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

CANADIAN MEDICAL PHYSICS NEWSLETTER / Le BULLETIN CANADIEN de PHYSIQUE MEDICALE

Février / February 1993

From the editor:

Here is the sixth issue of the Canadian Medical Physics Newsletter to come out of my office. That means that I am about half way through my tenure as editor. I think I am beginning to get the hang of this and that the Newsletter has been interesting and informative. I also believe that the community is beginning to realise its value in reaching each other across the country.

This issue, the longest from Montréal, attests to this value. The reports of the president and chairman of the CCPM and COMP review some of the important issues now confronting medical physicists. These address, in part, some of the issues raised in the Letter to the Editor published last issue. The executive reports have been translated by my faithful colleagues Jean-Pierre Bissonnette and Micheline Gosselin and by a new recruit Maryse Mondat. The issue also contains reports on manpower and on technological developments in medical physics. I thank Karen Breitman and Dev Menon for submitting this work. There are also a number of announcements of upcoming events, in particular the issue has a detailed report from Paul Johns on the next COMP/OCPM meeting in Ottawa.

This issue also contains a first. One of the theoretical advantages of being the editor of the Medical Physics Newsletter is that you get to put in articles which interest you. In the past I haven't had to make too many choices along these lines as I went with submitted work since it was interesting, topical and, best of all, submitted. This issue, however, contains an article solicited from someone not only outside of the ranks of COMP and the CCPM but, also, outside the field of physics, in fact, from a philosopher. The article, entitled *The Use and Abuse of Science in Risk Assessment*, is a transcript of a lecture given at McGill University last year by Prof. Lawrence Haworth of the Department of Philosophy at the University of Waterloo. I believe this to be the first article by a *professional* philosopher in our Newsletter (although there have been a number from amateurs in the past). While it is not explicitly on a topic in medical physics, it discusses issues in mandated science, an area in which medical physicists may potentially act as experts. I trust that you will find the discussion as interesting as I did, and I hope that it will generate some discussion in future issues of the Newsletter.

I have some sad news to report. It seems, from a lack of response to notices in the last two Newsletters, that there was very little graduate research done in medical physics in Canada in 1991. Very few people (6 to be exact) have admitted to relating their work in graduate theses in 1992. The only graduate medical research reported to the Newsletter to date was performed in radiation therapy at OCI in Toronto, LRCC in London and here at McGill. I hope that before May I will receive some more submissions from these and other centres for our annual thesis review. Remember to submit not only the thesis author, title and abstract, but also the department and supervisor under whom the work was done and the degree received.

Some of you may think that this issue of the Newsletter is late. The mailing was delayed slightly intentionally to bring you the latest news and developments in medical physics in Canada.

Finally, there are a number of additional items included in this mailing. Please look them over carefully.

John Schreiner
McGill University

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INFORMATION EXCHANGE

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Report on Proceedings of the 28th Annual Meeting of the National Council on Radiation Protection and Measurements

April 1 & 2, 1992
Arlington, Virginia, USA

1. The theme of the annual meeting was "Radiation Protection in Medicine". The last time the NCRP focussed on this particular topic at its annual meeting was ten years ago.

2. Dr. Fred Mettler reviewed changes to patterns of medical radiation exposures (USA) from 1980 to 1990 due to the evolution of certain types of imaging technology and interventional procedures. Over the last ten years the percentage of US hospitals (larger than 200 beds) with computed tomography (CT) x-ray installations grew from 20 to 80% , and those with cardiac catherization labs grew from 15 to 22%. Also during the last five years, the percentage of US hospitals (larger than 200 beds) housing magnetic resonance imaging (MRI) units increased from 1 to 12%. The number of medical radiologists has also increased considerably. The annual frequency of procedures per thousand population increased in CT, ultrasound, MRI, and radiotherapy while declining slightly in nuclear medicine (NM). Overall, there was a 30% increase in the annual number of procedures performed during a ten year period when the US population grew by 9%. Reasons for this increase, such as population growth, changing age demographics, mammography and other screening programs, physician self-referral in a for-profit medical system, etc., were discussed briefly. Of the collective radiation dose to the US population (including radon), 11 % is due to medical X-ray procedures, and 4% to NM procedures.

3. Dr. Michael Fry from the Oak Ridge National Laboratory discussed some of the uncertainties in the new ICRP risk estimates for low dose/dose rate radiation exposures. He indicated that patterns of excess cancer mortality in the Japanese A-bomb survivors appear to differ from large cohorts of occupationally exposed worker populations under study in the UK and USA.. For many workers handling radioisotopes (particularly in university and hospital environments), radiation doses due to internal contamination are not known; and even in certain industries where internal contamination monitoring programs are standard, there is inconsistency in the dosimetry models used. Dr. Fry concluded that there was much work yet to be done on topics like dose rate/fractionation, transfer of risk across populations, risk projection models and radiogenic cancer markers. He briefly mentioned some current work by Dr. Geoffrey Howe comparing radiation induced lung cancer from external radiation exposure in Japanese A-bomb survivors to Canadian TB patients who underwent extensive chest fluoroscopy.

4. Dr. Eugene Saenger from the University of Cincinnati also expressed concern about the new ICRP risk estimates. He emphasized that only 8% of the A-bomb survivors received a radiation dose higher than 0.5 Gy, and 71 % of the total excess cancer mortality occurred in this group. There are important questions surrounding the quality of epidemiological studies of occupationally exposed workers. He touched briefly on the question of high LET from Auger electrons emitted by gamma emitters like indium-111 and technetium-99m, which could change (increase) the internal dosimetry estimates for nuclear medicine patients and possibly NM staff. He pointed out that the A-bomb survivors received acute whole-body doses, while most patients undergoing radiological procedures receive only partial body exposures that are often significantly fractionated.

5. Dr. James Keriakes discussed the relationship between radiation dose and image quality in NM and X-ray imaging. In some imaging modalities, the development of new technology and methodology has had a dramatic effect. For instance over the last 20 years, the image quality (contrast and resolution) in mammography has improved markedly, while the radiation dose to the patient has dropped a hundredfold. Much of the improvement in diagnostic x-ray is due to the development of dedicated equipment and image processors, quality control standards, computer aided diagnosis, and continued voluntary accreditation programs. In nuclear medicine, instrumentation improvements in the areas of data acquisition (multi-head gamma cameras), collimation, light collection efficiency, computer technology and data manipulation capability have considerably improved image quality while holding the patient radiation dose at a stable level. A brief overview of radiopharmaceutical dosimetry (dependent on the NM procedure performed) to the patient shows the dose to the organ of interest to be in the range of 10-50 mGy, to other organs 20-60 mGy, gonads 0.2-10 mGy, with total body dose 0.2-10 mGy. Image quality in CT imaging has improved with advances in technology along with a drop in radiation doses to patients. The radiation dose per procedure to the CT patient is now in the order of 30-70 mGy.

6. Dr. Robert Miller discussed risk and exposure to the fetus in patients and workers. He reviewed some of the data from the children of pregnant A-bomb survivors. There was a 43% pre or neonatal death rate (13/30) in those whose mothers were within 200 metres of the blast centre. Small head size was observed in 180 children who were 4-18 weeks

gestational age at the time of the bomb (ATB). Small head size appeared to be due to the loss of glial material, *not neurones* and in the majority of cases was associated with normal intelligence. He questioned whether other negative factors like undernutrition, infection, trauma, etc. in the pregnant women and neonates during the months after the bomb may have played a role in some of the cases of mental retardation. He also briefly reviewed the work of Stewart and Neal on the risk of obstetrical x-rays.

7. Dr. Sandra Fernbach, a pediatric radiologist, discussed the political and practical issues surrounding the occupationally exposed pregnant radiation worker. Because of the lack of a national dose registry in the United States, reliable information on doses is patchy, and it is very difficult to determine the age/sex demographics of medical radiation workers (although it appears that most medical radiation technologists and an increasing number of radiologists are young women). Having recently researched and written on this topic, your reporter certainly gained more appreciation for the wealth of such data contained in the Canadian BRMD national dose registry. There appears to be considerable confusion and anxiety in many occupationally exposed women as to the exact level of risk they might face during pregnancy, primarily because of the paucity of easily accessible and understandable information on the topic.

8. Dr. Joel Gray spoke on the topic of high doses related to interventional radiological examinations, particularly in cardiac vessel angioplasties. Some of the cardiac fluoroscopy units have a "boost" output feature to improve the image quality during difficult catherizations (used with considerable regularity by cardiologists), which increases the patient's skin entrance dose rate from about 50 to 300 mGy per minute. The average fluoroscopy time per procedure is about 16 minutes although it is common in certain types of procedures to fluoro for 40 to 60 minutes or even longer. There are anecdotal reports that some patients exhibit erythema and/or epilation effects on the chest area after undergoing complicated cardiac catheterization procedures. There is a growing concern in the radiation protection community about the induction of deleterious long- term effects in this patient population due to these interventional medical exposures, as many of the patients undergoing cardiac catheterization and angioplasty are relatively young men, 35 to 50 years old. In order to optimize patient radiation doses, Dr. Gray recommended implementation of national standards, rigorous education of cardiologists and radiologists, automated display and recording of fluoro time and patient dose, as well as improvements to the technology, such as elimination of the "boost" output mode, pulsed fluoro, optimized video systems, increased x-ray tube filtration, removal of the grid, etc.

9. Dr. Marvin Rosenstein discussed occupational radiation exposures from interventional cardiology procedures. The recently published work of Canadian Dr. L. Renaud was quoted several times. Dr. Rosenstein endorsed the recommendations made by Dr. Gray, as most steps taken to reduce patient dose would simultaneously lower occupational doses.

10. Dr. Jacob Fabrikant spoke on the topic of second cancers following radiotherapy. A minority of adult radiotherapy patients develop later primary solid tumours either inside or on the margins of previous treatment fields. There is some evidence that chemotherapy for Hodgkins disease in adults may play a role in the later development of acute lymphocytic leukaemia. Because cancer is rare in children the data are more sparse, but there is strong evidence that second primary cancers occur in children previously treated for Wilms tumour, Ewings sarcoma and Hodgkin's disease. He briefly discussed the high rate of post-radiotherapy second primary cancer in children with Li-Fraumeni syndrome which is an inherited mutation in the P-53 tumour suppressor gene. Dr. Fabrikant concluded that children with familial or hereditary cancer have an increased susceptibility to second primary cancers. He also indicated that it was not useful at present to attempt to estimate risk coefficients for the development of second primary cancers in adults who had previously undergone radiotherapy.

11. Dr. James Adelstein addressed the topic of heterogeneity of dose-distribution in nuclear medicine with respect to the dosimetry of radionuclides in patients. He touched briefly on the question of heterogeneity of dose among organs, within organs and within cells, and asked whether there might be differences in radiation sensitivity among all cells of a certain type. He also discussed the dosimetry related to high LET auger electrons from Tc-99m which is used extensively in nuclear medicine. He suggested that it might be inappropriate to use the ICRP formula for calculation of effective dose in NM patients, because it does not account for the differences in age/sex distribution between the NM patient population and general population, nor for differences in life expectancy and also does not take into account the benefit to the NM patient population.

12. Dr. Thomas Payne emphasized the importance of properly educating fluoroscopy practitioners with particular emphasis on interventional cardiology procedures and patient doses from long fluoro times and repeated procedures. The problem appears to be that many cardiologists receive very little training about the possible deleterious effects of prolonged fluoro time, and are unaware of the actual radiation dose they may be delivering to the patient. He

reiterated many of Dr. Gray's suggestions for modifications to the fluoro machines and recommended formal training and accreditation for fluoro practitioners, along with the publication of guidebooks on this topic. One of the most important reasons given for the increase in medical radiation exposures relates to the financial rewards for physician practitioners. A recent report published in the November 1991 New England Journal of Medicine indicated that 93.1 % of freestanding diagnostic imaging facilities in Florida are owned by doctors who refer patients to them. In these facilities the rates of MRI and CT examinations are much higher than average. There is a concern that the growing excess of radiological examinations to the patient population will have implications in terms of future induced neoplasms.

13. Dr. Philip Cascade outlined definitions, clinical relevance, practical issues and organizational impact of quality control (QA) and continuous quality improvement (CQI). His goal is to estimate the scope of problems from an excess of radiological procedures in the population.

14. Dr. David Brenner received the 1992 NCRP Robert E. Moseley Award for Radiation Protection in Medicine for his recently published paper (Jan 1991 International Journal of Radiation Oncology and Biological Physics; coauthored with E.J. Hall) entitled *Conditions for the Equivalence of Continuous to Pulsed Low Dose Rate Brachytherapy*. He presented the study which sought to establish those combinations of radiation pulse widths and frequencies that would make brachytherapy employing one source in pulsed mode functionally equivalent to continuous irradiation via sources kept in place during treatment. The availability of this information will greatly simplify the utilization of remote afterloading techniques for low dose rate interstitial brachytherapy for those tumours that are accessible to an implant.

15. The 16th NCRP Lauriston S. Taylor Lecture entitled *Radiation Doses and Risks in Diagnostic Radiology: How Big? How Little?* was given by Dr. Edward W. Webster . He discussed methods of dose reduction in the quality assurance and operation of x-ray machines. He also thoroughly addressed the topic of fluoroscopy dose and hazard reduction. Unfortunately he ran out of time before he was able to present his thoughts on the new ICRP radiation risk estimates vis-a-vis patient and occupational exposure due to medical radiation procedures. This paper will be published by the NCRP in the near future.

16. Dr. J. Thornbury presented the first of three papers in a session dealing with *Efficacy in the Use of Ionizing Radiation in Medicine*. His discussed efficacy from a number of different perspectives - technical, diagnostic accuracy, diagnostic thinking, therapeutic, patient outcome and societal. He has recently coauthored a book on the topic with Dr. Fryback published in 1991, entitled *Medical Decision Making*.

17. Dr. Barbara McNeil's talk was entitled *Decision Making and Radiologic Tests*. She indicated that in recent years the percent increase in medical expenditures was 30% in cardiology and 20% in other areas of radiology. These figures are some of the most striking in an analysis of the effect of new or advancing medical technology on the mushrooming cost of medical care in the US. Reasons for increasing use of expensive medical radiation imaging technology included an aging population, AIDS/crime/drugs, defensive medicine, geographic variations, profit motive and patient demand.

18. Otha Linton, from the American College of Radiology who has a background as a science journalist, gave a very interesting and entertaining talk on society's view of utilization of technology.

19. Dr. Gerald Dodd from the M.D. Anderson Cancer Centre in Texas presented a paper on the risk versus benefit from mammography screening programs. To date there is no direct evidence that breast cancer is caused by mammography. The radiation dose from a single mammogram is 1 mGy. Resultant excess cancer mortality due to this dose is calculated to be 2 deaths per million irradiated women, and he equated the individual's lifetime risk to 1.5 cigarettes or a 5,000 mile flight. His calculation of benefit was as follows: if 1 million women aged 45 undergo screening mammograms, it is likely that 1500 occult breast cancers will be detected at a very early stage. Currently there is a 50% mortality rate associated with breast cancer. If early detection and therapy in these 1500 women causes a 20% reduction in mortality, 150 deaths are averted.

20. The meeting concluded with reports on selected NCRP activities. Scientific Committee 64-6 chaired by Drs. William Templeton and John Till has developed a screening model for release of radionuclides to air, surface water and ground water. It is intended for use by regulatory authorities in the assessment of compliance. In conjunction with this work by the NCRP, the EPA has developed a "Comply" software program. The intent of this forthcoming publication (in press) is to convert exit radionuclide concentration to population dose from all pathways, and should be of considerable interest to the ACRP and AECB staff. Dr. Donald Jacobs reported on the early progress of Scientific Committee 87 on radioactive and mixed waste.

On behalf of the ACRP, I thanked the NCRP president Charles Meinhold for the formal invitation

which was extended to the ACRP to send a representative to the annual NCRP meeting. The papers presented at the meeting were generally of very high quality, and gave a broad overview of the current major issues in medical radiation protection. For the time being, it appears that high priority should be given to the reduction of radiation dose to the patient population undergoing fluoroscopy for diagnostic and therapeutic cardiac catherization procedures.

Karin Gordon
AECB Advisory Committee
on Radiological Protection

CANADIAN MEDICAL PHYSICIST 1991 MANPOWER SURVEY

September, 1992

***Background*:**

The Manpower Survey originated with the CCPM in 1985 with the objective being to provide data to Health and Welfare Canada for publication in the Canada Health Manpower Inventory. To qualify for inclusion in this publication, the CCPM had to prove that medical physicists were relevant and important to the health service industry and that formal training in the discipline was required. For the first insertion, data going back to 1974 was provided.

The Survey initially limited its scope to answering the questions posed by Health and Welfare Canada. Namely, what are the numbers of active physicists in medicine, what are the numbers of vacancies, what are the numbers of graduates from training programs, and what are the numbers of members of the CCPM, all of the above to be totalled by province.

For the 1990 Survey, the objectives were expanded in order to provide information to the profession itself, resulting in a much larger questionnaire and much more effort on the part of the surveyors. The Survey began to examine the manpower and training situations within each discipline. The same limited information (Tables I-III) continued to be supplied to Health and Welfare, with the publication now being called Health Personnel in Canada.

Pursuant to a joint decision by CCPM and COMP, the 1991 Survey was done under the auspices of COMP, although the same personnel were involved. The recently convened Professional Affairs Committee will take responsibility for future Surveys.

Changes to the 1991 Questionnaire:

In the past, surveyors from some regional areas have had difficulty in assessing whether or not to include individuals in the Survey who were employed by a University. The criteria as stated was that the individual must be closely affiliated with a medical institution. There being great variability in the interpretation of this criteria, the 1991 Survey provided a parallel section so that physicists could be counted who considered themselves to be medical physicists but who are not practicing in association with a medical facility.

The sub-discipline categories initially provided in the 1990 questionnaire did not provide sufficient scope for the surveyors. As a result, there were several categories written in. These categories were added to the 1991 questionnaire.

Observations for 1991:

The number of medical physics vacancies was appreciably reduced during 1991. Both the large numbers of vacancies in 1990 and the subsequent reduction in 1991 were due to conditions in Ontario. Note that 44% of the medical physicists in Canada reside in Ontario, and 23% reside in Quebec.

As was evident last year, over 70% of the vacancies are in the discipline of radiation therapy, whereas only 10% of the graduates studied in that field. Most of the students in residency-type programs (informal or formal) are in radiation therapy (82%), although the number of graduates remains small.

The total number of students in the system is 158, equal to the total number of medical physicists employed in 1990.

Acknowledgments:
Many thanks to the "volunteers" all across Canada who gathered data for this Survey.

Respectfully submitted,
Karen Breitman FCCPM

Editor's Note: Data prior to 1980 are available but have been omitted from the following tables to clean up the presentation. They have been reported in previous reviews of manpower surveys. Also see the note concerning future surveys on pages 25 and 26 of this issue.

TABLE I *ACTIVE PHYSICISTS IN MEDICINE*
(Vacant positions beneath in italics)

PROV.	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
NFLD	2	2	2	2	3	2	2	2	2	2	3	3
PEI	0	0	0	0	0	0	0	0	0	1	0	0
					1	*1*	*1*	*1*	*1*	*0*	*0*	*0*
N S	4	4	5	6	7	6	7	7	7	7	7	7
						1					*1*	*1*
N B	2	2	3	3	3	3	3	3	3	2	2	4
										1	*1*	*0*
QUE	20	22	25	27	28	28	30	32	30	32	39	40
					5	*4*	*3*	*4*	*2*	*3*	*2*	*0*
ONT	38	37	40	45	46	48	52	55	57.5	67	69	76
					6	*8*	*8*	*4*	*6.5*	*10*	*22*	*17.5*
MAN	5	6	6	8	8	8	9	9	10	10	7	9
					1	*1*					*3*	*3*
SASK	3	3	3	4	8	8	7	8	9	8	10	9
					1	*1*	*1*	*2*		*2*	*0*	*0*
ALB	8	8	8	10	10	12	11	11	11	10	10	12
										3	*3*	*2*
B C	8	9	9	10	10	10	10	12	12	12	12	11
							1		*1*	*1*	*1*	*1*
Y & NWT	0	0	0	0	0	0	0	0	0	0	0	0
CANADA	90	93	101	115	123	125	131	139	141.5	151	159	171
					14	*16*	*14*	*11*	*10.5*	*20*	*33*	*24.5*

TABLE II *MEMBERS OF COMP*

PROV.	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
NFLD	0	0	0	0	0	0	0	0	0	0	0	0
PEI	0	0	0	0	0	0	0	0	0	0	0	0
N S	2	2	2	2	2	5	5	5	5	5	3	3
N B	0	0	0	0	0	0	0	0	0	0	1	1
QUE	6	7	8	10	11	17	16	14	15	16	16	16
ONT	18	20	20	20	20	20	24	27	30	35	39	44
MAN	1	1	1	1	1	1	6	6	6	8	5	5
SASK	2	2	2	2	3	8	8	8	6	6	5	6
ALB	2	2	2	2	2	5	6	5	7	7	6	6
B C	4	4	5	5	5	6	5	7	7	7	8	9
Y & NWT	0	0	0	0	0	0	0	0	0	0	0	0
CANADA	35	38	40	42	44	62	70	72	76	84	83	90
USA/Europe											9	8

TABLE III *GRADUATES OF MEDICAL PHYSICS PROGRAMMES (M.Sc. and Ph.D.)*

PROV.	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
NFLD	0	0	0	0	0	0	0	0	0	0	0	0
PEI	0	0	0	0	0	0	0	0	0	0	0	0
N S	0	0	0	0	1	1	0	1	2	0	0	0
N B	0	0	0	0	0	0	0	0	0	1	0	0
QUE	3	4	4	5	4	4	3	4	3	6	11	6
ONT	4	2	8	7	6	4	7	10	11	10	14	19
MAN	0	1	1	1	1	1	2	2	3	2	2	3
SASK	0	0	1	0	1	1	1	0	1	0	0	0
ALB	1	1	1	2	2	2	2	1	0	3	0	1
B C	1	2	1	1	1	0	0	1	0	0	0	0
Y & NWT	0	0	0	0	0	0	0	0	0	0	0	0
CANADA	9	10	16	16	16	19	15	19	20	22	27	29

TABLE IV *MEDICAL PHYSICISTS EMPLOYED IN SUB-DISCIPLINES*

	1990 employed	1990 vacancies	1991 employed	1991 vacancies	1991 not assoc. with medical facility
Radiation Oncology	95.3	27	96.5	17.5	0
Therapy Imaging	1	0	3	0	0
Radiation Dosimetry	0	0	5	0	0
Hyperthermia	2	0	2	0	1
Light /lasers/photodynamic therapy	0	0	1	0	0
Protection	1.7	0	6.6	0	8
Diagnostic Radiology	27	3	25.5	2	1
Nuclear Medicine	25	1	20.5	3	2
Magnetic Resonance	7	2	9.5	2	1
Total	159	33	171	24.5	13

TABLE V *GRADUATES FROM MEDICAL PHYSICS TRAINING PROGRAMS*

(Current enrollment is in parentheses)

	1990 MSc		1990 PhD		1990 Residency		1991 MSc		1991 PhD		1991 Residency	
Radiation Oncology	6	(16)	1	(10)	1	(13)	1	(8)	2	(4)	1	(23)
Therapy Imaging	1	(4)	1	(4)			1	(6)	1	(4)	0	(1)
Radiation Dosimetry	2	(3)	0				6	(8)	0	(9)	0	(2)
Hyperthermia	1	(3)	0	(5)			2		1	(1)	0	
Light	1	(5)	0	(2)			1	(2)	0	(4)	0	(2)
Protection							1		0		0	
Diagnostic Radiology	5	(19)	1	(16)			4	(21)	1	(13)	0	
Nuclear Medicine	2	(8)	2	(2)			2	(10)	0	(9)	0	
Magnetic Resonance	2	(8)	2	(11)			3	(11)	2	(18)	0	
Total	20	(66)	7	(50)	1	(13)	21	(66)	8	(64)	1	(28)

TABLE VI *EMPLOYMENT PATTERN OF RECENT GRADUATES*

Percentage of total Graduates:	1990	1991
Continuing their education:	33%	44%
Employed within the province:	41%	31%
Employed in another province:	15%	13%
Moved out of the country:	11%	6%

TABLE VII *REASON FOR VACANCIES OCCURRING DURING YEAR*

	1990	1991
New position	53%	50%
Retirement	6%	4%
Incumbent moved		
out of country	11%	4%
out of province	22%	17%
within province	3%	21%

TABLE VIII *SOURCE OF CANDIDATES HIRED*

	1990	1991
Medical Physicist (>1 year experience):		
outside the country	10%	23%
out of province	33%	14%
within province	10%	18%
Recent graduate in medical physics:		
outside the country	5%	9%
out of province	5%	0%
within province	14%	32%
Physicist from another field:	19%	5%

Editor's Note: The following article is taken from a brief prepared by the Canadian Coordinating Office for Health Technology Assessment (CCOHTA).

CCOHTA is a federal service intended to provide information on new and emerging technologies in health care. This service was introduced to me by Dr. Brendan McClean from the Cross Cancer Institute. He noted that the agency is not well known at present and suggested that the Newsletter solicit an article from CCOHTA's director Dr. Devidas Menon, a physicist who had worked in medical physics in Edmonton in the past.

Dr. Menon provided the Newsletter with the May 1992 Technology Brief which reviewed the distribution in Canada of some of the high technology equipment of interest to members of COMP. An edited version of the Brief is reproduced below. Such Briefs are prepared regularly by the agency along with a number of other publications and reports. The activities are reviewed in *CCOHTA UPDATE* , a newsletter put out by the agency.

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SELECTED HEALTH TECHNOLOGY IN CANADA

INTRODUCTION

The Canadian Coordinating Office for Health Technology Assessment (CCOHTA) frequently receives questions regarding the status of various health technologies in Canada. This report contains information (sites and numbers) on the following health technologies:

- cobalt radiation therapy units;
- computed tomography (CT) scanning units;
- linear accelerator (linac) units;
- magnetic resonance imaging (MRI) units;
- cardiac catheterization laboratories.

The information provided will be updated and published regularly in an effort to provide researchers and health policy makers with an accurate picture of the status and diffusion of key medical technologies in Canada.

This report is a condensed summary of a brief prepared by the staff of CCOHTA, with assistance from a number of medical specialists and manufacturers across the country. CCOHTA sincerely thank all those individuals who provided us with information, in particular: Mr. Michael de Wilton, Mevex Corporation, Mr. Roger Fayle, Siemens Electric, Mr. Ike Haq, Theratronics International Limited, Dr. Brendan McClean, Cross Cancer Institute, Mr. Harold Wodinsky, Ontario Cancer Treatment & Research Foundation.

COMPUTED TOMOGRAPHY (CT) SCANNING

Computed tomography (CT) scanning is a non-invasive technique that is used to produce cross-sectional images of the body's tissues and organs using X-rays. This technology is used mainly for brain, spine, lung and abdomen imaging. Recent developments in the technology have improved scanning speed and image quality and allow for three-dimensional CT reconstruction.

The first patient was scanned with CT in 1972. The following year, the first medical CT scanner was installed in Canada at the Montreal Neurological Institute.

A recent development in CT scanning is ultrafast CT (cine CT). Future applications for ultrafast scanning may include cardiac imaging, as well as conventional head and body imaging.

There are currently 200 CT scanner units in Canada (see the Summary Table on page 13 for distribution), 292 in Australia, and over 5,500 units in the United States. In 1990, Japan had 6,433 units.

COBALT RADIATION THERAPY UNITS

Cobalt-60, a radioactive isotope of cobalt, is used as a source of radiation to treat some kinds of cancer. Cobalt-60 emits radiation in the form of gamma rays with an effective energy of 1.25 MeV which can be used to treat brain, heart and breast tumours. However, treatment of more deep-seated tumours, such as those found in the pelvis, require high energies from linear accelerators (3-6 MeV) or recent versions of cobalt-60 units (post 1990 models).

The first medical cobalt-60 unit in the world resulted from work in the late 1940's that took place in Saskatoon, Canada. In 1951, the first commercial unit was installed at Victoria Hospital, London.

Today, there are 55 cobalt units operating in Canada. It has been estimated that there are over 1,500 units in operation throughout the world, outside the USSR and China.

Table 1: Distribution of Cobalt Units in Canada

PROVINCE	CENTRE	UNITS
BRITISH COLUMBIA		
	B.C.C.A.:	
	Vancouver Clinic, Vancouver	1
	Victoria Clinic, Victoria	1
ALBERTA		
	Tom Baker Cancer Centre, Calgary	3
	Cross Cancer Institute, Edmonton	1
SASKATCHEWAN		
	Allan Blair Memorial Clinic, Regina	1
	Saskatoon Cancer Centre	1
MANITOBA		
	MCTRF:	
	M.R. MacCharles Unit, Winnipeg	1
	St. Boniface General , Winnipeg	1
ONTARIO		
	OCTRF / Ontario Cancer Foundation:	
	Hamilton Centre	3
	Kingston Centre	1
	London Centre	1
	Ottawa Centre	
	Civic Hospital	2
	Ottawa General	1
	North East Program, Sudbury	1
	Thunder Bay Centre	1
	Toronto Bayview Centre	2
	Windsor Centre	1
	Ontario Cancer Institute:	
	PMH, Toronto	5
QUEBEC		
	Hôp. de Chicoutimi, Chicoutimi	1
	U. de Sherbrooke, Fleurimont	2
	Maisonneuve Rosemont, Montreal	5
	Notre Dame, Montreal	4
	Hotel Dieu, Montreal	3
	Montreal General Hospital	1
	Royal Victoria Hospital, Montreal	1
	Jewish General Hospital, Montreal	1
	Hotel Dieu , Quebec City	3
NEW BRUNSWICK		
	Saint John Regional Hospital	2
NOVA SCOTIA		
	NS Cancer Centre, Halifax	2
PRINCE EDWARD ISLAND		
	Q. Elizabeth Hosp, Charlottetown	1
NEWFOUNDLAND		
	NCTRF:	
	Nfld Cancer Clinic, St. John's	1

LINEAR ACCELERATOR

A linear accelerator (linac) produces beams of x-rays or high-energy electrons. These beams can be used for x-ray or electron therapy by focusing them on to a tumour within the body. Millions of volts of radiation (*sic*) can be delivered by linacs to help destroy tumours. Linacs are currently used to treat some kinds of cancer. Linacs are also used for stereotactic radiosurgery.

Linacs were developed in the 1930's, and used originally as a nuclear physics research device. The first radiotherapy linac was installed in England, at the Hammersmith Hospital in London in 1952. Currently, there are 72 linacs operating in Canada. Ten additional units will be installed in the near future.

Table 2: Distribution of Medical Linear Accelerators in Canada

(Numbers in brackets represent units which have not yet been installed)

PROVINCE	CENTRE	UNITS
BRITISH COLUMBIA		
	B.C.C.A.:	
	Vancouver Clinic, Vancouver	7
	Victoria Clinic, Victoria	2
ALBERTA		
	Tom Baker Cancer Centre, Calgary	2 (1)
	Cross Cancer Institute, Edmonton	5 (1)
SASKATCHEWAN		
	Allan Blair Memorial Clinic, Regina	2
	Saskatoon Cancer Centre	3
MANITOBA		
	MCTRF:	
	M.R. MacCharles Unit, Winnipeg	3
	St. Boniface General , Winnipeg	0 (1)
ONTARIO		
	OCTRF / Ontario Cancer Foundation:	
	Hamilton Centre	6
	Kingston Centre	2
	London Centre	5
	Toronto-Bayview	4
	Ottawa Centre	
	Civic Hospital	3
	Ottawa General	1
	North East Program, Sudbury	3
	Thunder Bay Centre	1
	Windsor Centre	1
	Ontario Cancer Institute:	
	PMH, Toronto	9

QUEBEC	
Hôp. de Chicoutimi, Chicoutimi	0 (1)
Notre Dame, Montreal	1
Montreal General Hospital	3
Royal Victoria Hospital, Montreal	2
Jewish General Hospital, Montreal	1
Hotel Dieu , Quebec City	1 (4)
NEW BRUNSWICK	
Hôpital Georges Dumont, Moncton	0 (2)
Saint John Regional Hospital	2
NOVA SCOTIA	
NS Cancer Centre, Halifax	2
NEWFOUNDLAND	
NCTRF:	
Nfld Cancer Clinic, St. John's	1

MAGNETIC RESONANCE IMAGING (MRI)

MRI is a non-invasive diagnostic technology. It provides cross-sectional or three-dimensional images of organs and structures within the body. Though similar to CT in some ways, MRI does not use ionizing radiation. Instead, magnets placed outside the body allow images of organs inside the body to be produced. Magnetic field strengths of commercial MRI units range from 0.2 to 2.0 tesla. The strength of the earth's magnetic field, in comparison, is less than one ten-thousandth of a tesla. Scanning of the head, central nervous system and spine are the major applications of MRI. Detailed imaging of the heart and major blood vessels, blood flow imaging and the examination of joints and soft tissues are other applications. MRI was developed in the early 1970's. In late 1982/early 1983, the first three MRI units were installed in Canada: at St. Joseph's Health Centre, London, University of British Columbia Hospital and Princess Margaret Hospital, Toronto. At that time, MRI was primarily a research device. In 1985, St. Joseph's became the first hospital to provide a clinical service.

New developments include: contrast agents, specialized surface coils, and MR spectroscopy (MRS) which permits measurement of metabolism and physiology.

There are presently 22 MRI units operating in Canada. Ten additional units will be installed in the near future. The United States has over 1,500 units; Japan has 746; Australia has 21 ; and, Israel has 4.

Table 3: Distribution of MRI Units in Canada

(Numbers in brackets represent units which have not yet been installed)

PROVINCE — CENTRE	UNITS
BRITISH COLUMBIA	
BC Children's Hosp., Vancouver	0 (1)
St. Paul's Hosp., Vancouver	0 (1)
University Hosp.Vancouver	1
Van. General Hosp., Vancouver	1
Royal Jubilee Hosp., Victoria	1
ALBERTA	
Foothills Prov. General Hosp, Calgary	1
Cross Cancer Institute, Edmonton	0 (1)
U. Alberta Hospitals, Edmonton	1 (1)
SASKATCHEWAN	
Royal University Hosp., Saskatoon	1
MANITOBA	
St. Boniface General , Winnipeg	1
ONTARIO	
Chedoke-McMaster, Hamilton	1
Kingston General Hosp.	0 (1)
St. Joseph's, London	1
University Hosp, London	2
Sunnybrook HSC, North York	1
Ottawa General	1
Hosp. for Sick Children, Toronto	0 (1)
PMH, Toronto	1
St. Michael's, Toronto	1
Toronto Hospital	2
QUEBEC	
Hôp. Notre Dame, Montreal	0 (1)
Hop. St-Luc, Montreal	1
Montreal Children's	0 (1)
Montreal General	1
Montreal Neurological Inst.	1
Hôp. de l'Enfant Jesus, Quebec	0 (1)
Hôp. St-Francois d'Assise, Quebec	1
NOVA SCOTIA	
Victoria General Hosp., Halifax	1
NEWFOUNDLAND	
General Hosp. HSC, St. John's	0 (1)

CARDIAC CATHETERIZATION

Cardiac catheterization uses x-rays and contrast agents to visually evaluate the condition of the heart and its surrounding blood vessels. A catheter that is introduced into the heart via a blood vessel is used to release dye or contrast medium so that the heart chamber and vessels can be viewed. This technology is used to diagnose and assess the extent of congenital heart disease and coronary artery disease, as well as to diagnose and treat some disorders of the heart valves.

Cardiac catheterization was developed in Germany in 1929. It was first used as a diagnostic tool in 1941 and as a therapeutic tool in 1964. The procedure was first performed in Canada in 1946 at the Hospital for Sick Children.

Recent developments in the field include a new generation of advanced electrophysiology catheters for diagnosing and treating tachycardias. Clinical trials for these devices have not yet begun.

There are currently 49 Canadian centres which offer cardiac catheterization. In the United States, over 5,000 facilities provide the technology. In 1989, 958,000 catheterization procedures were performed in the U.S., compared to 29,835 in Canada.

SUMMARY TABLE — *DIFFUSION OF KEY MEDICAL TECHNOLOGIES*

PROVINCE	BC	ALTA	SASK	MAN	ONT	QUE	NB	NS	PEI	NFLD	TOTAL
Cobalt Radiation Therapy Units	2	4	2	2	18	21	2	2	1	1	55
CT Scanning Units	23	22	5	8	65	58	6	7	1	5	200
Linear Accelerators											
installed	9	7	5	3	35	8	2	2	0	1	72
not installed		2		1		5	2				10
MRI Units											
installed	3	2	1	1	10	4	0	1	0	0	22
not installed	2	2			2	3				1	10
Cardiac Catheterization Laboratories	8	5	2	2	15	14	1	1	0	1	49

Your Newsletter editor says:

Editor's Note: The following article is a transcript of a lecture given at McGill last year by Dr. Lawrence Haworth of the Department of Philosophy at the University of Waterloo. It presents a discussion of mandated science based on an analysis of a particular problem made by Dr. Haworth and his colleagues Dr. Conrad Brunk and Dr. Brenda Lee. It offers a different view than we are conventionally used to in our work and I found the article very interesting. Dr. Haworth has graciously given the Newsletter permission to reprint this transcript.

THE USE AND ABUSE OF SCIENCE IN RISK ASSESSMENT

PRELUDE

I once began a talk for an occasion much like this by saying that I'm a philosopher and as such don't deal with facts but with ideas. I didn't *mean* it as a joke, but still the audience laughed. I've never been sure why, but in any case the laughter conveyed a belief that it's in some way ludicrous to deal with ideas and not facts. As you'll see, this little anecdote serves indirectly to introduce the theme of my remarks tonight.

Another and perhaps better way philosophers might describe themselves is by saying that they deal with *arguments*. That's a better way to begin this: tonight I'm going to present an argument. There'll be premises and a conclusion. You're invited to regard the premises as true and the conclusion as a reasonable inference from them. This time, though, I'm promising extensive reference to facts.

Actually, it'll be more of an argument-sketch than a fully articulated argument. I hope there'll be questions afterward which give me a chance to fill in the gaps in the sketch.

INTRODUCTION

The topic is mandated science, a term introduced by Liora Salter, currently a professor at Osgoode Hall, the law school at York University. It has somewhat the same meaning as "trans-science", a term coined many years ago by Alvin Weinberg. Mandated science is contrasted with pure and with laboratory science and means roughly applied science, science brought to bear on practical issues. Liora Salter mainly had in mind standard setting, for example, the hundreds of standards with which this building complies - for plumbing, wiring, lighting, load bearing walls, crush space, flooring, doors, windows, roof, insulation, wall plugs, and so on. A psychiatrist testifying as to an accused person's sanity in a legal proceeding is also practising mandated science, at least she is if psychiatry is a science. More to the point here, risk assessors, experts who advise us concerning the risks of chemicals, nuclear power plants and such, are mandated scientists.

You'll instantly recognize that we rely on mandated science at every turn. We look to scientific experts to advise us concerning most aspects of our lives. I start then with a question: Why this reliance and even dependence? The part of the answer I'll stress is suggested by the idea of neutrality being value free and, in a familiar but in my opinion misguided sense, objective. We think of the scientific experts who advise us in practical matters as objective and regard this as a virtue. When the issue is highly controversial we search for an objective opinion, not tainted by values and founded solely on the facts.

We can see perhaps that not all issues can be settled in this way; think how differently the abortion debate would be going, or better still the constitutional debate, if we imagined it was a factual matter and could be resolved by scientific experts. Nevertheless, most of us are somewhat biassed toward finding the questions we try to answer to be purely factual ones. And often, when we're unable to take that view of them, we fasten on the factual aspects of normative questions and imagine the answer will appear if we become clearer concerning the facts.

For example, in the applied ethics courses I teach I often refer to concrete cases and try to get my students to think the case through to arrive at a view concerning the best course of action to take in the imagined circumstances. Commonly, my students skirt right around the issues of principle and head straight for the issues of fact, thinking that if only they dwell there long enough the answer will magically appear without their having had to wonder what principles apply to the case. And my students are remarkably slippery. When I try to bring them back to the issues of principle I often get a short period of non-response, followed by renewed attention to one or another of the *factual* issues raised by the case.

I've said enough now to introduce my thesis. The tone of it is this: our assumption that mandated science can give us neutral, value-free advice is often mistaken. The scientific experts on whom we rely for guidance in practical matters are generally unable to provide the value-free guidance we are hoping for. The point isn't that they are **biassed** and illicitly allow their own values to creep in. I'll be arguing rather that often the questions mandated scientists try to answer aren't factual questions in the first place - they don't *admit* of value-free answers.

An implication is that we need to rethink the role of science in society. I'll have more to say about this later.

For many of you, my thesis will be a familiar one. It's a tenet of postmodernism that there's no such thing as an objective point of view. We approach all issues from our own perspective and our version of the truth is just that, our version - a version contextualized by our own particular slant on things. Anyone who believes this will not be challenged by the claim that mandated science isn't value-free. And even before the recent advent of postmodernism, philosophical and sociological literature was full of critiques of the fact - value distinction and the idea of a sociology of knowledge was widely accepted.

I want to distinguish these various ways of puncturing scientific claims to objectivity from the approach I'll be taking here. Arguing from some general postmodernist thesis, or from a critique of the fact/value distinction, or from the sociology of knowledge is, in effect, a top/down approach. It opposes the theory of scientific objectivity with another theory. Just because of their very abstract nature, none of these theories compels assent, except from the committed. Mandated scientists, convinced that their methodology is value-free, don't change their opinion when confronted with opposing *theories* about their methodology. And unless they're shown *where* the values enter and *how* these values influence their conclusions, they'd be *foolish* to heed their critics.

What's wanted then is a bottom/up approach. The best and most convincing way to explore how values influence the practice of mandated science is to actually study a particular case in detail.

You may expect that this more empirical, case study approach will have a problem of its own even more serious than the one I've attributed to the abstract and theoretical approaches of sociologists and philosophers. This is the problem of generalizability. If we look closely at a particular case and note the extent to which value assumptions influence the science, how can we derive from this conclusions about mandated science in general? Perhaps the case is idiosyncratic. Or possibly the mandated science practised in the case was deviant. If the scientists were merely biassed then what one is studying is simply a case of bad science.

I plan now to take up approximately a half hour of your time describing a particular case of mandated science which two colleagues and I have studied at length. The case, sometimes referred to as the alachlor controversy, has enjoyed considerable notoriety. It's of particular interest because of the prominent role value assumptions played in the controversy. What I'll especially emphasize, however, is the unavoidability of these value assumptions. The argument will be that making value assumptions was made necessary by the kind of task the mandated scientists faced. I'll claim that the results are generalizable because the features of the case which required introduction of value assumptions are ubiquitous in the practice of mandated science.

The alachlor controversy was a debate concerning the risk of a chemical herbicide, alachlor, which is used to control weeds in fields planted with corn and soybeans. In Canada, chemicals of this sort must be registered by Agriculture Canada. The procedure is that the manufacturer submits evidence bearing on the safety of its product. The government, usually Health and Welfare, uses the evidence to do a risk assessment and then Agriculture Canada decides whether the assessed risk is acceptable. If it's found acceptable, the product is registered, otherwise not.

For herbicides, the evidence is mainly of two sorts. First, there are animal feeding studies; rats, for example, are fed the product over a period of time, then killed to see whether they've developed tumours. From this a "dose-response" relationship is derived, where the dose is a certain quantity of the product; the response, presence or absence of tumours of one sort or other. Second, there are exposure studies in the case of alachlor, calculations of the amount of the product to which people who apply it are exposed. In the alachlor risk assessments, both the exposure estimates and the dose-response data were expressed in mg of alachlor/kg of body weight/day. Obviously, if one found that applicators would be exposed to dramatically less of the product than was required to induce a tumour in a rat, one would be encouraged to find the product safe; if one found applicators would be exposed to considerably more of the product than was required to induce a tumour in rats one would likely declare the product unsafe.

The evidence submitted by the manufacturer, Monsanto, on the basis of which alachlor was *initially* registered for sale in Canada, was found to be suspect. The government asked Monsanto to submit replacement studies. After analysing the replacement studies the government concluded that alachlor posed too high a risk of cancer and alachlor's registration was cancelled.

Monsanto appealed the decision. A committee, the Alachlor Review Board, was convened to hear the appeal. At the Hearings, during 1986 and 1987, risk assessors for Monsanto presented evidence in support of their assessment of alachlor's risks; risk assessors for the government presented evidence in support of their very different assessment. In their *Report* the Board reviewed the evidence from these sources and offered an assessment of its own.

Its conclusion was that alachlor is not a risky product and that the government erred in cancelling its registration. The Board therefore recommended to the Minister of Agriculture that the registration of alachlor be reinstated. As it happens, the Minister didn't accept the recommendation. This was in 1987, and to this day alachlor is not sold in Canada.

Our case study consisted in an analysis of the Hearings of the Alachlor Review Board, published in 45 or so volumes, and of the Report the Review Board presented to the Minister of Agriculture.

Now the plug: The results of our study are summarized in a book published last year by Wilfrid Laurier University Press, titled *Value Assumptions in Risk Assessment: A Case Study of the Alachlor Controversy*. My co-authors are Professor Conrad Brunk, at my university, and Dr. Brenda Lee, a Montreal consultant.

In our study, we focused on the reasoning the Review Board employed in its assessment of alachlor's risks, and also on the Monsanto and government risk assessors' reasoning. Generally speaking, all of these major parties to the debate thought the issue before them was purely scientific. For them, the challenge was to get at the facts and in an unbiased and value-free way come up with the most reasonable interpretation of the facts.

Table 1: Alachlor exposure estimates

mg/Kg/day	
2.7	HPB patch test, 100% absorption, no protective clothing, no amortization
2.5	LOWEST DOSE AT WHICH A TUMOUR WAS OBSERVED IN RAT STUDIES
0.26	Biomonitoring, no protective clothing, no amortization
0.21	HPB patch test, 100% absorption, protective clothing, no amortization
0.02	Biomonitoring, protective clothing, no amortization
0.001	UPPER LIMIT OF WORST CASE EXPOSURE SCENARIO
0.00038	HPB patch test, 100% absorption, protective clothing, full amortization, 1 day exposure/year
0.0001	LOWER LIMIT OF WORST CASE EXPOSURE SCENARIO
0.0000009	Biomonitoring, protective clothing, full amortization, 1 day exposure/year

But surprisingly their estimates of alachlor's risks varied widely (see Table 1). At one extreme were the Monsanto risk assessors, whose exposure studies indicated that an applicator would be exposed to only 9.0×10^{-7} mg/kg/day. That's at the bottom. At the other extreme, the government's risk assessors concluded that an applicator would be exposed to as much as 2.7 mg/kg/day. That's at the top. In between was the Review Board's estimate, that the exposure would fall somewhere between .001 and .0001. In other words, there was a 7 orders of magnitude difference between the most optimistic estimate (Monsanto's) and the most pessimistic estimate (the government's).

Since it was established that a dose of 2.5 mg/kg/day was sufficient to induce a tumour in a rat, the second line in the Table, the government's finding that applicators might be exposed to 2.7 mg indicated some danger. By contrast, the Monsanto estimate that applicators would be exposed to a dose 7 orders of magnitude *less* than the dose required to induce a tumour in a rat suggested there was no cause for alarm.

Who should one believe? You'll be struck by the magnitude of the disagreement. To make it easier to visualize this, it is as if one group of scientists had concluded that applicators would be exposed to *one ounce* of alachlor, while another group were insisting that the exposure was more like *six tons*. What explains this rather remarkable disagreement?

As I've suggested, the wide differences among the scientific experts resulted from their holding very different value perspectives. In particular, different views concerning the importance of technology, concerning the relative importance of human health and corporate profits, concerning the very meaning of rationality, and concerning the importance of allowing corporations freedom to conduct their business with minimal government interference. In the remarks that follow, I'll restrict myself to the ways different views concerning the importance of health and of economic benefits influenced the estimates.

These differences in value perspective underlay and largely explain the different exposure estimates. The scientists who were parties to the debate did not acknowledge or even recognize this fact. They carried on the debate as if their disagreement concerned purely factual matters. They didn't identify the normative issues that divided them, and so naturally they didn't get into the sort of discussion it would have taken to clarify why they disagreed, much less reach a settlement.

Well then: How *did* value judgements influence the alachlor risk assessment? In answering this question I'll particularly stress the basis for our view that the assessors' invoking of value perspectives was unavoidable owing to the nature of the task before them. I can best do this by calling your attention to some of the details of Table 1.

I hope you'll bear with me for a short while now. The discussion will get, I won't say technical but at least a bit detailed. But I need to go through this so that you can understand why we hold the rather counter-intuitive view that statements about risk are not purely factual or empirical but instead are normative and express value judgements.

Alongside each of the exposure estimates in the table is some text which indicates how the estimates were derived. The text alludes to four issues:

- Which of two methods of measuring exposure, patch tests or biomonitoring, was used to derive the estimate.
- Whether the exposure was amortized.
- Whether the applicator was assumed to be wearing protective clothing, especially gloves.
- How much alachlor the applicator was assumed to apply.

To simplify a complex matter, the situation is approximately this. All of these estimates, from the optimistic, as-it-were one ounce estimate at the bottom, to the pessimistic, as-it-were six tons estimate at the top, are based on more-or-less the same raw data. An applicator gets on a tractor and drives out into a field to apply the herbicide. He or she returns and the exposure incurred is translated into one of the exposure estimates. This is done by making assumptions with respect to each of the four issues.

If it's assumed that biomonitoring is the appropriate measuring method, that exposure should be fully amortized, that full protective clothing would be worn, and that a minimal amount of alachlor is applied, then an optimistic estimate such as that at the bottom will be the result.

If instead it's decided that the patch method is the appropriate measuring method, that exposure shouldn't be amortized, that no protective clothing would be worn, and that a very considerable amount of alachlor would be applied, then a pessimistic exposure estimate such as that at the top will be the result. And the intervening estimates result from other combinations.

So, to the question 'What explains the wide variation in exposure estimates?' we have the beginnings of an answer. It results from the estimator making different assumptions regarding the four issues. The rest of the answer is gotten by noticing the sort of issues these are. They fall into two groups. Two of the issues, the patch test and the amortization issues, are what one might call "uncertainty issues". For reasons which'll be evident shortly, we also call them "conditionally normative" issues. The other two, the protective clothing and the quantity applied issues, we call, for reasons to be explained later, inherently normative issues.

Table 2: Issues in Alachlor exposure estimates

- Protective clothing vs. No protective clothing
- How much alachlor is applied in a lifetime?
- Amortization vs. No amortization
- Patch test vs. Biomonitoring

Table 3 : Classification of Issues in Alachlor exposure estimates

Normative Assumptions

Conditional

- Amortize exposure ?
- Patch test or biomonitoring ?

Inherent

- Is protective clothing worn?
- How much alachlor is applied in a lifetime?

The reason we decided that the various estimates of alachlor's risk weren't purely factual but normative and value-laden is that these estimates were derived by making assumptions regarding the four indicated issues, each of which is, in one or another of two senses, normative. The reason we concluded that this value-ladenness was unavoidable is that one can't estimate alachlor's risk without making an assumption with respect to each of these issues. And the reason why these views are generalizable is that risk assessment of many other products, indeed mandated science practised in many other areas, confronts numerous issues which are in the same way conditionally or inherently normative.

The next step in the argument is to indicate why we call the uncertainty issues "conditionally normative" and why the protective clothing and quantity applied issues are "inherently normative". With respect to the uncertainty issues, I'll focus on amortization. The inherently normative issue I'll focus on is protective clothing. I pick these two issues because far and away the major part of the variation in the exposure estimates results from assumptions one makes regarding amortization and protective clothing.

First, then, amortization, a term which hasn't been defined as yet. Say a person is exposed to a large amount of a carcinogen over a short period of time, but that that represents the total amount to which the person will be exposed in their lifetime. Shall we express the amount of the substance to which the person is exposed as a daily average over a lifetime that is, shall we amortize the exposure and then ask whether receiving that amortized dose is safe? Or shall we simply take the total exposure in that short period of time and inquire whether that is safe?

In the case of alachlor, one simply doesn't know whether for purposes of a risk estimate exposure should be amortized. Yet the major source of the variance between the Monsanto and government exposure estimates was that the Monsanto assessors amortized exposure while the government assessors didn't. Given the uncertainty, there was no scientific answer to the amortization question. So we have here a prime example of what Alvin Weinberg called "trans-science": questions that arise *within* science but which science can't answer.

In the absence of a scientific basis for answering the question, what dictated the answers given by the Monsanto and government risk assessors? Values. Both groups of assessors recognized that, given the uncertainty, any answer they gave might well be mistaken. But if they wanted to assess alachlor's risk they couldn't duck the issue.

Their response was to decide the issue in a way that protected the values they were committed to. The Monsanto assessors were most concerned for the company's economic freedom and financial position. Accordingly, *they* decided the amortization issue in a way that minimized the risk to that. The government assessors were most concerned for the health of Canadian farmers. So *they* decided the amortization issue in a way that reflected their concern for health. In effect, each group's reasoning was: If we're proved wrong in our exposure estimate, in which way would we prefer to have erred? By having overestimated the health risk? Or by having underestimated it? If health is your dominant concern, you want to avoid an underestimation. If economics is your dominant concern, you want to avoid an overestimation.

To see the reasonableness of this approach, consider an analogous situation from sports. A golfer standing on the tee, is looking down a narrow fairway bordered on one side by bunkers and on the other by rough. Ideally, she would hope to place her tee shot in the middle of the fairway, but she isn't certain that she can manage this. If she plays shots out of bunkers better than out of rough, she'll aim her shot toward the bunker side of the fairway, thinking that if the shot strays she'll be better off having it stray into a bunker. But if she plays shots out of rough better than out of bunkers, she'll aim toward the rough side of the fairway - trying to stay away from the bunkers. This sort of behaviour we understand and regard as rational.

As in golf, so in risk assessment. Risk assessors for whom health is the value primarily in the balance decide the uncertain amortization issue by not amortizing exposure. In effect, they aim their exposure estimate so that if the estimate strays it will stray in the direction of overestimating the health risk. By contrast, risk assessors for whom economic considerations are uppermost decide the amortization issue by fully amortizing exposure. If the estimate strays they prefer that it land on the side where greater profits lie.

The general point suggested by these comments is this: In applied settings rationality or reasonableness is not entirely captured by the idea of technical or instrumental rationality. When the risk assessors for all three parties to the alachlor debate confronted the uncertain amortization issue they responded by making a choice - whether to amortize exposure and if so at what rate - which protected whatever value they had prioritized.

I'm going to linger over this a minute more to nail down the point. As you have been listening to me talking about one side prioritizing human health and the other side prioritizing profits and economic freedom, you may have been thinking something like this: "Well, what's wrong with prioritizing profits and economic freedom? After all, that's important, and the health risks were apparently not serious." Or maybe you thought: "My god! How could anyone be so inhumane as to risk people getting cancer just so a company can make a few bucks?"

I have nothing to say here regarding the reasonableness of either of these reactions. But I do want to call attention to what's transparent: both reactions, one of which endorses Monsanto's risk estimate, the other of which endorses the government's, are driven by a sense of what is important, of what matters most and what we should especially attend to. I mean, both express values and illustrate the claim that estimates of risk are value-laden. To refuse, nevertheless, to confront the normative nature of the issue, by debating the appropriateness of prioritizing health, or, alternatively, prioritizing profits and economic freedom - to continue supposing, whatever one's own view of the risk might be, that that view is entirely confirmed by "the facts" - to do this is to do in a particularly blatant way what I indicated earlier my students in applied ethics courses do when they try to deal with a case by ignoring relevant issues of principle and concentrating exclusively on the *factual* aspects of the case.

The point of calling the amortization issue conditionally "normative" is that it can only be resolved by invoking some value or other. In effect, its resolution carries an implicit "ought". We say that these issues are "conditionally" normative to mark the fact that their normativeness is conditional on the surrounding uncertainty.

I turn now to the protective clothing issue, which will serve to illustrate the idea of an "inherently normative" issue. The question, basically, is whether for purposes of an exposure estimate it should be assumed that the applicator will be wearing gloves. This is an important question, since upwards of 90% of exposure is on the hands and forearms. Risk assessors who assume that applicators will be wearing gloves find alachlor a much less risky product than do those who assume applicators won't be wearing gloves.

Not surprisingly, the Monsanto assessors assumed that applicators would be wearing gloves, an assumption built in to their optimistic one ounce estimate. I say not surprisingly, because I am mindful of Monsanto's interest in having its product found safe.

Also not surprisingly, the government risk assessors assumed applicators wouldn't be wearing gloves, an assumption built in to their pessimistic six tons estimate. Here I say not surprisingly because the government assessors work for an agency whose mandate is health protection.

But why regard the gloves issue as inherently normative? The simple answer is that in the farm community, practice is not uniform. Some applicators wear adequate protective clothing. Others are careless. So we can't decide the gloves issue by looking to what farmers actually do. In the alachlor debate it was decided in a very different way.

The Monsanto assessors argued that even though some applicators don't wear gloves, the exposure resulting from such carelessness shouldn't be counted. Since the herbicide containers provide clear instructions to wear gloves, it would be *unfair* to Monsanto to include in the estimate exposure which results from *not* wearing gloves. The operative word here is "unfair".

The government assessors disagreed. They discovered that despite container instructions a majority of applicators don't protect themselves. These assessors held that the *health* risk alachlor presents to such applicators shouldn't be ignored. Accordingly, the government assessors based their exposure estimate on an assumption that gloves wouldn't be worn. The operative value here is that health matters above all else.

We can see now that the gloves issue wasn't empirical or purely factual. It was normative and value-laden. *The issue was fairness versus health.* Fairness to Monsanto versus the health of those many applicators who didn't trouble to protect themselves. I'll now make a similar remark to one I made a few minutes ago. As you hear this, it doesn't matter whether you think the resolution of the issue is obvious. Maybe you think: But of course, why should exposure resulting from ignoring container instructions be counted? Or, you might think: Well, obviously, if *most* of the applicators ignore the labels, then we should count the exposure that results from such carelessness. In either case, you're taking a stand on a normative issue, by prioritizing a value and deciding what you think is fair.

We call such issues inherently normative because even if the assessors had perfect knowledge - if there were *no* uncertainty - the issues would still be there. Having all the facts wouldn't settle the issue.

So much for the specifics of the research. The immediate conclusion is that the risk assessment of alachlor wasn't and couldn't have been the purely factual exercise the assessors imagined. How far beyond the alachlor case can one generalize this conclusion? I assume, but shan't argue the point, that it's generalizable to the entire field of risk assessment and to mandated science generally.

My reason for saying this is that the features of the alachlor risk assessment which make it more than a purely factual exercise are found throughout mandated science. Uncertainty, which gives rise to the conditionally normative issues, is ubiquitous. So far as I can see, the only thing that *might* be peculiar about the alachlor risk assessment is the *degree* of uncertainty: surely exposure estimates don't usually range from, as it were, one ounce to six tons.

As well, it's not unusual for there to be variation in the circumstances under which individuals incur exposure to hazardous products. Where there is such variation, there'll also be issues, like the gloves issue, which are inherently normative - issues which raise fairness questions and which require a decision concerning the priority to be attached to human health.

You'll see now that the title I gave these remarks, *The Use and Abuse of Science in Risk Assessment*, is misleading, and maybe even inaccurate. I haven't talked about the uses of science, certainly, and I haven't discussed *ab*uses. Instead, I've been focussing on a misunderstanding concerning what mandated science delivers and can deliver. This is a misunderstanding under which the public and public officials labour. But it's also a misunderstanding under which mandated scientists themselves labour.

They're certainly in *error* when they protest that their work is objective when in fact it isn't. But noting this error doesn't diminish the value of that work. To discover the normative dimension of scientific work isn't to deny its factual dimension. Our research doesn't challenge the view that good risk assessments require good science, what is called objective science; the claim is only that more is involved.

IMPLICATIONS

I'm nearing the end. You may have heard more tonight about herbicides and gloves and amortization than you wanted to. Rather than apologize for that I'll make amends with a quick wrap-up. One wants to know what some of the implications of our study are. O.K., let's agree that risk assessment, and possibly much else in the domain of mandated science, can't fulfill its pretension to objectivity. What are the implications?

I'll respond to the question in three ways. First, implications for our attitude toward public debates concerning risky technologies. Second, implications for mandated science and the scientists who practise it. Third, implications for government regulatory policy. True to my promise, I'll be brief.

First implication: We all have views about the risks posed by overhanging power lines, chemical pesticides, nuclear power plants, genetic engineering, and such, and we react, often strongly, to media reports concerning these risks. In other words, most are active or passive participants in the risk debates that go on around us. These debates, we can now see, are normative. Although couched in empirical terms which suggest they concern nothing but facts, they are heavily value-laden. When we take a position in any of these debates (and my "we" is meant to include risk assessors and other mandated scientists as well as ordinary folks), for example by expressing the view that the risks of genetic engineering are minimal, we reveal something about our own values. The same may be said of those with whom we disagree. Our disagreement with these others is, whatever else, a normative disagreement. If then the debates are to be intelligently conducted it's necessary that their normative dimension be made explicit. The points of disagreement concerning values need to be identified and then discussed. Of course there may also be disagreement regarding issues of fact that requires attention. But often those factual issues pale into insignificance alongside the normative issues.

Second implication: Mandated scientists - which includes many economists, engineers, and molecular biologists, often psychiatrists, other health care professionals, scientific ecologists, and of course risk assessors - need to consider their methodology more closely to identify the points at which their specific expertise runs out and their value predilections take over. Risk assessors, for example, need to become more sensitive to the ways value perspectives influence their assessments. Then they have two alternatives. They can resolve to stay within their area of specific expertise, which in many cases will involve their stopping short of offering full-blooded risk assessments and contenting themselves with more modest factual claims such as that an applicator's exposure will fall in a range between some minimum and some maximum (one ounce and six tons, say). Or they can continue as at present to offer full risk assessments but frankly recognize the ways those assessments express and reflect their value commitments but aren't supported by their scientific expertise.

Third implication: Regulatory agencies in Canada generally rely exclusively on scientific experts for the risk assessments on which regulatory decisions are based. The Alachlor Review Board, for example, was a committee of scientific experts. It would be better if others were invited to the party. We certainly need the experts. But if resolving the issues inevitably involves bringing contentious value perspectives to bear, then we can't rely entirely on the experts. It would've been better, I think, if the Review Board had included a person from the farm community, an environmentalist or someone from a public interest group such as Pollution Probe, and a lay person - enough non-experts in all so that that subset of the Board wouldn't have been snowed and cowed by the superior expertise of the scientists. The principle here is that if value perspectives shape the assessment, then it's wrong for the assessment to be made by a select group of people who may represent just one of the conflicting value perspectives found in the community at large.

CONCLUSION

In place of a proper conclusion I want to finish this by making two final comments. The first reemphasizes something said earlier. I don't think of my remarks as science - bashing or in any way critical of mandated scientists, except for the criticism implicit in noting that they often misidentify the limits of their expertise.

And the second comment is this: Although I've stressed the role of value judgements in mandated science I don't regard this as implying that mandated science is subjective - that risk assessments, for example, are just matters of opinion, so that if two people disagree concerning the risk of some product then there's no way of resolving the dispute, it's just one person's opinion against another's. I think there are reasonable ways of resolving disputes concerning values, just as there are reasonable ways of resolving

disputes concerning facts. Despite its normative character, then, a risk assessment might be well-founded and sane, or it might be weak and foolish.

This last observation suggests the thought I'll close on: Whether a risk assessment is sound partly depends on the soundness of its supporting value judgements.

Dr. Lawrence Haworth
Department of Philosophy
University of Waterloo.

Cross Cancer Expansion

An exciting summer of AAPM meeting preparation was followed immediately by the major relocation of the Medical Physics department into the new expansion of the Cross Cancer Institute. Some of you may recall that the physicists and computer and research personnel moved out of the Cross into a neighbouring building in late 1988. We survived as a physically split department for 4 years, with our offices 8 walking minutes away from the treatment units.

Building Layout: The Cross will have a "linac row" of 7 vaults along the southern front of the building (3 high energy/electron machines + 4 low energy machines). The linacs are built outside the "footprint" of the building with no offices above them. The Department of Medical Physics was moved into entirely new basement space, into an expansion on the south-eastern corner of the Cross. A row of physicist offices line the eastern wall, with a large machine shop, electronics shop and roomy laboratory space in the interior. While our mould room has relocated into adjacent space, the treatment planning workroom remains to be relocated in Phase 2.

New Linacs: Renovations are still ongoing in the neighbouring Radiotherapy Department and the entire expansion will not be complete until 1996. I estimate that we will be commissioning or recommissioning a machine every year until 1996. We just received our Varian 2300CD with multileaf collimator and portal imaging and will begin acceptance testing in January 1993. The remaining 3 vaults which are just being dug out now, will be sequentially filled by existing and new 6 MV machines.

New Personnel: We were pleased to welcome Colin Field as medical physicist this year making a total of 7 physicists excluding the director. Dr. Will Ansbacher has started as a physicist resident and we recently hired Chris Davey into the newly created Radiation Safety Officer position. The search and selection process for a new director is still under way but hopefully will be concluded by spring. Dr. Rick Hooper as Acting Director has done an admirable job of guiding the department through the move and into the expansion.

If anyone is in the neighbourhood, please drop in and pay us a visit. We'd be pleased to show you around.

Sherry Connors
Edmonton, AB

REPORT OF THE COMP CHAIRPERSON

As we face the new year we are encouraged to reflect on our achievements of the past year and to plan our strategy for the next. Sometimes the incremental change seems small from year to year, and we have some difficulty pinpointing our activities. However, in my case I have the unique opportunity to look back over more than ten years since I was the 1979 chairman of the Division of Medical and Biological Physics of the Canadian Association of Physicists (I put the whole name for those of you who are too young or too old to remember!).

Canadian Medical Physics has certainly come a long way in that time!

The late seventies was a time of quite feverish activity for medical physics, especially the formation of the Canadian College of Physicists in Medicine after years of debate and worries over dominance by other professional groups. In 1977 the medical physics community made another leap of faith with the prediction that the need for medical physicists would explode in the following 10 years.

There were 82 active medical physicists in 1977 and a prediction was made for this to more than double to 169 in 1987; this outrageous number was actually reached sometime in 1988! Gallup - eat your heart out! As you will know from the recent manpower survey there were 195 medical physicists and 158 students and residents in 1991.

Canadian medical physicists have made outstanding contributions to their fields, and are well recognized in international meetings, organizations and the world's literature. How many issues of Medical Physics are there with no contribution from a Canadian centre? In 1990, for example, 25% of the Articles and 10% of the Technical Reports in Medical Physics came from Canadian centres, very much more than one would expect on a per capita basis.

So what about 1992? This was a grand year too! Finally after enormous effort by our colleagues in

Alberta the AAPM came to Canada and the meeting was a tremendous success socially, scientifically and financially. The brochure Medical Physics in Canada from CCPM/COMP became a best seller judging by the requests coming through this clinic. And last but not least COMP achieved 200 members for the first time in 1992 and now stands at ~240

The Year Ahead. When asked about the direction the stock market would take in the following year John Kenneth Galbraith confidently predicted that 'it would change'. No doubt 1993 will provide some surprises for us too but plans are well underway in some areas.

The Professional Committee now has a head of steam and is meeting in the early New Year to consolidate its strategy. Among the items to be discussed are career structures for physicists, professional training, the professional and salary surveys, and how we can promote medical physics in Canada.

Having the inside track at AECB I can predict that the Board will continue to be very pro-active. C-122 will be finalized in a slightly modified form and be translated into legalese to be published in Gazette Part 1. We will be asked for advice on the new consultative documents on ALARA(C-129), Consolidated Licences(C-121), and Training Programs for Radiation Workers(C-111). I am involved in developing a document on the *Management of Occupationally Exposed Workers* which will incorporate the latest thinking of ICRP, IAEA and perhaps even AECB.

As you may know it is likely that there will be a change in the personnel dosimetry service currently operated by BRMD. This section is undergoing privatization and there are bound to be changes.

1993 means that we are only two years away from celebrations to mark the discovery of x rays by Roentgen. As medical physicists are well represented on the various groups set up to organize the activities we have a great opportunity to engender some well-earned recognition for our profession. So if you have any special ideas for activities in your region or the country as a whole please let one of the executive know.
You will have now received details of the joint COMP/CMBES meeting in Ottawa. There are further details elsewhere in this Newsletter so make plans to attend now!

Just a reminder to those of you who have omitted to pay your subscriptions - please pay up as soon as you can. (And remember that the annual $100 CCPM dues are waived and your annual AAPM membership is only $95 if you are a member of COMP). Think also of encouraging another member of your group to join COMP. It is only by working as a coordinated group of medical physicists that it will be possible to continue the great progress that has been made over the last ten years.

John E. Aldrich
Halifax, NS
January 5th, 1993

RAPPORT DU PRESIDENT DE L'OCPM

En ce début d'année, je vous invite à réfléchir sur nos réalisations de la dernière année et à planifier notre stratégie pour la nouvelle année qui commence. Parfois, le changement semble faible d'une année à l'autre et nous avons de la difficulté à identifier nos activités. Cependant, en ce qui me concerne, j'ai le privilège de pouvoir retourner à plus de dix années en arrière au moment où j'étais, en 1979, le président de la division de physique bio-médicale de l'Association canadienne des Physiciens (j'inclus le nom au complet pour ceux et celles d'entre nous qui sont trop jeunes ou trop vieux pour s'en rappeler).

La Physique médicale au Canada a certainement fait beaucoup de chemin pendant cette période!

La fin des années soixante-dix a été une période d'activités fébriles pour la physique médicale sourtout en ce qui concerne la création du Collège Canadien des Physiciens en Médecine qui a eu lieu après de nombreuses années de débats et d'inquiétudes concernant la prédominance d'autres groupes professionnels. En 1977, les physiciens médicaux ont de nouveau fait un acte de foi en prédisant que le besoin en physiciens médicaux exploserait dans les 10 prochaines années.

En 1977, on comptait 82 physiciens médicaux et on avait prédit que ce nombre plus que doublerait pour atteindre 169 en 1987; ce nombre phénoménal fut effectivement atteint en 1988! Gallup n'aurait pas fait mieux! Comme vous allez l'apprendre dans le récent sondage sur la main-d'oeuvre, il y avait en 1991, 195 physiciens médicaux et 158 étudiants et résidents.

Les physiciens médicaux canadiens ont apporté une contribution remarquable dans leurs domaines respectifs et sont très bien reconnus dans les organisations et congrès internationaux ainsi que dans la litterature mondiale. Combien de publications de Medical Physics y a-t-il sans aucune contribution d'un centre canadien? En 1990 par exemple, 25% des articles et 10% des rapports techniques dans Medical Physics venaient de centres canadiens, beaucoup plus que nous serions en mesure de s'y attendre sur une base per capita.

Et 1992 a été une excellente année aussi. Finalement, après les nombreux efforts de nos collègues de l'Alberta, l'AAPM est venu au Canada et le congrès fut un énorme succès tant au point de vue social que scientifique et financier. La brochure La Physique Médicale au Canada produite par le CCPM et l'OCPM est devenu un best-seller si on en juge par le nombre de demandes qui parviennent à notre clinique. Et en dernier mais non par ordre d'importance, l'OCPM a atteint 200 membres en 1992 et on en compte maintenant 225.

Et que nous réserve la nouvelle année? Quand on a demandé à John Kenneth Galbraith comment se comporteraient les marchés financiers en 1993, il a répondu en toute confidentialité qu'ils "changeraient". Il n'y a aucune doute que 1993 comportera des surprises pour nous aussi, mais dans certaines domaines, la planification est déjà amorcée.

Le comité professionnel a le vent dans les voiles et se rencontrera au début de 1993 pour consolider sa stratégie. Parmi les sujets qui seront discutés, on retrouve les plans de carrière pour les physiciens, la formation professionnelle, le sondage sur les salaires et la profession, et finalement, la meilleure façon de promouvoir la physique médicale au Canada.

Puisque j'ai été mis dans le secret à la CCEA, je peux prédire que la Commission continuera d'être à l'avant-garde. C-122 sera finalisé dans une version quelque peu modifiée et sera traduit en texte juridique avant d'être publié dans la Partie 1 de la Gazette du Canada. Nous serons consultés au sujet des nouveaux documents consultatifs d'ALARA (C-129), des Permis Consolidés (C-121) et des Programmes de Formation pour les Travailleurs en Radiation (C-111). Je suis aussi impliqué dans le développement d'un document sur la Gestion des Travailleurs sous Rayonnements qui incorporera les dernières recommendations de la CIPR, l'AIEA et peut-être même la CCEA.

Comme vous le savez peut-être, il est fort possible qu'il y ait un changement dans le service de dosimétrie personnelle présentement assuré par le BRIM. Ce département se privatise et des changements sont certainement à prévoir.

L'année 1993 signifie aussi que nous ne sommes plus qu'à deux années des célébrations prévues pour souligner la découverte des rayons x par Roentgen. Comme les physiciens médicaux sont bien représentés dans les différents groupes formés pour organiser les activités, une excellente opportunité nous est offerte pour favoriser une reconnaissance bien méritée de notre profession. Donc si vous avez des idées spéciales quant aux activités à organiser dans votre région ou à travers le Canada, veuillez en aviser un des membres du comité.

Vous avez déjà reçu les informations concernant le congrès conjoint de l'OCPM/SCGB à Ottawa. Vous retrouverez plus d'information à ce sujet dans ce bulletin. Ne tardez pas à planifier votre participation.

En terminant, juste un rappel à ceux et celles qui ont oublié de payer leur cotisations annuelles à l'OCPM. (Souvenez-vous que les cotisations annuelles de 100$ du CCPM sont annulées et que celles de l'AAPM sont seulement de 95$ pour les membres de l'OCPM). Pensez aussi à encourager un autre membre de votre groupe à se joindre à l'OCPM. C'est seulement en formant un groupe coordonné de physiciens médicaux qu'il sera possible de continuer à progresser tel que nous l'avons fait durant les dernières dix années.

John E. Aldrich
Halifax, NS
January 5th, 1993

CCPM PRESIDENT'S PODIUM

On Monday, December 7, 1992, the Board of the Canadian College of Physicists in Medicine (CCPM) had a full day meeting to address a variety of issues related to the purpose and function of the College. In this President's Podium, I will address only a few of the major issues that were discussed.

One of the two primary functions of the College is "to identify competent persons who are responsible for applications of the physical sciences in the medical field". In this context, the Board has spent considerable time evaluating and reviewing our existing admissions process. While in general, the process has been working reasonably well, we do recognize that there are a number of areas that could be streamlined and improved. The Board reviewed some of the perceived deficiencies (some of which were nicely summarized in a letter to the editor of the Canadian Medical Physics Newsletter in the last issue) and has decided to propose the following changes which will be formally presented to the College Membership at the upcoming CCPM Annual General Membership Meeting in May in Ottawa. The following summarizes the proposed changes:

a) The College intends to formally acknowledge the subspecialty in which individuals are deemed competent. Presently, the three areas of subspecialization are the Physics of Therapeutic Radiology, the Physics of Diagnostic Radiology and the Physics of Nuclear Medicine. Other subspecialities will be added as the need arises. For example, MR imaging is being considered for 1994. This subspecialization will require that the candidates, upon application for admission to the College, will

indicate their area of specialization and that they answer specific components of the Membership examination as well as prove their competence in their specialty area in the Fellowship examination.

b) The CCPM will create a formal registry of certified Medical Physicists including their area of specialization.

c) The application forms for admission to the College have been modified to allow thorough assessment by the Credentials Committee of the eligibility of the applicant to sit the Membership or Fellowship examination. Incorporated into the application material are forms that also have to be filled in by the referees. The intent is that the College obtain from the referees and the applicants a clear indication of their working experience and their ability to function in the clinical environment. All Membership applicants will need two years of patient related experience within the last five years. Fellowship applicants will need seven years of full-time equivalent experience in medical physics but this may be reduced to a minimum of four years after credits for education and publications have been applied. One physician and two physicist referees will be required. At least one physicist must be a Fellow.

d) The Membership examination will contain the following changes:

i) The overall length of the exam will be increased by one hour to a total of five hours.
ii) The present Part B of the exam will be reduced from three questions to two questions. (One from two banks of 10 questions within the candidates' subspecialty and the second from an optional third bank of 10 questions).
iii) A new section, Part C, will be added which contains short answer questions relating specifically to the candidate's area of specialization. These questions will incorporate routine day-to-day medical physics problems. As in Part A, these questions will not be available in advance.
iv) The examination itself will take place in two sittings of 2 1/2 hours each with both sittings being held on the same day. The first sitting will contain Part A (General Medical Physics) and Part C (short answers, Medical Physics related to specialty). The second sitting will contain Part B which is composed of questions from the previously distributed Medical Physics Questions for Membership Examination.

The Board has also undertaken direct contact with the American Board of Radiology (ABR) and the American Board of Medical Physics (ABMP) to encourage standardization of the certification process across North America. The initial intent is to develop informal channels of communication to address issues relating to certification philosophy, eligibility requirements, mutual recognition of certified individuals who could act as referees, and continuing Medical Physics education.

The above summarizes the discussions of only 2 items of the 18 item Agenda of the Board meeting. Admittedly it represented a major component of discussions of the day and, of course, is the raison d'etre of the College. The Board would appreciate further feedback on any of these issues preferably before the Annual General Membership Meeting in May.

Jake Van Dyk,
President, CCPM

NOTE DU PRÉSIDENT du CCPM

Une réunion du Conseil d'Administration du Collège Canadien des Physiciens en Médecine a eu lieu le 7 décembre 1992. On y a discuté des objectifs et des fonctions du Collège, et j'aimerais profiter de cette tribune pour présenter quelques-uns des sujets qui y ont été traités.

L'une des deux fonctions primaires du Collège est d'identifier les personnes compétentes qui sont responsables de l'application des sciences physiques dans le domaine médical. Le Conseil d'Administration a donc pris beaucoup de son temps pour évaluer et réviser le processus d'admission au Collège. Bien que le processus actuel fonctionne bien en général, nous reconnaissions qu'on puisse l'améliorer et en aplanir certaines difficultés. Le Conseil d'Administration a pris en considération quelques-unes des difficultés perçues par les membres (décrits en partie dans la Lettre au Rédacteur signée par Milton Woo; voir le Bulletin de novembre 1992), et a décidé de proposer les modifications qui suivent (ces modifications seront présentées en bonne et due forme à l'Assemblée Annuelle et Générale des Membres du CCPM, à Ottawa, en mai 1993):

(A) Le Collège a l'intention de reconnaître officiellement les sous-spécialités dans lesquelles les membres ont prouvé leur compétence. Présentement, les trois spécialités reconnues comprennent la Physique de la Radiologie Thérapeutique, la Physique de la Radiologie Diagnostique, et la Physique de la Médecine Nucléaire. D'autres spécialités seront reconnues au besoin. Par exemple, la Physique de l'Imagerie par Résonance Magnétique pourrait faire son apparition en 1994. Pour faire reconnaître la

spécialité du candidat, ce dernier devra indiquer sa spécialité lors de la demande d'admission au Collège. De plus, le candidat devra (1) répondre aux questions pertinentes à sa spécialité lors de l'examen écrit (Membre), et (2) démontrer sa compétence dans cette spécialité lors de l'examen oral (Fellow).

(B) Le CCPM créera un registre officiel des Physiciens Médicaux certifiés qui inclura leur spécialité.

(C) Les formulaires d'admission au Collège ont été modifiés afin de permettre une interprétation rigoureuse de l'éligibilité de l'appliquant à l'examen écrit (Membre) ou oral (Fellow) par le Comité des Créances. La demande d'admission comprendra aussi des lettres de recommandation qui seront écrites par trois répondants, incluant un médecin et deux physiciens. Au moins un des physiciens sera un Fellow du Collège. Le Collège obtiendra, par ces lettres, une évaluation claire de l'expérience de travail du candidat et de la capacité du candidat à travailler en milieu clinique, de la part de l'appliquant et des répondants. Je vous rappelle que tous ceux qui appliquent au statut de Membre doivent avoir deux années d'expérience clinique lors des cinq dernières années. Ceux qui appliquent au statut de Fellow doivent avoir l'équivalent de sept années d'expérience clinique en Physique Médicale (à temps plein), mais l'éducation et les publications du candidat peuvent réduire le nombre d'années d'expérience requises jusqu'à un minimum de quatre.

(D) L'examen écrit (Membre) sera modifié comme suit:

(i) Le temps alloué pour écrire l'examen augmentera d'une heure, pour un total de cinq heures.

(ii) La partie B de l'examen ne comprendra plus que deux questions plutôt que trois (une question proviendra des deux banques de dix questions couvrant la spécialité du candidat, et la seconde proviendra d'une autre banque de questions, au choix du candidat).

(iii) Une nouvelle section, la partie C, sera ajoutée. La partie C comprendra des questions qui demandent une réponse courte et qui seront reliées directement à la spécialité du candidat. Ces questions incluront des problèmes routiniers auxquels le Physicien Médical pourrait faire face chaque jour. Ces questions, tout comme les questions de la partie A de l'examen, ne seront pas disponibles avant l'examen.

(iv) L'examen sera divisée en deux sessions de deux heures et demie chacune, qui auront lieu la même journée. La première session comprendra les parties A (Physique Médicale Générale) et C (questions reliées à la spécialité du candidat et demandant des réponses courtes). La seconde session comprendra la partie B de l'examen. Cette partie est composée de questions provenant du livret Medical Physics Questions for Membership Examination, distribué par le Collège.

Le Conseil d'Administration a aussi entrepris des contacts directs avec l'American Board of Radiology (ABR) et l'American Board of Medical Physics (ABMP) afin d'encourager la standardisation des procédés de certification à travers l'Amérique du Nord. Les communications avec ces agences furent entreprises avec l'intention d'établir la justification de la certification, les règles d'éligibilité, la reconnaissance mutuelle d'individus certifiés qui pourraient agir en tant que répondants, ainsi que l'enseignement de la Physique Médicale.

Les paragraphes ci-dessus résument les discussions portant sur seulement deux des dix-huit (!) items à l'agenda de cette réunion du Conseil d'Administration. Ces items représentaient toutefois une fraction majeure des discussions de la journée et concernaient, bien sûr, la raison d'être du Collège. Le Conseil d'administration apprécierait recevoir les réactions des membres face à ces propositions, de préférence avant l'Assemblée Annuelle et Générale des Membres de mai prochain.

Jake Van Dyk,
Président, CCPM.

From the Professional Affairs Committee of COMP

At a meeting of the Professional Affairs Committee held in January 1993, a decision was taken to amalgamate and reformat the Professional and Manpower Survey Forms. Our objectives were to simplify the questionnaire and to reduce the national effort required to collect the necessary data. Revised forms are now being distributed to Department Heads only. Maryse Mondat is communicating with Quebec Centres and Peter Dunscombe is dealing with the rest of the country. Interested members of COMP are invited to obtain a copy of the new forms from their Department Head and to relay any comments they may have to Maryse or Peter.

A decision was also taken at the meeting to initiate discussion on national professional standards in Medical Physics. It is recognised that this is a difficult issue and one that is not likely to be concluded quickly. As a basis for this discussion, a recently developed and still somewhat controversial

Ontario document is also being distributed to Department Heads for circulation. The Professional Affairs Committee would particularly welcome receiving your views on this initiative and any relevant documentation in existence in your Centre.

Peter Dunscombe
for Professional Affairs Committee, COMP

Du comite des affaires professionnelles de l'OCPM

La décision de fusionner et de réécrire les formulaires du sondage professionnel et du sondage de la main-d'oeuvre a été prise lors d'une réunion du comité des affaires professionnelles tenue en janvier 1993. Nos objectifs étaient de simplifier le questionnaire et d'alléger le travail national requis pour amasser toutes les données nécessaires. Les formulaires revisés seront distribués aux chefs de département seulement. Maryse Mondat communique avec les centres du Quebec, tandis que Peter Dunscombe s'occupe de ceux du reste du pavs. Les membres de l'OCPM intéressés sont invités à obtenir une copie du nouveau formulaire via leur chef de département et à adresser tous commentaires à Maryse ou à Peter.

A cette réunion, il a été aussi décidé d'amorcer une discussion sur les standards professionnels nationaux en physique médicale . Il est reconnu que c'est une question difficile pour laquelle une conclusion ne pourra probablement pas être tirée rapidement. Comme base de discussion, un document développé récemment en Ontario et encore quelque peu contreversé est aussi distribué aux chefs de département pour faire circuler. Le comité des affaires professionnelles aimerait recevoir vos avis sur cette démarcher, ainsi que tous autres documents pertinents existant déjà dans votre centre.

Peter Dunscombe et Maryse Mondat
Pour le comité des affaires professionnelles, OCPM

Roentgen Centennial Celebrations for 1995

Help Wanted!

The year 1995 is of course a landmark anniversary for all of us who work with radiation in medicine. The Roentgen Centennial is an opportunity for us as medical physicists to celebrate what we have achieved and to increase our public profile at the same time.

For several years there has been talk of celebrations to coincide with the 100th anniversary of the discovery of x-rays by Roentgen. A non-profit organization Roentgen Centennial Canada Incorporated (RCCI) has now been formed to help sponsor the various activities surrounding this event. These may include permanent and travelling exhibits and a book documenting the history of the uses of radiation in medicine in Canada.

The book, tentatively called *Radiation in Medicine: A Canadian History*, will sketch the highlights of this topic over the last hundred years. I have volunteered to be responsible for the medical physics input into this, and I would like to appeal to everyone to send me any material concerning the use of radiation in Canada. Please do not worry that someone else may send the same items. Like any editor I would rather have too much than too little! I especially need photographic material, anecdotes, and overviews that will make interesting reading. And if there is anyone who would like to help.....

Many of these events are still in the early stages of development and ongoing information about the Centennial will be a regular feature of this Newsletter. There will be many opportunities for involvement in this important celebration.

John Aldrich, Halifax
CTRF of Nova Scotia

COMP/OCMP Corporate Membership

The Canadian Organization of Medical Physics would like to acknowledge the support given by our 1992 corporate members:

Kodak Inc.

Varian

Theratronics

We hope to continue our association with these and new corporate members in this new year. To encourage this affiliation we are implementing new benefits for our corporate members.
Details are available from the COMP office.

Newsletter Announcements

Addresses for Submissions:

Submissions should be sent to

L. John Schreiner
Medical Physics Department
Montréal General Hospital
1650 Avenue Cedar,
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.

When making Submissions to the Newsletter, please confirm that your submission arrives at our office by phone or FAX.

Newsletter Submissions
Format for contributions:

Articles for the Newsletter are best submitted by E-mail (at CXLS@MUSICA.MCGILL.CA.) or on computer disk. The Newsletter is produced on a MacIntosh computer so submissions must be on Mac compatible disks or on 31/2 inch IBM disks *in text or ASCI* format. Please send a hard copy by mail or FAX so that any symbols or special characters can be verified.

Good quality, formatted submissions for direct use are also welcome. This reduces the work in setting-up the newsletter considerably. 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.

FAX submissions will have to be supported by original copy and will not be used directly.

When making any submissions to the Newsletter, please confirm that your submission arrives at our office by phone or FAX.

DEADLINE FOR NEXT ISSUE OF THE COMP NEWSLETTER

The Annual General meeting of COMP will be held very shortly *(May 12 - 15, 1993).* ***At this stage*** we do not plan to put out an issue before that time. Therefore, the next issue is planned for June 1993. I ask all executive members of COMP and the CCPM to prepare copies of their annual reports for this issue before they come to Ottawa.

If there is a large number of submissions (enough to make up a 15 page issue say) to this office ***before April 11th, 1993***, an issue of the newsletter will go out before the end of April.

PLEASE SUBMIT YOUR MEDICAL PHYSICS THESES AND ABSTRACTS FROM 1992 ***(SEE NOTICE PAGE 29)***

Calendar of Events

March 18 - 20, 1993
Saskatoon Cancer Centre, *WESCAN 93*
see notice below

May 12 - 15, 1993,
Carleton University, Ottawa, ON
COMP/CCPM/CMBES JOINT CONFERENCE
Contact: Dr. Ken Shortt, NRC

June 4 - 5, 1993
Toronto, ON, *Digital Networks and Communications in Nuclear Medicine*
Contact: The Michener Institute,
(see application form in this mailing)

June 6 - 9, 1993
Toronto, ON, *40th ann mtg SNM*
Contact: Soc Nucl Med, 136 Madison Ave, NY, NY 10016-6760

August 8 - 12, 1993
Washington, DC, *AAPM ann mtg*
Contact: AAPM, 335 East 45 St, NY, NY, 10017

Sept 8 - 11, 1993
Bristol, UK, *50th Ann Mtg IPSM-HPA*
Cntct: IPSM-HPA, 4 Campleshon Rd, York YO2 1PE

Nov 28 - Dec 3, 1993
Chicago, IL, *Joint Mtg AAPM / RSNA*
Contact: AAPM, 335 East 45 St, NY, NY, 10017

WESCAN 93

March 18-20, 1993
Saskatoon

The annual WESCAN meeting for 1993 will be held at the Saskatoon Cancer Centre. The meeting will follow the traditional format of an informal discussion on Thursday evening; a day and a half of presentations on Friday and Saturday; and the opportunity to visit the centre on the Saturday afternoon. One session of the meeting will be devoted to the technologists presentation competition.

For further information please contact:

Alistair Baillie
Physics Services
Saskatoon Cancer Centre
20 Campus Drive
Saskatoon, Saskatchewan, S7N 4H4
Phone: (306) 966-2697
FAX: (306) 966-2910

COMP/CCPM/CMBES JOINT CONFERENCE

May 12 - 15, 1993
Carleton University, Ottawa

Please be reminded that the 1993 Canadian medical physics meeting will be held in Ottawa in May in conjunction with the annual meeting of the Canadian Medical and Biological Engineering Society (CMBES). This will be the first formal meeting of the two groups and will provide us an opportunity to exchange information with our biomedical engineering colleagues, with whom we have many common interests in health care. The CCPM and CMBES will co-sponsor a symposium of invited speakers on the subject of "Lasers and Electro-Optics in Medicine".

Aaron Fenster, the COMP Scientific Program Chair, has obtained agreement from John Laughlin, the editor of Medical Physics, to publish abstracts in that journal from the COMP submissions, sometime after the conference. COMP authors whose submissions are accepted will be asked for an abstract in AAPM format at the time of notification of acceptance. This is in addition to the one- or two-page camera-ready entry for the proceedings which is due February 15 and which will be printed in time for the conference in May. Registration material for the conference is included with this mailing of the Newsletter. (Author instructions were enclosed with the November 1992 Newsletter).

Immediately following the conference, the Ionizing Radiation Standards group of the NRC will offer a course on the fundamentals of radiation dosimetry, radiation standards, and dosimetry protocols. It is intended for persons who use calibrations based on primary measurement standards for ionizing radiation. Topics will include: fundamentals, standards for exposure, absorbed dose and radioactivity, services offered by the NRC IRS group, linac standards and AAPM TG-21, and future dosimetry protocols. While starting with fundamentals, it will be assumed that participants have some knowledge of radiation dosimetry. Material on the NRC course was enclosed with the November 1992 Newsletter mailing.

Paul Johns
Co-Chair '93 COMP/CCPM/CMBES Local Arrangements Committee

PLEASE NOTE

Medical Physics Graduate 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. Last year the Medical Physics Newsletter published the abstracts from theses completed in 1991 in a compilation which was very well received by the COMP/OCPM membership. We plan to repeat this report of graduate work annually and *are now calling for submissions for the June 1993* issue of the Newsletter. ***To date we have received very few submissions!***

Please submit ***work completed in 1992*** to the Newsletter office as soon as possible. Use clear format with at least 12 pitch type or e-mail your submission to the editorial office. FAXed submissions will not be accepted except as verification of good copy.

Submissions should include the name of the institute and department at which the work was done, the name of the author and thesis title, the degree received, the thesis abstract and the name of the research supervisor. Examples can be seen in the June 1992 issue of the Newsletter. ***INCOMPLETE SUBMISSIONS*** ***(e.g., author and title only)*** ***WILL NOT BE PUBLISHED.***

We look forward to your submissions.

NRC Course

FUNDAMENTALS OF RADIATION DOSIMETRY, RADIATION STANDARDS & DOSIMETRY PROTOCOLS

This course will be given by the Ionizing Radiation Standards group of the Institute for National Measurement Standards.

The course is intended for persons who use calibrations based on primary measurement standards for ionizing radiation, with a special emphasis on Medical Physics. It will start with fundamentals, but presupposes some knowledge of radiation dosimetry.

The topics to be covered include: fundamentals, standards for exposure, absorbed dose and radioactivity, services offered, linac standards and AAPM TG-21 and future dosimetry protocols. The course will be given in English.

Place: I.N.M.S., Bldg. M-36, NRC, Ottawa

Date: May 17-19, 1993

Fee: $700, includes registration, lunches and coffee. A reduced fee is available for full-time, Canadian graduate students.

Hotel: Group rates at a local hotel will be available.

For further information, please contact Dr. Norman Klassen, INMS, Bldg. M-35, National Research Council, Ottawa, Ontario K1A 0R6.

Telephone 613-993-2715 - FAX 613-952-9865.

Cours du CNRC

PRINCIPES DE BASE DE DOSIMÉTRIE DE RAYONNEMENTS IONISANTS, ÉTALONS DE RAYONNEMENTS IONISANTS, & LES PROTOCOLES UTILISÉS EN DOSIMÉTRIE

Ce cours sera donné par la groupe des Étalons de rayonnements ionisants de l'Institut des étalons nationaux de mesure du Conseil national de recherches du Canada.

Ce cours s'addresse aux personnes qui utilisent les services d'étalonnage fondés sur les étalons primaires pour la mesure des rayonnements ionisants, avec orientation spéciale sur la physique médicale. Bien que nous présumons des connaissances en dosimétrie de rayonnements ionisants, le cours débutera par les principes de base.

Les sujets traités comprendrons: les principes de base, les étalons d'exposition, de dose absorbée et de radioactivé ainsi que les services d'étalonnage offerts, également l'étalon de dose absorbée avec linac et les protocoles AAPM. Le cours sera presenté en anglais.

Endroit: IENM, bâtiment M-36, CNRC, Ottawa

Date: 17-19 mai, 1993

Frais: $700, comprend inscription, déjeuners et cafés. Pour étudiants canadiens à plein temps, il y a un coût réduit.

Hôtel: Le tarif de groupe sera disponible dans un hôtel avoisinant.

Pour de plus renseignements, s'addresser à Dr. Norman Klassen, IENM, bâtiment M-35, Conseil national de recherches du Canada.

Téléphone 613-993-2715 - FAX 613-952-9865.

COMP ANNOUNCEMENT

According to the recent changes of the COMP bylaws, the election of officers will be done by mail ballot. Nominations are now solicited for the following positions on the COMP executive:

- *chair-elect*
- *treasurer*

Please submit nominations to:

AVIS DE L' OCMP

L'élection des membres de l'exécutif se fera par la poste, selon les nouveau règlements. Nous demandons des candidatures pour combler les postes suivants au comité exécutif de l'OCPM:

- *président-élu*
- *trésorier.*

Envoyez vos candidatures au:

Ellen El-Khatib
Cancer Control Agency of BC
Department of Radiation Physics
600 West 10th Ave
Vancouver, BC., V5Z 4EG

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 deadline for the next award is January 31, 1993.

La date limite pour les demandes du prochain concours est le 3lme janvier 1993.

Past recipients:

Récipiendaire anterieur:

1990	Dr. L. John Schreiner, Montreal
1991	Ms. Moira Lumley, Kingston
1992	Dr. Donald Robinson, Edmonton

Members of the COMP/OCMP and/or the CCPM can make a donation to the fund by volunteering to increase their 1993 membership dues.

Les membres du COMP/OCPM et\ou du CCPM peuvent faire un don à la cotisation de 1993 un montant additionel de leur choix.

CCPM EXAM SCHEDULE

The schedule for application and sitting of exams in 1993 is:

membership exam:

apply by:	Dec. 31,1992
exam date:	March 6, 1993

fellowship exam:

apply by:	March 1,1993*
exam date:	May 11, 1993

*Note: Those writing the membership exam on March 6, 1993 should confirm their fellowship application and pay the fee within one week of receiving the exam results.