investigations are complete, it is in the interests of the whole Medical Physics community that the full facts are widely disseminated, so that the lessons they contain may be learned.

Published by SFPH, in their Bulletin No. 60

We have learned through the press and from CGR-Mev that, following a malfunction of a SAGITTAIRE accelerator between 10th. and 20th. December last, and due to a lack of daily quality control on the equipment, several patients were irradiated excessively, leading, to date, to the deaths of three of them.

At present, an inquiry and legal action are in progress to determine the exact causes of the accident.

The French radiotherapy community, physicists and radiotherapists, are working to obtain full and accurate information on what, in fact, happened.

As soon as that information is available, we will pass it on to you.

Once again, as when M. Rosenwald reported in Bulletin No. 57 after the accident in England at a Gamma therapy installation, we must draw the attention of the managers of public and private institutions and of the clinicians with whom we work to those responsibilities which are ours and to the risks involved if we have insufficient resources in personnel and equipment to guarantee patient safety and the associated quality standards in dosimetry.

We recall that since 1969 French law requires the presence of a full-time physicist at accelerator installations, and that European directives since 1984 require a physicist to be associated with gamma therapy and nuclear medicine installations.

This implies that we should be responsible for all the verifications which are required on receipt of the equipment and after all work by the manufacturer, in addition to regular checks.

In 1986, SFPH published a document on the quality control of accelerators in medical use, recommending the frequency of checks to be made.

A French standard, C74 209, has just been published in January 1991, and restates the same recommendations.

G. Gaboriaud, President

Circulated to IPSM Members, April 1991

Some of you may have read brief press reports about a radiotherapy 'accident' in Zaragoza, Spain. Information is now coming in to suggest that this may have been a rather serious incident. We do not have sufficient details at this stage to make a full statement but on the basis of the information already available wish to re-emphasise the three essential principles of good medical physics practice in Radiotherapy.

1. Do ensure that you have adequate qualified staff to do the work.
2. Do ensure that all equipment capable of generating high dose rates of ionising radiation is adequately calibrated and checked at frequent intervals.
3. Do ensure that physicists are proactive in ensuring good communications between staff groups involved in treatment delivery.

Dr. P.P. Dendy, Chairman, Health and Safety Policy Committee

Report on the Accident of the Electron Therapy Linear Accelerator Sagittaire of the Radiotherapy Department of the Clinical Hospital of Zaragoza, Spain

1. Cause of the Accident

Initial breakdown of the accelerator, followed by an incorrect repair and a manipulation of the equipment interlock systems.

2. Operation of the Equipment in Normal Conditions

The accelerator started to function in 1976.

When the operator selects a determined electron energy on the control panel, the equipment "automatically" selects the phase difference of the microwaves which are injected in the acceleration section and the current intensity of the bending magnet. These values are different, specific and concrete for each energy.

The microwave phase difference determines the beam energy of the accelerated electrons. The current intensity of the bending magnet determines the bending angle of the electron beam.

3. Failure

The apparatus suffered a breakdown in the bending magnet power supply. With this failure, the current of the bending magnet stayed fixed for any selected energy and reached a value near the maximum.

The accelerator had this failure quite frequently and there had never been any consequence for the patients. In this case, the electron beams of low energy were correctly accelerated at the energy selected by the operator on the control panel, since the equipment correctly selected the appropriate phase. However, since the beam was bent with an incorrect current, there was no radiation output at the exit and the interlock of the equipment automatically shut down its operation, indicating the situation of "FAILURE".

4. Incorrect Repair

In other occasions when this malfunction occurred, the repair was done by substituting the deteriorated transistors in the power supply, achieving again the normal operation. In this case, instead of repairing the bending magnet power supply (deteriorated transistors), the microwave phase difference was modified. As a consequence, the energy of the exit beam was modified until it matched the energy corresponding to the "incorrect" bending magnet current.

This would not have occurred if:

1. The phase would not have been manipulated.

2. The automatic phase selection would not have been changed to manual selection by the technician that repaired the failure.

This manipulation could only be done inside the machine room.

5. Consequences

When the operator selected a determined energy, the equipment supplied a different one, since in colloquial terms, it "had been fooled" by the repair.

In addition, this "fooling" the equipment resulted in the fact that the scanning magnet current to obtain a wide beam was not the correct one for the real energy of the beam, with the consequent change in the response of the accelerator transmission ionisation chambers and, hence, of the emitted radiation dose.

6. Clarification

The selection of the electron beam energy is performed with luminous buttons placed on the control panel.

In the control panel there is an analogue dial of the bending magnet current. So, when the problem occurred, the energy indicated was the one selected by the operator, in spite of the fact that this indicator logically showed its maximum value.

No device on the control panel reflects a measure of the real energy of the electron beam.

Two voluntary re-enactments of the failure and of its incorrect repair, performed in the presence of General Electric technicians, the Physics Department, the Maintenance Department, the Department of Radiotherapeutic Oncology and the Hospital Management, corroborated the accuracy of this technical interpretation of the causes of the accident.

ANNOUNCEMENT

1992 AAPM SUMMER SCHOOL

THE PHYSICS OF MRI IMAGING
Banff Centre, Canada
Aug 30 - Sept. 4 1992

TOPIC: The Physics of Magnetic Resonance Imaging

LOCATION: The Banff Centre,
Banff, Alberta, Canada

DATE: August 30 - September 4, 1992

PROGRAM DIRECTORS:

Perry Sprawls, Ph.D., F.A.C.R.
Professor and Director
Magnetic Resonance Education Center
Emory University
Atlanta, Georgia

Michael J. Bronskill, Ph.D., F.C.C.P.M.
Director, Medical Physics
Reichmann Research Bldg.,
Sunnybrook Health Science Centre
Toronto, Ontario, Canada

LOCAL ARRANGEMENTS:

Sherry Connors, M.Sc., F.C.C.P.M.
Department of Medical Physics
Cross Cancer Institute
Edmonton, Alberta, Canada

Larry Filipow, Ph.D.,
Radiology and Diagnostic Imaging
University of Alberta Hospital
Edmonton, Alberta, Canada

COURSE DESCRIPTION:

A comprehensive five-day course has been planned to address the physics and clinical support responsibilities of the practicing medical physicist. The course is appropriate for individuals with minimal experience in MRI.

The objectives of the summer school are to provide the medical physicist with the knowledge to : 1) teach the principles of magnetic resonance imaging and spectroscopy to health professionals; 2) evaluate magnetic resonance image quality and general system performance; 3) provide consultation on equipment selection and related physics issues; and 4) provide consultation to clinical colleagues on optimizing imaging procedures.

The lecture sequences will cover the basic principles of NMR and MRI, imaging methods and techniques, motion and flow phenomena, clinical protocols, optimizing image quality and system performance, spectroscopy, evaluating system performance, developing specifications, safety, and facility planning.

The faculty includes many national and internationally known experts in the field of magnetic resonance imaging who are actively engaged in various aspects of academia, clinical service, industry and the private consultant sector.

Opportunity will be provided for informal discussion with the lecturers and for informal discussions related to specific topics.

The summer school will be held in the Banff Centre, set amidst the splendor of the Canadian Rockies. The facilities and locale are the finest to be offered . Advance registration is recommended.

ATTENUATION FACTORS FOR X-RAY PROTECTIVE GARMENTS

Our laboratory has been interested in the protective capability of apparel worn in x-ray procedure rooms. Our involvement began as part of a project attempting to find an optimized mixture of attenuating materials which would provide equivalent radiation protection to the traditional lead vinyl fabrics but with a lower overall garment weight. The results of that work are described elsewhere[1] but basically involves use of materials whose atomic K absorption edges are located at energies just below the K absorption edge of lead, in the region where lead exhibits somewhat reduced attenuation capability.

In the course of our work, we realized that there were many misconceptions about the protective factor provided by various equivalent thicknesses of lead. We thought that it would be useful to present experimental attenuation data for various thicknesses of lead at different kilovoltages that are used in diagnostic radiology. Such data are presented in Table I as percent transmission of exposure at four different kilovoltages. The measurements were obtained in our laboratory using a constant potential x-ray unit and a relatively heavily filtered x-ray beam. Although the measurements of transmission are of primary radiation, it is our experience that the effective energy of scattered radiation in this general energy range is quite similar to that of the primary, and, therefore, attenuation factors should also be similar. Shown also in the table are the weights in grams per 100 cm^2 of lead at each thickness.

Although it is often assumed that protective garments are virtually opaque to x rays, note that 0.5 mm Pb transmits approximately 5 percent of the incident exposure at 100 kVp and almost 7 percent at 120 kVp, while 0.36 mm Pb transmits 9.6 percent and 12.6 percent at these voltages.

In Table II we give the weight and x-ray transmission data for samples cut from typical x-ray protective garments. Since the attenuating material is mixed with binder, the weights for equivalence to a given thickness of Pb will be greater than those for pure lead. Some of the samples, identified in the table by "light" are composed of material which is designed to provide reduced weight. The aprons included in this survey were produced by more than one manufacturer, and we do not in some cases have the details of their component materials. In general, however, our experience suggests that when an apron includes x-ray attenuating materials other than lead, its attenuation equivalence to lead will depend on the kilovoltage, and, therefore, either its attenuation or its lead equivalence in mm should be specified at each kilovoltage for which the garment is to be used. This behaviour can be seen, for example, in apron "G" which is matched to 0.5 mm Pb at 100 kVp but whose Pb equivalence is less at lower or higher voltages.

We have found that some aprons like Apron E (light), which appears to be underweight, transmits 23.7 percent of the incident exposure at 100 kVp and 29.2 percent at 120 kVp.

We also found that some Pb aprons sold as nominally equivalent to 0.5 mm Pb (eg Apron I) actually provide greater protection because they are made with more attenuator. This may be a result of a desire to avoid the possibility of an underweight garment due to manufacturing tolerances. As expected, such garments will weigh more than a true 0.5 mm apron.

We believe that it is very important that the protection of aprons be indicated at each kilovoltage. As well, we think that it is more useful to describe the protective value in terms of the fraction of exposure <u>transmitted</u> through the apron rather than the fraction <u>not transmitted</u>. This is because an apron which is 99 percent absorbing, transmits twice the radiation exposure as one which is 98 percent absorbing while the absorption factors suggest that the two aprons are almost equivalent.

Now that it is possible to make aprons which, compared to lead vinyl, are reduced in weight for a given attenuation factor, it is even more important to ensure that any apron, regardless of composition is in fact providing the stated attenuation factor. We, therefore, recommend field testing of these aprons by comparison against a sample of accurately-known Pb equivalence. If the aprons are providing their nominal Pb equivalence they should provide attenuations in agreement with Table I. An alternative simple "go-no-go" test can be done by radiographic the apron next to the standard sample using fixed manual mAs factors at each kVp of interest and comparing densities on the processed film.

Martin J. Yaffe, Ph.D
Gordon E. Mawdsley, B.Sc., FCCPM
Reichmann Research Laboratories, Sunnybrook Health Science Centre
Toronto

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[1]Yaffe, MJ et al. Compositie materials for x-ray protection. Health Physics, Vol. 60, pp 661-664, 1991.

Table I Transmission of Pure Lead

Material	weight (g/100 cm2)	Percentage of Exposure Transmitted at 60 kVp (HVL = 1.36 mm Al)	Percentage of Exposure Transmitted at 80 kVp (HVL = 2.0 mm Al)	Percentage of Exposure Transmitted at 100 kVp (HVL = 5.02 mm Al)	Percentage of Exposure Transmitted at 120 kVp (HVL= 6.7 mm Al)
Pure Lead (Pb)					
0.0 mm Pb	0	100.00%	100.0%	100.0%	100.0%
.25 mm Pb	28.38	1.15%	3.6%	15.0%	18.7%
.36 mm Pb	40.86	0.40%	2.1%	9.6%	12.0%
.50 mm Pb	56.75	0.12%	0.96%	5.2%	6.7%
.65 mm Pb	73.78	0.046%	0.50%	3.2%	4.1%

Table II Samples of Commercial Aprons

Material	weight (g/100 cm2)	Percentage of Exposure Transmitted at 60 kVp (HVL=1.36 mm)	equivalent lead weight g/100 cm2	calculated Pb thickness equivalent at 60 kVp	Percentage of Exposure Transmitted at 80 kVp (HVL=2.0 mm)	calculated Pb thickness equivalent at 80 kVp	Percentage of Exposure Transmitted at 100 kVp (HVL=5.02 mm)	calculated Pb thickness equivalent at 100 kVp	Percentage of Exposure Transmitted at 120 kVp (HVL= 6.7 mm)	calculated Pb thickness equivalent at 120 kVp
A) Typ. .50 mm Pb Apron	68.93	0.12%	56.	0.49	0.96%	0.50	5.0%	0.52	6.2%	0.51
B) Typ .25 mm Pb Apron	46.7	0.98%	30.	0.26	3.4%	0.27	13.6%	0.27	16.9%	0.27
C) "Light" Brand 1	44.6	0.42%	41.	0.36	2.1%	0.36	9.3%	0.36	13.1%	0.33
D) "Light" Brand 2	40.8	0.45%	39.	0.34	2.2%	0.35	9.9%	0.34	13.0%	0.33
E) "Light" Brand 2 (underweight)	21.4	3.5%	18.	0.15	7.2%	0.17	23.7%	0.18	29.2%	0.17
F) "Light" Brand 2 (.3mm nom)	approx 38	0.52%	37.	0.33	2.7%	0.31	10.8%	0.33	13.1%	0.33
G) "Light" Brand 3 (.5 mm nom)	34.6	0.24%	47.	0.41	1.2%	0.47	5.0%	0.50	6.9%	0.48
H) "Light" Brand 4 (.5 mm nom)	61.49	0.19%	51.	0.45	1.2%	0.46	6.2%	0.46	7.6%	0.48
I) .50 mm Apron (overweight)	approx 90	0.08%	65.	0.57	0.76%	0.56	4.5%	0.55	5.6%	0.56
J) .25 mm Apron (overweight)	approx 60	0.47%	39.	0.34	2.0%	0.37	9.7%	0.35	11.5%	0.36

Newsletter Announcements

Addresses for Submissions:

Until a local contact network is established, submissions should be sent to

L. John Schreiner
Medical Physics Department
Montréal General Hospital
1650 Cedar Ave,
Montréal, QC.
H3G IA4

tel: (514) 934-8052
fax: (514) 934-8229

E-mail can be sent to me at McGill University at:
CXLS@MUSICA.MCGILL.CA.

Newsletter Schedule:

The newsletter schedule is :

issue	submission deadline	mailing date
Fall issue:	2nd week Nov.	1st week Dec.
Winter issue:	2nd week Feb.	1st week March.
Spring issue:	1st week May	4th week May
Summer/Fall issue:	3rd week of August	2nd week Sept.

POLICY STATEMENT

Recommended Minimum Staffing Levels for the Medical Physics Support of Radiotherapy, Nuclear Medicine, Diagnostic Radiology, and associated Radiation Protection.

A statement issued by the Board of Directors of the Institute of Physical Sciences in Medicine.

THE INSTITUTE OF
PHYSICAL SCIENCES
IN MEDICINE

1 INTRODUCTION

1.1 Medical physicists make a vital contribution to the medical uses of both ionising and non-ionising radiations, through their understanding of the production of radiation, its interaction with the human body, its detection and the complexities and operation of modern treatment and imaging equipment.

1.2 The complex role of the medical physicist has been described in a series of related documents:

Radiotherapy (IPSM, 1989)
Nuclear Medicine (IPSM, 1991)
Diagnostic X-ray Services (HPA, 1986a)
Radiation Protection (HPA, 1986b, c)

1.3 The recommendations contained in this document refer to the minimum physics staffing necessary for the safe operation of radiation equipment and facilities, the provision of services outlined in IPSM & HPA documents (see 1.2) and compliance with current radiation protection legislation in the United Kingdom.

1.4 The recommendations include provision for some clinical research and development work. This is an integral part of the provision of medical physics services and should be closely integrated with 'routine' services in order to respond effectively to changing needs and demands.

1.5 The duties to which these staffing recommendations refer can be carried out only if the physicist is adequately supported by medical physics technicians. Technicians make a vital contribution to all aspects of work involving ionising radiation, but require appropriate supervision and advice from medical physicists. It is assumed in this document that adequate technician support will always be available.

1.6 Other important duties of the medical physicist which are not addressed here, include for example:

1.6.1 formal teaching (for example, to technical, medical and radiographic staff)

1.6.2 training of Grade A medical physicists.

Medical physicists are responsible for the structured training of Grade A medical physicists in all fields of medical physics, provision of update training for more senior medical physicists and for training a wide range of staff groups in other areas of health care.

1.6.3 grant-funded clinical research and development.

1.7 Guidance on the management of medical physics has been given by IPSM (1988). Although a Medical Physics Department may be based in a Health Authority or hospital Unit, it is strongly recommended that the services which it provides be organised or co-ordinated at the highest practicable level, certainly not at a level such that the population served is less than that of a typical District. These staffing recommendations are only valid when applied to services organised in accordance with IPSM (1988). If the Medical Physics Department serves a population less than that of a typical District, then more staff will be required. The importance of maintaining a 'critical mass' of scientists having maximum potential for innovation, development and research, together with the economic and quality benefits of supra-District and Regional services, has been emphasized in a Health Notice (1990).

1.8 This document is divided into four specialties of medical physics; radiotherapy, nuclear medicine, diagnostic radiology and radiation protection. In order to calculate the minimum support required for radiotherapy, nuclear medicine or diagnostic radiology, the tables in those sections should be used. In addition, it will be necessary to include the relevant aspects of radiation protection from section 5. This last section also includes radiation protection activities which cross the boundaries between radiotherapy, nuclear medicine and diagnostic radiology (e.g. management of a personal monitoring service). If the establishment for radiation protection activities alone is required (for staff involved only in radiation protection activities), then section 5 alone should be used. Obviously, in arriving at final staffing levels, no component in any of the tables should be invoked more than once.

2 RADIOTHERAPY

Guidance on recommended minimum staffing levels for the medical physics support of Radiotherapy given previously (IPSM, 1989) is superceded by the following advice.

2.1 Introduction

2.1.1 The role of the medical physicist in radiotherapy has been described in a policy document (IPSM, 1989).

2.1.2 The number of medical physicists required for the support of radiotherapy depends upon:-
(i) the amount and complexity of equipment used
(ii) the number of patients treated.

2.1.3 In addition to the staffing resources identified in 2.2, further resources should be allocated for the duties identified in 1.6 and any other additional duties such as those aspects of routine treatment planning which may be performed by technical or radiographic staff.

2.2 Recommendations

2.2.1 In all departments, there must be at least two whole time equivalent (WTE) medical physicists, each specialising in radiotherapy physics. One of these must be employed at Grade C, or Grade B at spine point 17 or above.

2.2.2 If the number of physicists calculated from Table 1 (see 2.2.4) is less than three, then, in order to cover absences, the establishment should be made up of at least three individuals, each of whom is a specialist in radiotherapy, but who may have some responsibilities in other areas of medical physics.

2.2.3 Only staff who have completed an approved course of training, or its equivalent, in radiotherapy physics should be included in the estalishment derived from Table 1.

2.2.4 Staffing levels should be calculated from Table 1. For each component, the number of items applying to the department should be multiplied by the number of WTE physicists per item to give the number of physicists for that component. The number of physicists for each of the eight components should then be summed. In order to cover all aspects of service provision, including radiation protection, the WTEs derived from Table 1 must be augmented by those calculated from components 2 and 3 in Table 4, section 5 (Radiation Protection).

2.2.5 The necessary staff to ensure the proper management of radiotherepy physics services are included in the figures given in Table 1.

2.2.6 Additional staff will be required when there are Grade A physicists undergoing radiotherapy physics training.

2.2.7 In very large radiotherapy centres, there may be economies of scale. If the total establishment given by Table 1 is more than seven WTE physicists, then the minimum number required may be less than that calculated from the table but should not be less than that given in Note 7.

2.2.8 Quantification of clinical research and development needs cannot be exact, as requirements and local initiatives will vary. Nevertheless, it is recommended that the number of WTEs derived from Table 1 be increased by at least 20%, in order to carry out research and development programmes which are essential for the establishment of future services.

2.2.9 These recommendations refer to staffing levels for radiotherapy services which are situated at one site. Modifications may need to be made, depending upon local circumstances, for co-ordinated services which cover two or more geographically separated sites. Such modifications should take account of any shared resources and time spent in travelling between sites.

2.2.10 IPSM considers that these recommendations reflect the factors currently recognised by the profession as constituting the minimum standards of practice necessary to avoid serious harm to patients in the United Kingdom. However, radiotherapy is associated with changing technologies and techniques. Although account has been taken of the introduction of recent developments, local circumstances should be evaluated and, where appropriate on scientific and technical grounds, modifications to these recommendations made.

TABLE 1

Minimum staffing levels for the medical physics support of radiotherapy

Component	Item		WTE Physicists Per Item	Notes
Equipment Dependent Factors				
1	1	Special accelerator	0.7	1,2
2	1	Standard accelerator	0.5	1,2
3	1	Major item	0.4	3,2
4	1	Minor item	0.2	4,2
Patient Dependent Factors				
5	1000	New patients treated per year by external beam therapy	1.2	5
6	100	New patients treated per year by brachytherapy	0.2	6
7	100	New in-patients treated per year with unsealed sources	0.3	
8	100	New out-patients treated per year with unsealed sources	0.1	

Notes

1. A special accelerator is one which has more than one X-ray energy or has an electron facility. For treatment machines which are computer controlled, particularly where the versatility and sophistication introduces the need for more extensive quality assurance and treatment planning, an additional 0.2 physicists per machine are required.
2. The number of physicists per item may be reduced by 0.1 if maintenance and repair are not carried out by staff managerially responsible to the physicist.

3. A major item is a cobalt or similar teletherapy unit, a high dose rate afterloading machine, or a simulator. A computer treatment planning system is also identified as a major item to allow for hardware and software maintenance and Quality Assurance which will be independent of patient throughput.
4. A minor item is an orthovoltage or superficial X-ray unit or a low/medium dose rate afterloading machine.
5. The number of physicists per item may be reduced by up to 0.4 (i.e. to 0.8) according to the extent of the routine duties carried out by staff who are not supervised by the physicist.
6. The number of physicists per item will need to be increased by 0.1 if a substantial fraction of these patients are treated by more complex techniques such as iridium wire or iodine-125 implants.
7. The minimum number, M, of staff recommended, where the number N, derived from Table 1 is more than seven, is given by $M = 7 + (N-7)/2$.

3 NUCLEAR MEDICINE

3.1 Introduction

3.1.1 The role of the medical physicist in nuclear medicine has been described in a policy document (IPSM, 1990)

3.1.2 The number of medical physicists required for the support of nuclear medicine services depends primarily upon:-
(i) the amount and complexity of equipment used
(ii) the number and complexity of clinical examinations carried out.

3.1.3 In addition to the staffing resources identified in section 3.2, further resources should be allocated for duties identified in 1.6 and any other relevant additional duties.

3.2 Recommendations

3.2.1 In all departments there must be at least two WTE physicists available, each specialising in nuclear medicine physics. One of these must be employed at Grade B (spine point 17 or above) or Grade C. A second physicist should be employed at Grade B or above.

3.2.2 Only staff who have completed an approved course of training, or its equivalent, in nuclear medicine physics should be included in the establishment derived from Table 2.

3.2.3 Staffing levels should be calculated from Table 2. For each component, the number of items applying to the department should be multiplied by the number of WTE physicists per item to give the number of physicists for that component. The number of physicists for each of the four components should then be summed to give the total establishment.

3.2.4 Staffing levels for radionuclide therapy support should be calculated from components 7 and 8 in Table 1 (Radiotherapy) and added to the numbers calculated from Table 2.

3.2.5 Staffing levels to provide adequate radiation protection support should be calculated from component 10 of Table 4 (Radiation Protection) and added to the numbers calculated from Table 2.

3.2.6 The management arrangements for nuclear medicine departments are diverse. The figures given in Table 2 apply to those situations where the service is managed entirely by the Medical Physics Department. If this is not the case, the establishment calculated will need to be reduced by a factor appropriate to local circumstances.

3.2.7 Additional staff will be required when there are Grade A medical physicists undergoing nuclear medicine physics training.

3.2.8 In very large centres there may be economies of scale. If the total establishment given by Table 2 is more than seven WTE physicists, then the minimum number required may be less than that calculated from the table but should not be less than that given in Note 3.

3.2.9 Quantification of clinical research and development needs cannot be exact, as requirements and local initiatives will vary. Nevertheless, it is recommended that the number of WTEs derived from Table 2 be increased by at least 20% in order to carry out research and development programmes which are essential for the establishment of future services.

3.2.10 These recommendations refer to staffing levels for nuclear medicine services which are situated at one site. Modifications may need to be made depending upon local circumstances, for co-ordinated services which cover two or more geographically separated sites. It is recommended that the number of medical physicists calculated from Table 2 is multiplied by a factor $[1 + (0.1S)]$ where S is the number of remote sites.

3.2.11 IPSM considers that these recommendations reflect the factors currently recognised by the profession as constituting minimum standards of practice necessary to avoid serious harm to patients in the United Kingdom. However, nuclear medicine is associated with changing technologies and techniques. Although account has been taken of the introduction of recent developments, local circumstances should be evaluated and, where appropriate on scientific and technical grounds, modifications to these recommendations made.

TABLE 2

Minimum staffing levels for the medical physics support of nuclear medicine

Component	Item		WTE Physicists Per Item	Notes
1	1	Gamma camera	0.5	1,2
2	1000	Examinations per year	0.1	1
3	500	Dynamic studies involving data processing by a physicist	0.25	1
4	250	Studies involving SPECT per year	0.25	1

Notes

1. Additional staff are required if the nuclear medicine department has facilities such as sample counting or a whole body counter.
2. The number of physicists for the second and subsequent gamma cameras may be reduced if they are used mainly for simple static imaging studies.
3. The minimum number of M, of staff recommended, where the number of N, derived from Table 2 is more than seven, is given by $M = 7 + (N-7)/2$.

4 DIAGNOSTIC RADIOLOGY

4.1 Introduction

4.1.1 The role of the medical physicist in the support of diagnostic radiology is described in documents issued by IPSM (1986a, b, c). Responsibilities and staffing levels in the fields of ultrasound and nuclear magnetic resonance imaging are not included in this document.

4.1.2 The number of medical physicists required for the support of diagnostic radiology services depends upon the amount and complexity of equipment used. Because these recommendations apply to services provided to at least one District, it has been possible to make some simplifying assumptions about the 'profile' of both X-ray equipment and examinations. This has resulted in recommended staffing levels which may simply be calculated from the total number of X-ray tubes of all kinds, including dental units. Guidance on the calculation of staffing levels for other 'profiles' is given in Annex 1.

4.1.3 The need for patient dosimetry is recognised but is best assessed by considering the amount of equipment involved.

4.1.4 The recommendations contained in this deocument refer to the minimum staffing necessary for compliance with the Ionising Radiations Regulations (1985) and the Ionising Radiation (Protection of Persons undergoing Medical Examination or Treatment) Regulations (1988).

4.1.5 In addition to the staffing resources identified in section 4.2, further resources should be allocated for the duties identified in 1.6, and any other additional relevant duties.

4.2 Recommendations

4.2.1 Staffing levels should be calculated from Table 3. For each component, the number of items should be multiplied by the number of WTE physicists per item to give the number of physicists for that component. The number of physicists for each of the three components should then be summed. In order to cover all aspects of service provision, including radiation protection, the WTEs derived from Table 3 must be augmented by those calculated from components 1 and 8 in Table 4 in section 5 (Radiation Protection).

4.2.2 The establishment must consist of at least two WTE physicists, at least one of whom must be employed at Grade B (spine point 17 or above) or Grade C. The other must also be a specialist in diagnostic radiology physics, but may have some responsibilities in other areas of medical physics.

4.2.3 Only staff who have completed an approved course of training, or its equivalent, in diagnostic radiology physics, should be included in the establishment derived from Table 3.

4.2.4 The staff necessary to ensure the proper management of disgnostic radiology physics services are included in the figures given in Table 3.

4.2.5 Additional staff will be required when there are Grade A physicists undergoing diagnostic radiology physics training.

4.2.6 Quantification of clinical research and development cannot be exact, as requirements and local initiatives will vary. Nevertheless, it is recommended that the number of WTEs derived from Table 3 be increased by at least 20%, in order to carry out research and development programmes which are essential for the establishment of future services.

4.2.7 IPSM considers that these recommendations reflect the factors currently recognised by the profession as constituting minimum standards of practice necessary to avoid serious harm to patients in the United Kingdom. However, diagnostic radiology is a developing field and new techniques and equipment, together with local circumstances, should be taken into account and, where appropriate on scientific and technical grounds, modifications to these recommendations made.

TABLE 3

Minimum staffing levels for the medical physics support of diagnostic radiology

Component	Item	WTE Physicists	Notes
1 Equipment Dependent Factor			
	250 X-ray tubes	1	1
	1 X-ray bone densitometer	0.25	4
2 Patient Dependent Factor			
	500 X-ray tubes (see para 4.1.3)	1	2
	1000 bone densitometry studies	0.1	4
3 Implementation of Forrest breast screening programme			
	One NHS Region, Wales, Scotland or Northern Ireland	1	3

Notes

1. This component is intended to cover work arising from quality assurance duties but not for breast screening programmes arising from the implementation of the Forrest Report (1986) (See item 3 and note 3) or radiation protection aspects of diagnostic radiology.

2. This component is intended to cover work arising from The Ionising Radiation (Protection of Persons undergoing Medical Examination or Treatment) Regulations (1988).

3. This component is intended to cover work arising from the implementation of the Forrest Report (1986).

4. This component assumes that the medical physics department provides calibration and quality assurance services and that the physicist has direct involvement in the acquisition and processing of the studies or is directly responsible for the staff who provide the service.

5 RADIATION PROTECTION

5.1 Introduction

5.1.1 The role of the medical physicist in radiation protection has been described in two policy documents (HPA 1986b, c).

5.1.2 The number of medical physicists required for the support of radiation protection services depends primarily upon:-

5.1.2.1 the amount and complexity of radiation equipment used

5.1.2.2 the total number of employees (medical plus non-medical) in the Health Authorities covered. This parameter is chosen because it is closely related to the number of staff covered by the radiation protection service.

5.1.3 In addition to the staffing resources identified in section 5.2, further resources should be allocated for the duties identified in 1.6 and any other relevant duties.

5.2 Recommendations

5.2.1 Physicists appointed as Radiation Protection Advisers within the meaning of the Ionising Radiations Regulations (1985) must be employed at Grade B (spine point 17 or above) or Grade C. Where the Radiation Protection Adviser is a corporate body, it must be managed by physicists at a similarly senior level.

5.2.2 Staffing levels should be calculated from Table 4. For each component, the number of items should be multiplied by the number of WTE physicists per item, to give the number of staff for that component. The number of physicists for each of the 10 components should then be summed to give the total establishment.

5.2.3 The numbers of WTE staff in Table 4 apply to a radiation protection service which covers three or more Districts. Where a service covers less than three Districts, a minimum of 0.65 WTE physicists per District should be employed in radiation protection.

5.2.4 Quantification of clinical research and development needs cannot be exact, as requirements and local initiatives will vary. Nevertheless, it is recommended that the number of WTEs derived from Table 4 be increased by at least 20%, in order to carry out research and development programmes which are essential for the establishment of future services.

5.2.5 IPSM considers that these recommendations reflect the factors currently recognised by the profession as constituting minimum standards of practice necessary to avoid serious harm to patients. However, radiation protection is a developing field and new techniques, legislation and practice, together with local circumstances, should be taken into account and, where appropriate on scientific and technical grounds, modifications to these recommendations made.

TABLE 4

Staffing levels for the medical physics support of radiation protection

Component	Item		WTE Physicists Per Item	Notes
Equipment Dependent Factors				
1	100	diagnostic X-ray tubes	0.3	3
2	1	major radiotherapy item	0.01	1
3	1	minor radiotherapy item	0.005	2
4	1	surgical laser	0.025	
5	1	UV/microwave/shortwave unit	0.005	
6	1	contamination/survey meter	0.001	
7	1	diagnostic quality dosemeter	0.002	
Employee Dependent Factors				
8	1000	employees in Health Authorities covered (medical plus non-medical). This covers radiation protection in diagnostic radiology.	0.02	3
9	1000	employees in Health Authorities covered (medical plus non-medical). This covers management of a personal monitoring service	0.02	
10	1000	employees in Health Authorities covered (medical plus non-medical). This covers radiation protection in nuclear medicine, including the use of radionuclides in departments other than nuclear medicine (e.g. biochemistry, haematology)	0.01	4

Notes

1. A major radiotherapy item is a cobalt or similar teletherapy unit, a linear accelerator, a high dose rate afterloading machine, or a brachytherapy ward excluding any afterloading machine.
2. A minor radiotherapy item is an orthovoltage or superficial X-ray or a low/medium dose rate afterloading machine.
3. These components cover radiation protection advice to diagnostic radiology and should be combined with the recommendations given in section 4.2, if the total minimum staffing for support of diagnostic radiology is required. Assumptions about the 'profile' of X-ray equipment and examinations have been made as in 4.1.2.
4. This component covers radiation protection advice to nuclear medicine services and should be combined with the recommendations given in section 3.2, if the total minimum staffing for support of nuclear medicine is required.

REFERENCES

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The Forrest Report 1986 - *Breast Cancer Screening* (HMSO London) ISBN 0 11 431071X.

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IPSM 1988 *The Organisation and Management of Medical Physics* (IPSM, York).

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IPSM 1989 *The Role of the Physical Scientist in Radiotherapy* (IPSM, York).

IPSM 1991 *The Physical Scientist in Nuclear Medicine* (IPSM, York).

ANNEX

It has been assumed that, amongst several hundred X-ray tubes, the proportions of each main kind will be approximately:-

	%
Fixed radiographic	30
Dental radiographic	25
Mobile radiographic	25
Fluoroscopic (fixed and mobile)	18
Computed tomographic systems and other digital radiographic systems	2

If actual percentages within the above categories depart significantly from those above, the following values of WTEs for single items provide an alternative means of calculation:-

Item		WTE
1	fixed radiographic tube	0.003
1	dental radiographic tube	0.003
1	mobile radiographic tube	0.002
1	fluoroscopic system (fixed or mobile)	0.01
1	CT scanner or digital radiographic system	0.015

SCIENCE AS A CAREER: A financial evaluation

INTRODUCTION

It is not uncommon for practising scientists, through domestic, social or professional connections, to be asked for their view of science as a career. More often than not the enquirer is a student at a stage where he or she is establishing the information base upon which to make a career path decision. The advice received can be of critical importance to the enquirer's future.

Career path decisions are based on expectations of the future. Several categories of such expectations can be identified and these include, but are not limited to, job satisfaction, perceived value to society and financial considerations. Clearly on an individual basis these and other expectation will be weighted differently.

For young decision makers evaluating science, or any other field, as a career it is vital to distinguish between anecdotal information based on one individual's experience and projections based quantitatively on realistic input information. This distinction should be relatively easy for a scientist to make. Of the available categories of expectations only one is amenable to quantitative assessment - financial considerations.

In this communication we present the results of a calculation of accumulated wealth of individuals who follow four different career paths including science. The inputs to the model, predicting as they do the future, must be subject to some uncertainty. However, the substance of the model output will not be significantly altered by realistic changes in input.

We have identified and analyzed one factor which is relevant to young people making a career path decision. We do not suggest that financial considerations are necessarily even a major factor in this decision. The relative significance of personal wealth is clearly a matter of individual choice.

THE MODEL

Four careers have been chosen for comparison: secretary, radiation therapist (technologist), radiation physicist and radiation oncologist. All these individuals are assumed to have commenced employment in a cancer treatment centre during the financial year 90/91, with the age of commencement depending on the training required for the position. Salaries are not based on any particular institution although they are, to the best of the authors' knowledge, representative of the Canadian Radiation Oncology community.

.../2

The following general assumptions are made in the model:

1) zero inflation
2) all individuals commence their post secondary education at age 19
3) federal and provincial tax for a single, childless individual living in Ontario are deducted from the salary
4) there are no deductions from gross income apart from income tax
5) no tax write-offs are permitted
6) $10,000 is required annually to keep body and soul together
7) no loans are repayable as a result of educational costs
8) the residual after the deduction of income tax and the $10,000 is invested and compounded annually at 5%.

CAREER PATHS

Secretary

Education: 1 year diploma
Age at entry to workforce: 20
Salary: $25,000 - $30,000 in steps of 5% per annum.

Radiation Therapist (Technologist)

Education: 3 year certification program
Age at entry to workforce: 22
Salary: $30,000 - $45,000 in steps of 5% per annum.

Radiation Physicist

Education: B.Sc. (4 yrs); M.Sc. (2 yrs), Ph.D. (4 yrs) and 1 year residency ($40,000 p.a.)
Age at entry to workforce: 30
Salary: $45,000 - $70,000 in steps of 5% per annum.

Radiation Oncologist

Education: B.Sc. (3 yrs); M.D. (4 yrs) and 4 year residency ($45,000 p.a.)
Age at entry to workforce: 30
Salary: $80,000 - $180,000 in steps of 25% per annum.

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RESULTS AND DISCUSSION

Fig. 1 shows the time course of gross income for the four individuals who enter the workforce in 90/91. The ranking is not surprising. The magnitude of the differentials, however, might be considered to be an inadequate reflection of educational background, responsibility and academic contributions for the scientific career path in particular.

The information presented in Fig. 1 suggest that from simply a financial viewpoint and considering the many years of university education required, science is a relatively unattractive option. A more realistic assessment is, in the view of these authors, conveyed by the wealth accumulated as a function of age. Based on the model described above this has been calculated for the four career paths and is presented in Fig. 2. With such a presentation, science becomes even less attractive than it appeared in Fig. 1.

The most questionable inputs to the model are the rate of return on investment (5%) and the body and soul factor ($10,000). Increasing the former to 10% which, when real estate is included, is probably a more accurate reflection of the recent past than 5%, we find that a physicist never catches up with a therapist (technologist) and overtakes a secretary at age 50. With the body and soul factor of $15,000 and interest set back to 5% the physicist at age 45 has accumulated the same amount as the therapist and at age 35 the same amount as a secretary.

It is appropriate to reiterate that financial considerations are only one factor contributing to the selection of a career path and others may be rated more highly. Amongst those other factors mentioned earlier was the perceived value to society of the profession under consideration. If value to society is reflected by 'society's' willingness to remunerate, then Figure 2 suggest that science does not rate highly in this category either.

Peter Dunscombe
Peter McGhee
Northeastern Ontario Regional Cancer Centre

Figure 1

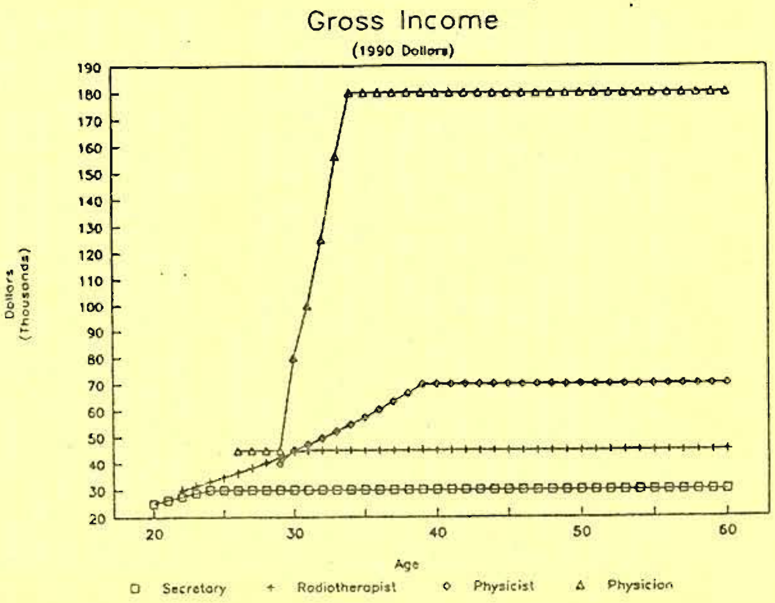
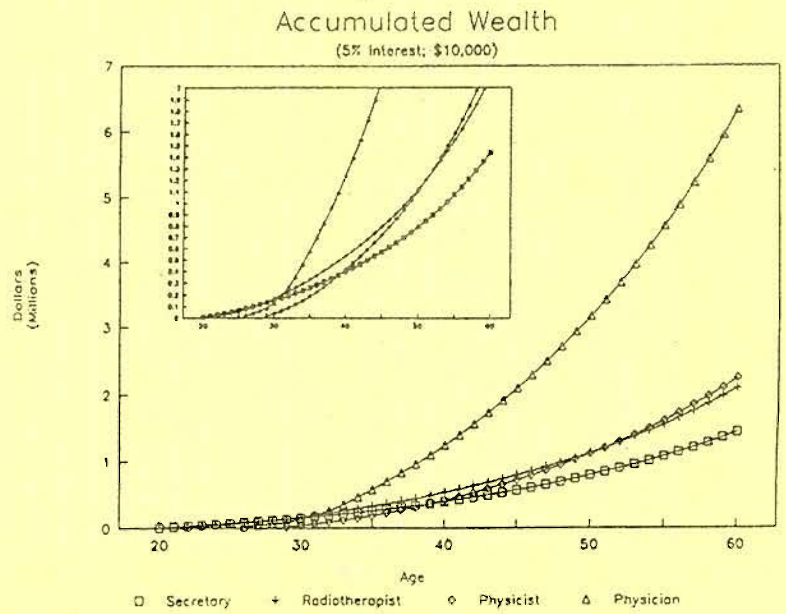


Figure 2



JOINT REPORT of the COMP CHAIR and CCPM PRESIDENT

The CCPM board and COMP executive have met separately and jointly in several very long meetings at the RSNA in Chicago on the weekend of November 30 and December 1, 1991. Many issues concerning medical physicists in Canada were discussed and tasks were assigned to various individuals. We would like to report on several issues of general interest.

Medical Physicists are represented on various committees and these may be either CCPM representatives or COMP representatives. Stuart Jackson of the Vancouver General Hospital has for a number of years been the COMP representative on the Conjoint Committee for Accreditation of Educational Programs in Diagnostic imaging and Medical Radiation Technologies. This committee is concerned with the accreditation of training programs in medical radiation technologies, and since physicists play an important role and contribute to the training programs at the various institutions, they should certainly be involved and represented on this committee. It was felt that this should be a CCPM committee since education and accreditation is a CCPM issue. Stuart has agreed to carry on his duties and his travel costs will be shared by CCPM and COMP. Our involvement with the accreditation process should be strengthened and a panel of physicists will be selected in each province who would be willing to participate in the accreditation process. Physicists who are interested to participate should submit their names to the CCPM President, Jake Van Dyk.

Another committee that has medical physics representation is the Advisory Committee to Radiopharmaceuticals Section of Bureau of Radiation and Medical Devices in Health and Welfare, Ottawa. Trevor Cradduck has represented CCPM on this Committee. He will henceforth represent COMP. All associated costs are carried by Health and Welfare. Paul Johns represents COMP on the National Consortium of Scientific and Educational Societies in Ottawa. This is an organization whose aim is to raise the profile of science and education in Canada.

It was agreed that all physicists representing CCPM or COMP on various committees should submit a report on their activities to the CCPM president or COMP chairperson, at least annually. Their activities will also be reported in the COMP/CCPM newsletter.

At our last annual COMP membership meeting in Winnipeg, members asked COMP to play a greater role in professional affairs. It was, therefore, decided that COMP will set up a committee for professional affairs. The tasks of this committee would be to collect data on the professional status of Canadian medical physicists in the various provinces, to appoint a liaison person in the different provinces and then share information that would help the physicists in their bargaining with their respective institutions. The committee should also be concerned with raising the profile of the medical physicist both in the scientific community and in the media. This committee can also establish a liaison with the American College of Medical Physicists who are responsible for professional affairs in the U.S. Physicists wishing to serve on this committee should contact the COMP chairperson. Also, those who may want to serve on any of the other COMP or CCPM committees, please contact either Jake Van Dyk or Ellen El-Khatib.

Other issues discussed related to the status of the medical physicist in various government regulations. For example, we will examine the implications of Ph.D. medical physicists working in hospitals and the possible restriction of the use of the title "Dr" as regulated by the Health Professions Act 1991 in Ontario and the definition of Medical Physicist and Radiation Protection Officer by the HARP Commission in Ontario. Both CCPM and COMP will lobby the appropriate agencies regarding these issues.

The brochure on Canadian Medical Physicists will soon be coming out. Many thanks are due to John Andrew for the preparation of this document.

The plans for future meetings of COMP/CCPM are well under way. The 1992 meeting will be held jointly with the AAPM in Calgary, Aug. 23-27. The scientific program is handled by Brian McParland who has also put together an interesting joint AAPM/COMP/CCPM mini-symposium entitled "Roles of Three-Dimensions in Medical Imaging and Radiotherapy Planning". Local arrangements are chaired by Karen Breitman. This meeting is followed by the Summer School, 30 Aug. - 4 Sept, in Banff. the topic is "The Physics of Magnetic Resonance Imaging". Local arrangements are chaired by Sherry Connors and Larry Filpow. The following year COMP/CCPM will meet with CMBES in Ottawa. Local arrangements will be chaired by Paul Johns and the most likely date will be the second week in May. In 1994 COMP/CCPM will meet with CARO in Toronto. Jake Van Dyk will take care of local arrangements. This meeting will be held around Sept 15. In 1995, the centennial of the discovery of x-rays will be celebrated and our meeting will move to Montreal with CAR on June 2-7. Terry Peters will be local arrangements chair. We hope that you will support us in these endeavors and participate in our scientific meetings.

We have a final request to the membership in that we ask your active participation in the recruitment of corporate members. Last year we sent a letter to various manufacturers describing our organization and requesting their application for corporate membership. We have had some response to that, however, nothing works better than a personal approach and we would ask those of our members who have much contact with manufacturers of radiotherapy or medical imaging equipment to encourage them to apply for membership. Martin Yaffe, who represents this year's COMP credentials committee, can then follow up by sending literature describing our organization and outlining the benefits associated with corporate membership.

Jake Van Dyk — President, CCPM
Ellen El-Khatib — Chairperson, COMP

RAPPORT DE LA PRESIDENTE DE L'OCMP ET DU PRESIDENT DU CCPM

Le Conseil d'Administration du CCPM et l'Exécutif de l'OCMP se sont réunis à plusieurs reprises (séparément et conjointement) lors du récent congrès de la RSNA, à Chicago (le 30 novembre et le 1er décembre 1991). On y a discuté de plusieurs questions concernant les Physiciens Médicaux du Canada, et plusieurs tâches ont été attribuées à certains membres. Nous voulons maintenant vous faire part de certaines sujets d'intérêt général.

Les Physiciens Médicaux Canadiens sont représentés dans le cadre de plusieurs comités comportant des membres de l'OCMP et du CCPM. Stuart Jackson, de l'Hôpital Général de Vancouver, a représenté l'OCMP au sein du Comité Conjoint sur l'Accréditation de Programmes Educatifs en Imagerie Diagnostique et en Radiotechnologies Médicales depuis plusieurs années. Ce comité, chargé d'étudier l'accréditation de programmes d'entraînement en radiotechnologies médicales, devrait sans doute comporter quelques Physiciens Médicaux puisqu'ils jouent un rôle de premier plan dans la conception et la réalisation de ces programmes dans plusieurs institutions. On croit que ce comité devrait être relié au CCPM puisque les questions d'éducation et d'accréditation sont du ressort du collège. Stuart poursuivra donc son travail à l'intérieur de ce comité; ses frais de déplacement seront partagés entre le CCPM et l'OCMP. Notre implication dans le processus d'accréditation sera donc plus importante. De plus, une tribune de physiciens sera choisie dans chaque province qui serait intéressée à participer au processus d'accréditation. Les physiciens qui intéressés à participer devraient communiquer avec le président du CCPM, Jake Van Dyk.

Le Comité-Conseil de la Section des Radio-pharmaceutiques du Bureau de la Radiation et des Appareils Médicaux (Santé et Bien-Etre Social Canada, Direction Générale de la Protection de la Santé) est un autre de ces comités où la Physique Médicale canadienne est représentée. Jusqu'à maintenant, Trevor Cradduck y a représenté le CCPM. Dorénavant, Trevor représentera l'OCMP. Tous les frais associés à cette représentation seront assumés par Santé et Bien-Etre Social Canada. Paul Johns représente l'OCMP au sein du Consortium National des Sociétés Scientifiques et Educatives à Ottawa. Le but de cette organisation consiste à augmenter l'exposition du public à la science et à l'éducation.

Il fut donc décidé que tous les physiciens représentant officiellement le CCPM ou l'OCMP dans ces comités devraient soumettre un rapport sur leurs activités au président(e) de l'OCMP ou au président(e) du CCPM, et ce au moins une fois par année. Ces rapports seront aussi publiés dans le Bulletin Canadien de Physique Médicale.

Des membres de l'OCMP ont demandé à leur exécutif de jouer un plus grand rôle dans les questions d'ordre professionel lors de la réunion tenue à Winnipeg cet été. Il fut donc décidé à Chicago d'étabilr un comité pour ces questions. Les tâches de ce comité consitent en la collection de données concernant le statut des Physiciens Médicaux à travers les provinces, en la nomination d'une personne-liaison dans chaque province, et au partage d'informations qui aideraient les physiciens à négocier leurs contrats de travail avec leurs institutions respectives. Le comité devra aussi s'occuper d'augmenter la présence des Physiciens Médicaux dans la communauté scientifique ainsi que dans les médias. Ce comité pourra aussi établir des liens avec l'American College of Medical Physicists, qui est responsable des questions d'ordre professionel aux Etats-Unis. Les physiciens qui désirent joindre ce comité devraient contacter la présidente de l'OCMP. De même, ceux qui désirent devenir membre d'un ou de plusieurs comités où le CCPM ou l'OCMP sont représentés sont priés d'entrer en contact avec Jake Van Dyk ou Ellen El-Khatib.

D'autres sujets reliées au statut du Physicien Médical dans plusieurs règlements gouvernementaux furent mentionnées à Chicago. Entre autres, nous examinerons les implications de la présence de Physiciens Médicaux détenant un doctorat en milieu hospitalier, ainsi que de l'usage du titre "docteur", tel que réglementé par l'Acte des Professions Médicales 1991, en Ontario, et des définitions des rôles du Physicien Médical et de l'Officier de la Radioprotection, telles que présentés par la Commission HARP en Ontario. Le CCPM et l'OCMP compte faire pression sur les agences appropriées à cet effet.

La brochure sur les Physiciens Médicaux Canadiens sera bientôt prête. Nous voulons utiliser cette occasion pour remercier John Andrew pour la préparation de ce document.

Les rencontres futures de l'OCMP et du COMP sont déjà en préparation. La rencontre de 1992 sera tenue conjointement avec l'AAPM, à Calgary, du 23 au 27 août. Brian McParland préparera le programme scientifique ainsi qu'un mini-symposium de l'AAPM/OCMP/CCPM intitulé "Le rôle des trois dimensions en imagerie médicale et en planification de traitements radiothérapeutiques". Les arrangements locaux seront supervisés par Karen Breitman. La rencontre de Calgary sera suivie par l'Ecole d'Été qui aura lieu à Banff du 30 août au 4 septembre et qui aura pour sujet "La physique de l'imagerie par résonance magnétique nucléaire". Les responsables des arrangements locaux sont Sherry Connors et Larry Filipow. Le CCPM et l'OCMP se réuniront en 1993 avec la Société Canadienne de Génie Biomédical à Ottawa. Paul Johns s'occupera des arrangements locaux, et il semble que le congrès aura lieu lors de la seconde semaine de mai. En 1994, Jake Van Dyk organisera la réunion annuelle qui se tiendra à Toronto avec la participation de l'Association Canadienne des Radio-Oncologistes. Cette réunion aura lieu dans les alentours du 15 septembre. Le Centenaire de la Découverte des Rayons X sera célébré à Montréal du 2 au 7 juin, conjointement avec l'Association Canadienne de Radiologie. Nous souhaitons votre support ainsi que votre participation lors de ces congrès scientifiques.

Comme dernier point, nous aimerions demander aux membres une participation acrue pour le recrutement de membres corporatifs. Nous avons, l'an dernier, envoyé une lettre décrivant notre organisation à plusieurs intérêts privés, leur demandant de supporter notre organisation en tant que membres corporatifs. Quoique notre démarche ait apporté quelques résultats, nous sommes toujours convaincus que l'approche personnelle est préférable; donc, nous voulons demander à ceux de nos membres qui sont en contact avec les manufacturiers d'équipements radiothérapeutiques ou radiographiques d'encourager ces compagnies à devenir membres corporatifs de l'OCMP. Le représentant du comité des références de cette année, Martin Yaffe, se fera un plaisir d'envoyer des documents décrivant notre organisation ainsi que les bénéfices reliés aux membres corporatifs.

Jake Van Dyk, Président, CCPM

Ellen El-Khatib Présidente, OCMP

Newsletter Submissions Format for contributions:

Please submit good quality, formatted submissions for direct use. This reduces the work in setting-up the newsletter considerably. The final quality of the newsletter is limited by the quality of the submissions since articles are used directly.

Newsletter articles should be single or double column on 8 1/2 by 11 inch paper with 1 inch margins on the sides and top and 1/2 inch on the bottom, if using two columns leave 1/2 inch between columns. Contributions should be single spaced in a clear font or type, the font size / pitch should give lower case letters that are ~2 mm high with ~6 lines of text per inch. If possible justify text on both margins. Please end your submission with your name and institution.

Text can also be sent to me through E-mail at CXLS@MUSICA.MCGILL.CA. FAX submissions will have to be supported by original copy and will not be used directly.

Medical Physics Theses and Abstracts

Each year graduate students write M.Sc. and Ph.D theses which are full of detailed analysis and basic insights rarely covered in the literature. In order to disseminate this work the **second issue of 1992** (May/June) will reproduce the **thesis titles and abstracts** of Canadian medical physics theses completed in 1991. Please submit **titles and abstracts** in a format which will enable 4 abstracts to be printed per page.

Media Contacts

Items often appear in the news on topics relevant to medical physics, e.g., radiation leaks, risk of cancer, imaging, etc. Sometimes it is quite clear that there is a lack of understanding, on the part of the reporter, of the basic science underlying the issue. In an effort to ensure that these topics can be treated more knowledgeably, COMP/OCMP is compiling a list of experts prepared to comment on various issues to the electronic or print media. A list of these people will be circulated nationally to newspapers, radio and television stations. A further benefit of the process is to make the profession of Medical Physicist more well known to the public and government.

If you are willing to participate please send your name, address, phone number (business and home if you are willing) and FAX number to Martin Yaffe at the COMP/OCPM address. Indicate your field of expertise.

Nominations for COMP Executive

The positions of Chairperson-elect and Secretary of COMP/OCPM become available for election at the annual general meeting in Calgary next August. We are seeking nominations from the COMP/OCPM membership for these positions. The COMP/OCPM bylaws specify a three year progression from Chairperson-elect to Chairperson to Past-chairperson. The position of Secretary is for a term of 3 years.

Please send nominations to my attention at the COMP/OCPM address by Feb. 1, 1992.

Martin Yaffe
Chairman, Nominations Committee

Physicists for Accreditation Surveys.

It is not often that medical physicists have the opportunity to speak directly to hospital administrators, program organizers and educators, in a way which can directly affect the membership of our profession and influence our role in the medical community. Our continued participation in the process of educational program accreditation by the Conjoint Committee for Accreditation of Educational Programs in Diagnostic Imaging and Medical Radiation Technologies does precisely that. The various educational programs in radiotherapy, radiography, nuclear medicine and ultrasound technology are surveyed by a team of specialists every five years in order to promote a uniform standard of excellence. It is during this process that we can observe, and make recommendations which will be addressed. I am currently the only physicist participating in this process. The COMP/OCMP and CCPM would like to recruit a number of individuals willing to become involved with accreditation surveys. This is not a time consuming undertaking, but is most certainly worthwhile, in addition you also learn a great deal about other institutions. To find out more about this opportunity, please contact Jake Van Dyk.

Stuart Jackson, Vancouver BC

Communication with Other Organizations

Starting with this issue the Canadian Medical Physics Newsletter will be mailed to representatives of other organizations with similar interests as COMP/OCPM and CCPM to make them aware of our activities (e.g., the AAPM, the Australasian College of Physical Scientists and Engineers in Medicine, etc). I only have the addresses of three of these groups on file. Please sent me the names and addresses of contact persons (president or newsletter editors) for organizations you feel should be contacted.

John Schreiner

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 John's Travel Award for Young Investigators. This award, which is in the amount of $1,000.00, is made to a College member under the age of 35 who has been a member for not more than two years. The award is intended to assist the individual to extend his or her knowledge by travelling 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 endeavor in medical physics.

Enquiries should be directed to:

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 $1000,00, est éligible aux membres du Collège agés de moins de 35 ans et qui sont membres depuis deux ans ou moins. 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 specialisé.

Les demandes seront addressées à::

The Registrar / Le Registraire
CCPM
Suite 102
1200 Tower Road
Halifax, NS
B3H 4K6

The new deadline for the next award is January 31, 1992.

La date limite pour les demandes du prochain concours est le 31me janvier 1992.

Past recipients:

Récipiendaire anterieur:

1990 Dr. L. John Schreiner, Montreal
1991 Ms. Moira Lumley, Kingston

Members of the COMP/OCMP and/or the CCPM can make a donation to the fund by volunteering to increase their 1992 membership dues.

Les membres du COMP/OCPM et\ou du CCPM peuvent faire un don à la cotisation de 1992 un montant additionel de leur choix.

CCPM EXAM SCHEDULE

The schedule for application and sitting of exams in 1992 is:

membership exam:

apply by:	Jan 10,1992
exam date:	April 11, 1992

fellowship exam:

apply by:	June 19,1992
exam date:	August 23, 1992

Calendar of Events

March 26-28 1992
Thunder Bay, Ontario
Joint EASTCAN/WESTCAN Meeting
Contact: Dr. Muthana Al-Ghazl, Medical Physics,
Thunder Bay Regional Cancer Centre,
290 Munro St, Thunder Bay
Ontario, P7A 7T1
Tel: (807)345-2630

April 3, 1992
TRIUMF/ UBC, Vancouver, British Columbia
Workshop on Scatter and Attenuation Corrections in PET and SPECT
Contact: Dr Anna Celler, Vancouver General Hospital
Division of Nuclear Medicine
855 West 12th Ave., Vancouver BC V5Z 1M9
Tel: (604) 875-5252

August 23 - 27, 1992
Calgary, Alberta
34rd Annual Meeting of AAPM and COMP
Contact: AAPM Exec Office, 335 East 45th St,
NEW YORK, NY 10017,USA

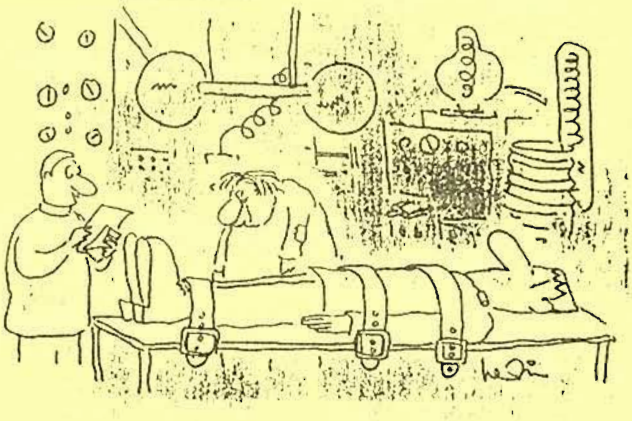
August 30 - September 4, 1992
Banff Centre, Banff, Alberta
AAPM Summer School,
The Physics of Magnetic Resonance Imaging
Contact: AAPM Exec Office, 335 East 45th St,
NEW YORK, NY 10017,USA

Joint EASTCAN/WESTCAN Meeting

March 26-28 1992
Thunder Bay, Ontario

Deadline for Abstracts: Feb. 28, 1992

Contact:
Dr. Muthana Al-Ghazi, Medical Physics,
Thunder Bay Regional Cancer Centre,
290 Munro St, Thunder Bay
Ontario, P7A 7T1
Tel: (807)345-2630



"Well, we got the grant."

Sondage de Salaires COMP/OCPM 1991 Salary Survey

Enclosed in this mailing is the 1991 salary survey. Please take a few minutes to fill it out. We aim to publish the results in the Newsletter before our 1992 annual meeting. Therefore we ask that you send the questionnaire before January 31, 1992.

If you are concerned that confidentiality be maintained, fold and staple the survey before mailing.

Ci-inclus nous vous envoyons le sondage de salaires pour 1991. S.V.P. prenez quelques moments pour remplir le questionnaire. Nous avons l'intention de publier les résultats dans notre Bulletin avant la réunion général de 1992. S.V.P. retournez le sondage avant la fin de janvier 1992.

Pour fournir une réponses anonymes, veillez plier et brocher le questionnaire.

PLEASE COMPLETE AND RETURN THIS SURVEY AS SOON AS POSSIBLE TO:

S.V.P. COMPLETER ET RETOURNER CETTE EVALUATION LE PLUS TOT POSSIBLE A:

Dr. Ron Sloboda

Dept. Medical Physics,
Cross Cancer Institute
11560 University Ave
Edmonton, AB
T6G 1Z2