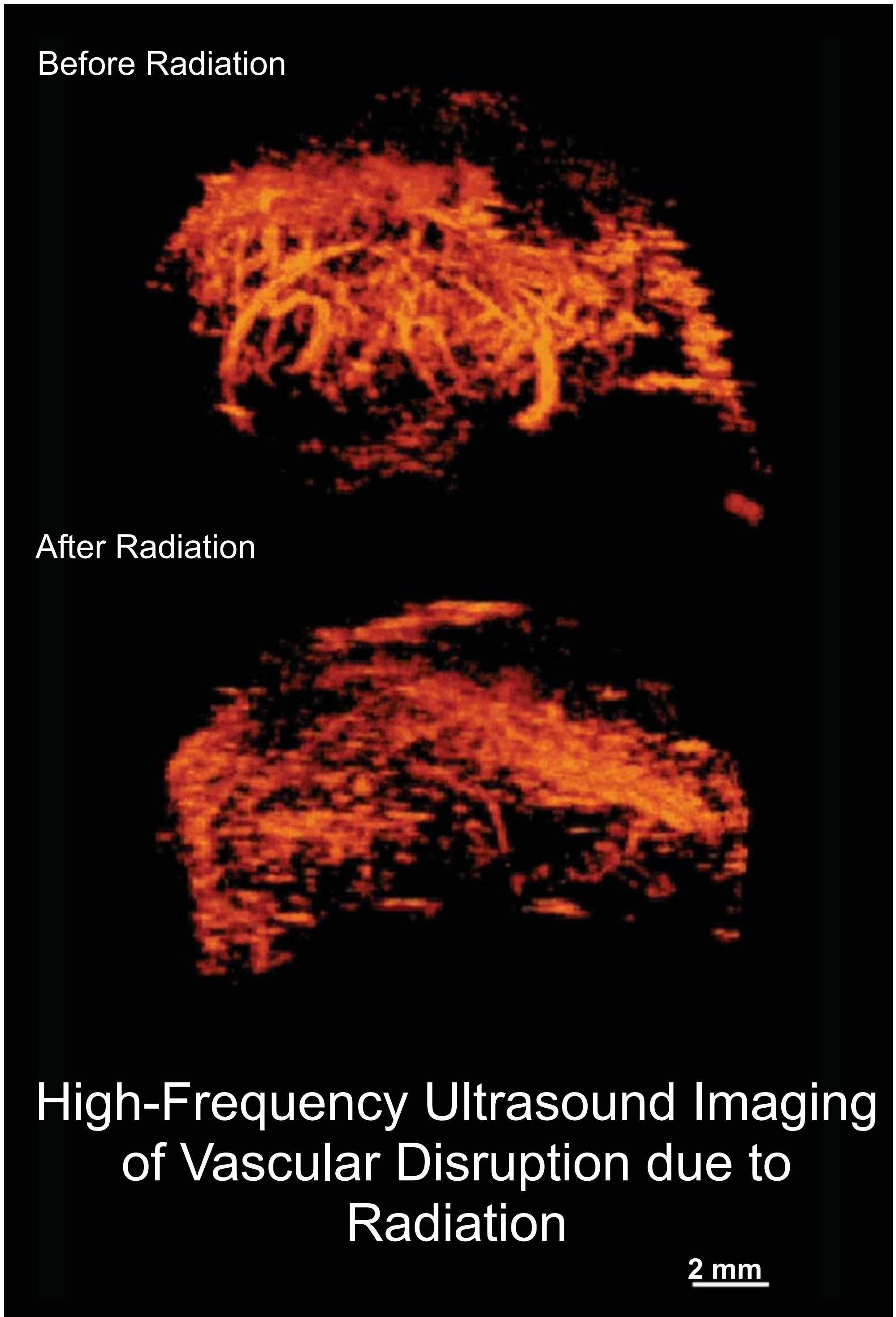
InterACTIONS

CANADIAN MEDICAL PHYSICS NEWSLETTER
Le BULLETIN CANADIEN de PHYSIQUE MÉDICALE



High-Frequency Ultrasound Imaging of Vascular Disruption due to Radiation

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LE COLLÈGE CANADIEN DES PHYSICIENS EN MÉDECINE

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COMP OCPM
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Volume 54, Number 2– avril/April 2008

Cover Image

Researchers in Dr. Czarnota's laboratory, in collaboration with Dr. Peter Burns, both at Sunnybrook Health Sciences Centre in Imaging Research are investigating the effects of radiation on blood-flow using high-frequency ultrasound.

Power Doppler images (25 MHz) are shown for a human prostate tumour xenograft (left) before and (right) 24 hours after the administration of radiation. The scale bar represents 2 mm. Data was acquired with a VisualSonics VEVO770 scanner. Images indicate the disrupton of blood flow due to vascular radiation effects which can be correlated to endothelial cell death. Radiation is now understood to cause endothelial cell damage by inducing the ceramide cell death pathway. Whereas canonical radiobiology is based on tumour cell death occurring due to tumour cell DNA damage emerging evidence suggests that it may be due to vascular damage which leads to decreased blood flow and subsequent tumour cell death. Vascular blood flow images and quantitative data being obtained such as these shown here suggest that there are significant blood flow changes as soon as 24 hours after the administration of large (>8Gy) doses of radiation.

Image provided by Gregory Czarnota, Sunnybrook Health Sciences Toronto ON

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

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

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Message from the COMP Chair:

Yesterday I attended a talk by the 2003 Physics Nobel Laureate, Sir Anthony Leggett on "Why Can't Time Run Backwards?" In his speech, Sir Leggett showed there is little in the physics realm preventing time from running backwards.

However, from a personal perspective, I cannot alter the speed by which the last two years has flown by. Thus, this is my last message to you, the members, as COMP Chair.

In looking back, we have had a number of great scientific meetings, recognized distinguished members of the profession and have seen a number of changes in the organization which will help maintain COMP as the vibrant and valuable organization which it should be.

Thanks to our intrepid editor this newsletter continues to grow in quality and the Communications Committee has been working hard not only to put a new face to our web-site but to make it easier to manage, thereby allowing it to become a more dynamic portal to the profession.

We have created a new Science and Education Committee (SEC), which will, in the interim, be chaired by Marco Carlone. Marco has agreed to work on setting up this committee and will assist the students in creating a Students Council ...

This work will continue and we will in the future be making greater use of our web-site to assist in communicating with our members, to provide enhanced services and to reduce costs.

There are a number of initiatives that are "in the works" that I am sure will come to pass under the able leadership of **Jason Schella** who will take over from me as chair at the next AGM.

We have created a new Science and Education Committee (SEC), which will, in the interim, be chaired by **Marco Carlone**. Marco has agreed to work on setting up this committee and will assist the students in creating a Students Council, and I anticipate that an exploratory meeting of our student members will be held in Quebec City to discuss this further.

A by-law sub-committee of the board has been established to assist the Secretary in reviewing and drafting new by-laws in order to make the many Board recommended changes that will be required, such as including the chairs of the SEC and RTSAC onto the COMP Board and the creation of a Fellow membership category.

One of the biggest challenges that still faces us as an organization is getting members to volunteer to assist us in the operations of COMP. I would extend a heartfelt plea to all members and in particular those that are relatively new to COMP to consider volunteering.

There are many roles which are required including committee positions, liaisons with other professional organizations, abstract evaluation and assistance with scientific meetings of the annual conference.

One of the biggest challenges that still faces us as an organization is getting members to volunteer to assist us in the operations of COMP.

Please do not wait to be asked, call and let us know you are interested. Volunteers are vital to our success and what has occurred over the last two years would have not been possible without the support and assistance of those volunteers who have served on the Board, on the various committees and behind the scenes. Thanks to You.

Dr. Stephen Pistorius
COMP President

I would also like to express my gratitude to Nancy Barrett for maintaining a calm reasoned persona even when things are not going as smoothly as we would like. She and her support staff have played a major part in helping us achieve what we have in recent years. I look forward to a large turnout of our members at the meeting in Quebec City in June.

Please give us your feedback and suggestions as to what more we should be doing to support you, the members, at any time.

Please give us your feedback and suggestions as to what more we should be doing to support you, the members, at any time.
Thank You.

Message from the CCPM President:

The CCPM board is looking at the issues for implementing a CAMPEP residency requirement for CCPM board certification by 2014 in parallel with the ABR requirement in the USA.

This requirement means that enough CAMPEP approved residency positions would have to exist by March 31, 2012 in order to meet the CCPM requirement for two full years of patient related experience by March 31 of the year one writes the CCPM board exams.

The main problem in meeting this requirement, both here and in the USA, is that there are not enough CAMPEP approved residency positions.

In Canada only three provinces currently have CAMPEP accredited residency training programs: Alberta, Ontario, and Quebec, and within those provinces not all residency positions are CAMPEP accredited.

The CCPM board is looking at the issues for implementing a CAMPEP residency requirement for CCPM board certification by 2014 in parallel with the ABR requirement in the USA.

Usually, the large training centers are CAMPEP accredited, but the smaller provincial centers are not accredited because the infrastructure does not exist in a small center to meet all the CAMPEP accreditation requirements.

Everyone including CAMPEP and the certification boards recognize this problem. One solution is the suggestion that each province creates a residency training network with one or more CAMPEP accredited centers that support residency training positions in the smaller centers.

The CCPM board is looking at the issues for implementing a CAMPEP residency requirement for CCPM board certification by 2014 in parallel with the ABR requirement in the USA.

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CAMPEP would provide a checklist of tasks that would have to be carried out by the resident during their two years of residency training and each task would have to be signed off by the chief physicist at the site.

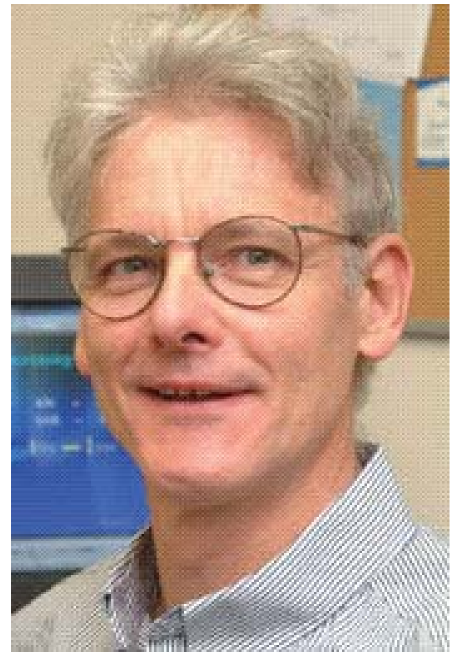
If a particular task was not available at a smaller training center, the resident would need to travel to another training site to learn and successfully perform that task.

This implementation of CAMPEP residency training requirements is a formalization of current practice at some centers already, is already supported by CAMPEP in their guidelines (see page 5 in Guidelines for Accreditation under Residency Education Programs in http://www.campep.org/) and should be the practice at all training centers in Canada.

This approach means that all residency positions in a province would be CAMPEP accredited. It does require that each province or region such as the Maritimes have at least one CAMPEP accredited center.

Although this requires more work, CAMPEP, CCPM, ABR, ABMP and we as teachers all have the same goal.

Regardless of where in Canada or the USA a patient receives their radiation therapy treatment or diagnostic imaging procedure, that patient should receive the same high standard of medical physics service.



Dr. Dick Drost,
CCPM President

Regardless of where in Canada or the USA a patient receives their radiation therapy treatment or diagnostic imaging procedure, that patient should receive the same high standard of medical physics service.

This requires that the training program for medical physicists have consistent high quality throughout Canada and the USA.

Message from the Executive Director of COMP/CCPM:

Speaking as a resident of Ottawa – it was a long winter (and I actually like winter sports) so I am happy that spring is upon us. So far, 2008 has been a busy year for COMP as both our many volunteers and the COMP office have been working hard on your behalf.

We were very appreciative of your patience as we dealt with some of the technical challenges of implementing the new website and related processes. With any change, there are always issues to deal with and we encourage you to continue to bring these issues to our attention.

Luc Beaulieu and his team are planning a top notch 2008 ASM, which will be taking place in beautiful Quebec City from June 25-28.

Be sure and mark your calendars. Regular updates will be available on the website and via e-broadcast

As we work through the second year of the implementation of our strategic plan, we thought it would be important to let you know what activities the many COMP volunteers are working on:

As you can see, this list is extensive and volunteers are always welcome! If you are interested in serving on a COMP committee (specific opportunities can be found at www.medphys.ca), please let us know.

Please feel free to contact me at nancy@medphys.ca or Gisele at admin@medphys.ca at any time.

Ms. Nancy Barrett,

Strategic Pillar	Strategic Plan Activity	Responsibility	Status
Community	Identify potential membership categories and targets (including international)	Secretary/ED	In progress
Community	Research membership barriers and opportunities (e.g. academics)	Past Chair/ED	In progress
Community	Develop and implement a recruitment strategy	Past Chair/ED	In progress
Community	Implement Communications Strategy & Plan	Executive	In progress
Community	Establish relations with adjacent communities (AAPM, CARO, CAP)	Chair/PAC	AAPM/COMP Joint ASM 2011 Clarification of COMP representation on ancillary organizations is in progress
Community	Add information about volunteer opportunities on the website	Communications Committee/ED	Complete
Community	Explore the creation of an Academic Affairs Committee	Executive	In progress
Consensus	Develop guidelines to develop, approve and use consensus statements	Chair-Elect	In progress
Education	Consider adding refresher courses/workshops to the 2009 ASM	Science & Education Committee	In progress
Education	Conduct a feasibility study re: running a winter program	Science & Education Committee	In progress
Education	Explore running a formal track at future CARO meetings	Science & Education Committee	In progress
Profile	Develop a database of experts who can serve as spokespersons for COMP on specific topics	Communications Committee/ED	Ongoing
Profile	Revise promotional materials for the medical physicist profession	Communications and Science & Education Committees/ED	In progress

Harold Johns Travel Award Announcement
Deadline for Application: 4th April 2008

The Board of the Canadian College of Physicists in Medicine is pleased to honour the Founding President of the College by means of the Harold Johns Travel Award for Young Investigators. This award, which is in the amount of $2000, is made to a College member under the age of 35 who became a member within the previous three years. The award is intended to assist the individual to extend his or her knowledge by 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 endeavour in medical physics.

The H. E. Johns Travel Award is awarded annually by the Canadian College of Physicists in Medicine to outstanding CCPM Members or Fellows proposing to visit one or more medical physics centres or to attend specialized training courses such as the AAPM summer school. The applicant should not have previously taken a similar course or have spent a significant amount of time at proposed institutions. The award is for $2,000 and will be paid upon receipt of a satisfactory expense claim. The deadline for application is four months prior to each CCPM annual general meeting. All applicants must have written and passed the exam for membership in the CCPM within the previous three years. They should supply a one page proposal indicating the course they wish to attend or the name(s) of the institutions they would visit and the reasons for their choice. They should also supply an estimate of the costs involved and letters from their present employer indicating that they are in agreement with the proposal. For a visit to an institution the candidate must have the institution write to the Registrar in support of the visit. The candidate should also provide their curriculum vitae and the names and phone numbers of two references whom the Awards Committee can contact. No reference letters are required. The Awards Committee reserves the right to contact additional individuals or institutions.

Applicants may travel either inside Canada or elsewhere. If their proposed expenses exceed the value of the award, then they should also indicate the source for the additional funds required.

The award is intended both to assist the individual in their medical physics career and to enhance medical physics practice in Canada. Recipients are therefore expected to remain in Canada for at least one year following their travel. Applicants should be working in Canada but need not be Canadian citizens.

Successful candidates will have two years after their application deadline to complete their travel. They will be required to submit a short report to the Canadian Medical Physics Newsletter.

The award recipient will be chosen by a committee consisting of the Chairman of the Examining Board, The Registrar and the President of the College. Their choice will be based upon 1) the written proposal submitted by the candidate, 2) references obtained by the committee and 3) membership exam results. The award will be announced at the Annual General Meeting of the College.

Unsuccessful candidates in any one year who are still eligible in subsequent years may have their applications considered again by writing to the Registrar and providing any necessary updated information.

Applications should be sent to:
Dr. Wayne Beckham
The Registrar
Canadian College of Physicists in Medicine
c/o BC Cancer Agency, Vancouver Island Centre
2410 Lee Avenue, Victoria, BC, Canada V8R 6V5

Errata

54(1)
The issue should have page numbers starting at 1, ending at 32 instead of 141-172. The Editor apologizes for this error (corrected in the online version)

CNSC Feedback Forum

Submitted by: Mike James & Kavita Murthy
CNSC Ottawa

The RSO Amendment
Affecting Class II Licensees

The mandate of the CNSC includes ensuring that nuclear facilities and radioisotopes are managed so as to promote safety. The Radiation Safety Officer at any facility is a key person in this effort. For this reason the CNSC began examining new RSOs some time ago.

In order to achieve transparency and promote fairness in the process the *Class II Nuclear Facilities and Prescribed Equipment Regulations* will be amended so as to more clearly define the process.

At this time, in a relatively informal process, we check out prospective RSOs (or recently hired ones) by examining their credentials and by setting an examination. The examination normally consists of a telephone interview, a process which takes an hour or two.

The examination reviews the candidate's knowledge in the following areas:

- radiation physics
- radiation safety
- Class II facility operations in general
- CNSC regulations
- Site specific issues, e.g., operations and the radiation safety program

The exact content is customized for the individual candidate based on his résumé and the type(s) of facility involved.

When the process is formalized in an amendment to the *Class II Nuclear Facilities and Prescribed Equipment Regulations,* the basic requirements will remain the same. However, in the interest of clarity and fairness certain things are spelled out:

- there will need to be a designated backup RSO (uncertified) for times when the RSO is unavailable. The backup person may act for no more than 60 days per year.
- a person who fails the certification exam has a right to appeal (quaintly called "an opportunity to be heard").
- the licensee must apply on behalf of the prospective RSO. The content of the initial application is defined.

We will request comments from licensees and other affected persons in the near future.

New Linacs in Old Rooms
Shielding - Calculations vs. Measurement

Your clinic has ordered the latest and greatest new linac. It will replace the old Whatsit-XX which has worked so long and hard and is now just not up to snuff. The new machine will do the same types of treatments with the same energy and workload as the old Whatsit, but will be more reliable, more precise, and better looking.

You are filling in the long, bureaucratic form that the CNSC insists on for new facilities and you've just got to Box G5 – Dose Rate and Annual Dose Calculations. Dawggone – this would all have been so easy for Smedley to calculate; he did all the original calculations but he left for other pastures a year ago.

Time to get out the sharp pencil, Excel and tables of TVLs. And to remember what's a Kersey path (or was that "Kelsey"?). Why do I have to do this work when Smedley already did it?

Well…you don't really need to recalculate – all we want at the CNSC is to know the dose rates and annual doses and you have measurements from the old machine. You do have those on hand, don't you?

But remember – the old machine's numbers have to be valid for the new one. This means that the new machine must be in essentially the same location and orientation as the old one. We will check to see that the largest available field (+ a few centimeters) will still fit on the primary shielding, even when turned diagonally. Also, new treatment modalities (for example, IMRT) may affect the effective workload.

And you'll confirm all this with your measurements during commissioning.

Cobalt-60
The M.D. Anderson Perspective

Peter R. Almond, PhD

Department of Radiation Physics,
The University of Texas M. D. Anderson Cancer Center, Houston, Texas

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Figure 1: Leonard George Grimmett, 1949
Chairman of the Physics Department, M. D. Anderson Hospital, 1949-1951

Introduction

The excellent series "Cobalt-60: A Canadian Perspective" was published in four parts in *Interactions* (vol. 45, 1999). Part 4 was entitled "The M. D. Anderson ^{60}Co Teletherapy Unit," and although the article was generally factual, it did not tell the whole story. During the last few years, an increasing number of historical documents have been uncovered that shed new light on the genesis and development of the M. D. Anderson cobalt-60 unit. These documents include contemporary memos, reports, letters, and publications and provide a detailed look at how the unit came about.

History

Perhaps the first public awareness that cobalt-60 was obtainable by activation in a nuclear reactor and might be a replacement for radium came with Mitchell's article published in the *British Journal of Radiology* in 1946 (Mitchell, 1946). This article resulted from his activities at Chalk River during World War II, where the use of artificial radioactive isotopes in medicine had been discussed in several internal reports. Mitchell suggested that cobalt-60 might be used for both brachytherapy and teletherapy. Although the brachytherapy aspects of cobalt-60 were pursued for a short time, it was its use in teletherapy that proved useful. When the suggestion was first made, however, it was not clear how cobalt-60 could be used to replace radium in teletherapy treatment machines and how much activity or what levels of specific activity would be required.

Wrote Grimmet:

"Many radiologists believe that gamma-ray therapy is superior to X-ray therapy in its biological effects, and they attribute this superiority to the shorter wave-length of the gamma-rays; encouraged by this belief, they are striving after X-rays generated at higher and higher voltages, which approach the gamma-rays of radium in their nature."

Grimmett

Leonard George Grimmett (Fig. 1), in a paper published in *Nature* in 1937 that was coauthored by Arthur Eve was the first person to suggest that radium might be replaced with an artificial radioactive material in a teletherapy unit (Eve and Grimmett, 1937). Grimmett was working at the Radium Beam Therapy Research in London, and Eve was the honorary physicist on the board of directors. Radium Beam Therapy Research was the brainchild of Professor Cunningham McLennan who had been the professor of physics at Toronto University and retired back to England in 1932. He was convinced that the only way that radium could be proved useful in teletherapy cancer treatment was if enough radium could be made available to undertake a reasonable clinical trial. Radium Beam Therapy Research was established to investigate the efficacy of teleradium treatments when a sufficient amount of radium was available, and Grimmett was appointed its medical physicist. He designed a very successful treatment unit in which the radium was kept in a safe until the patient and treatment head had been correctly positioned and the treatment personnel had left the room (Grimmett, 1937). The radium was then transferred to the treatment head pneumatically. When the treatment was completed, the radium was pneumatically returned to the safe. Initially designed for 5 gram of radium, a 10-gram unit was also built (Fig. 2).

In the 1937 *Nature* paper, Grimmett discussed the pros and cons of using radium. He wrote:

> *"Many radiologists believe that gamma-ray therapy is superior to X-ray therapy in its biological effects, and they attribute this superiority to the shorter wave-length of the gamma-rays; encouraged by this belief, they are striving after X-rays*

(Continued on page 43)

(Continued from page 42)

generated at higher and higher voltages, which approach the gamma-rays of radium in their nature."

He went on to show that even with a tube operating at 1 MeV, there would be no X-rays of that energy, whereas radium has quite a few gamma rays in the 1–2 MeV range. To match these gamma rays with comparable X-ray energies would require a 3-MeV tube, and Grimmett was not sure that such was possible. He was also concerned that the cost of the radium limited its use for beam therapy.

One of the problems with radium, beside its high cost, was that the treatment units were short source-to-surface distance (SSD) units, 5–10 cm that resulted in a very poor depth dose. Orthvoltage machines operating at 75-cm SSD had far superior depth-dose characteristics. The short SSD was a result of the limited supply and high cost of radium. Even with 10 grams at 10-cm SSD, the treatment times were of the order of 30 minutes or more, and sometimes two treatments were given in one day to reach the desired dose. Another problem was the large source size (several centimeters across), which at the short SSD, gave a poorly defined beam edge and large penumbra. Even so, the radium units seemed to do well in treating head and neck cancers.

Grimmett concluded:

> *"The fact is that both radium and X-ray treatments are governed by the inverse square law, and that the superior penetrating power of gamma-rays cannot be exploited unless prohibitive quantities of radium are available to make it possible to work with large radium-skin distances…*
> ***It is possible that in a few years time the new discoveries of physics…artificial radioactivity, will find a place in radiation therapy… it is now possible to obtain gamma-rays from artificial radioactive substances with energies far in excess of anything radium emits…if it is possible to make it cheaply in bulk, it could be inserted…into a radium unit of conventional design and used for treatment in place of radium."*** (Emphasis by present author.)

His suggestion was somewhat ambivalent, seeming at first to suggest that if large amounts of artificial radioactivity were available, treatments could be given at an extended SSD. But then he suggests that an artificial radioactive source could be placed in a radium unit of conventional design and used simply as a replacement for radium, presumably at the shorter SSD. These conflicting ideas would appear again later on in the story.

In the paper, Grimmett gave radio-sodium as an example of a radioactive isotope that might be used because it had been produced in weighable quantities. Although radio-sodium has a very short half-life, he suggested that the source might be exchanged daily. Not enough was known about cobalt-60 at that time to support Grimmett's suggestion, but the idea clearly stayed with him.

In his memoirs, Marshal Brucer recalls that Grimmett told him he first thought of cobalt-60 as a suitable choice to replace radium when catching up on his reading of *Physical Review* in an air-raid shelter during World War II (Brucer, 1990). It is know that Grimmett's house in the suburbs of London was damaged by a flying bomb and that he presumably took refuge in his own home-built air-raid shelter during such attacks. This would have been the middle of 1944 to the early part of 1945. During the 1930s, several reports and papers concerning induced radioactivity in cobalt appeared, but there was initially much confusion about the emitted radiations, especially the half-life and energies of the gamma rays, probably because of impurities in the cobalt and a competing 10-minute half-life isomeric transition. Three papers, however, are likely candidates for the ones Grimmett read in his air-raid shelter. Risser had published an article on "Neutron-Induced Radioactivity of Long Life in Cobalt" in October 1937 (Risser,1937). Risser came close on the gamma ray energy, suggesting one gamma ray only between 1.5 and 2.0 MeV, but he did not have enough activity to measure the half-life accurately, which he approximated as 2.00 $\pm$0.5 years. A paper by Livingood and Seaborg in 1941 (Livingood and Seaborg,1941) reported producing radioactive cobalt both in the cyclotron using deuteron bombardment as well as using a radium-beryllium neutron source to irradiate Co-59. They measured the energy of the high-energy gamma rays as 1.3 MeV, but were off on the half-life, believing a value of over 10 years was indicated. The last paper in *Physical Review* that Grimmett could have read was published by Nelson et al in 1942 (Nelson, Pool and Kurbatov,1942). The paper identified the half-life of cobalt-60 as 5.3 years.

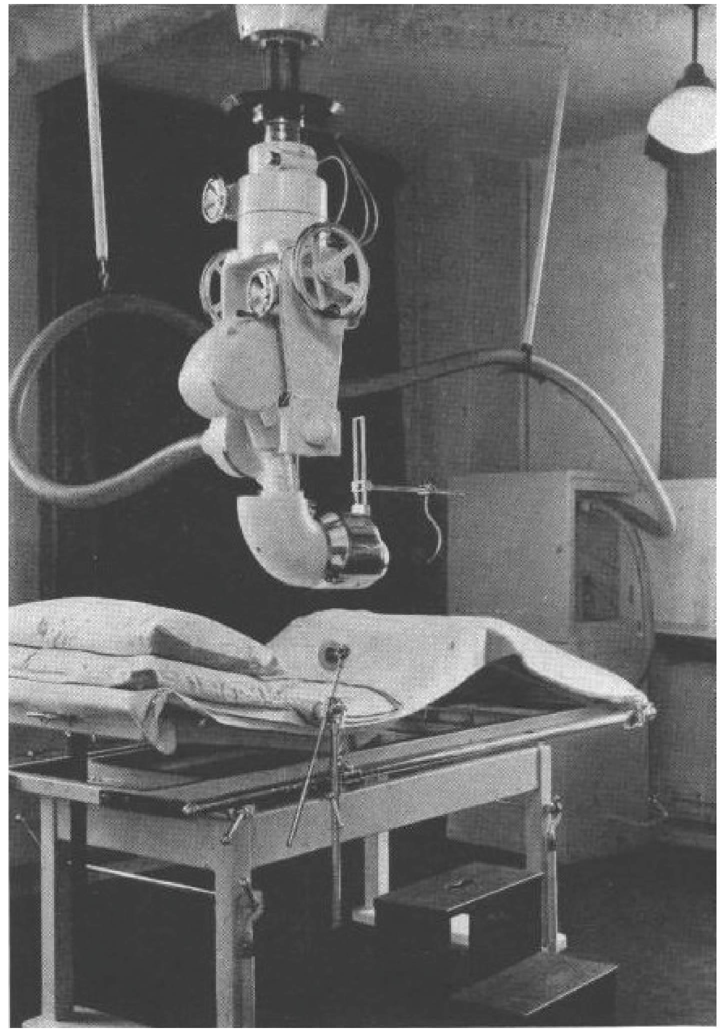

Figure 2. The 10-gram radium unit showing the flexible tube between the treatment head and the storage safe through which the radium was pneumatically transferred. (Wilson,1948)

(Continued on page 44)

(Continued from page 43)

Here then was a radioactive isotope with the right energy gamma rays and a half-life that would allow the treatment machine to be used for several years without replacing the radioactive source. Although the published gamma ray energies of 1.5–1.7 MeV were not known accurately, they were sufficiently high for Grimmett to realize the potential of cobalt-60. However, neither Grimmett nor anyone else at that time could have had any idea of how and how much cobalt-60 could be produced and at what cost.

By late 1944 to early 1945, Grimmett had left medical physics and eventually ended up working for the fledgling United Nations Educational Scientific and Cultural Organization (UNESCO) in Paris.

Fletcher

In 1947, Gilbert Fletcher was appointed a traveling fellow at the University of Texas M. D. Anderson Hospital for Cancer Research, which was just getting started in Houston. His task was to visit radiotherapy departments in Europe and to report on the latest ideas that might be useful at the new institution. Fletcher recalled later:

> *"Part of my charge as a traveling fellow was to contact possible recruits for the M D Anderson Hospital, and in that capacity, I met in London an English physicist, .G. Grimmett, who in the mid-1930s had developed teleradium units, the use of which had been very popular."* (Fletcher,1979)

This meeting most probably took place in late 1947, between Christmas and New Year's 1948. It is not known whether at that meeting they talked about the possibility of replacing radium with cobalt-60 for teletherapy purposes, but shortly thereafter, the topic would enter their discussions.

Fletcher's first day of employment at M. D. Anderson Hospital was February 16, 1948, and in April, David E. Lilienthal, Chairman of the U.S. Atomic Energy Commission (AEC), announced the discovery and production of inexpensive radioactive cobalt that might eventually become a substitute for radium in the treatment of cancer. A Field Notice (4-30-48) from the American Cancer Society followed and advised:

> *"While it is uncertain when radioactive cobalt will become widely available for clinical use, you are advised to defer, if possible the purchase of radium for the use in cancer clinics…"*

Following that notice, in 1948, Fletcher wrote a memo to Dr. R. Lee Clark, director of M. D. Anderson Hospital:

> *"Radioactive cobalt could develop into a substitute for radium if it becomes much cheaper… When radioactive cobalt will be cheap enough, it will make the possibility of a radioactive cobalt bomb within reasonable cost and will make a very interesting project, both physically and clinically… This ground work* (sic) *requires the presence of an excellent work shop* (sic) *manned by good instrument makers… It is feared that, until the really experienced physicists in that field are with us and adequate equipment and an adequate research fund is available, no real valuable work can be done."*

"And the hospital! Well, words fail me! Its (sic) true that they told me it was in sheds, but I wasn't prepared for anything so primitive."

This sounds very much like part of Fletcher's arguments to Clark to get Grimmett appointed and probably indicates some of Grimmett's requirements in order for him to accept the position. Grimmett was almost fanatical about the need for a well-equipped workshop and a qualified instrument maker (machinist).

M. D. Anderson Hospital and the Atomic Center

About this time, the concept of replacing the radium in one of Grimmett's pneumatically operated teleradium units with radioactive cobalt-60 began to take shape. It is likely that this idea evolved during correspondence between Grimmett, Fletcher, and Clark concerning Grimmett's appointment to M. D. Anderson Hospital. Clark envisioned an "Atomic Center" for the new hospital where the medical applications of radioactive isotopes would be studied and used to treat cancer. When Grimmett decided to join the group in Houston he wrote his letter of resignation from UNESCO on November 9, 1948 to Dr. Pierre Auger (of Auger electron fame):

> *"I have now been away from active scientific work for four years, two years with UNESCO, and two with the Conference of Allied Ministries of Education before that, and I feel that unless I get back into scientific work soon, I shall lose the right to rank as a scientific worker.*
> *It so happens that I have been offered a most interesting post as Physicist to a new cancer Research Institute and **Atomic Centre** in the University of Texas, which I have provisionally accepted."* (Emphasis by present author.) (Grimmett,1948)

He arrived in Houston on Monday afternoon, February 7, 1949, and went straight to the M. D. Anderson Hospital, which was housed in "The Oaks," the old Baker estate at 2310 Baldwin Street. What he found greatly shocked him!
He wrote his wife the next day (Grimmett,1949):

> *"And the hospital! Well, words fail me! Its* (sic) *true that they told me it was in sheds, but I wasn't prepared for anything so primitive."*

Temporarily housed on an old estate near downtown Houston, the hospital comprised an old mansion, various outbuildings, and surplus army wooden barracks from World War II. Grimmett had his work cut out for him just establishing a medical physics group in such surroundings, and there is no record that he or Fletcher pursued a cobalt-60 treatment unit at that time—that is, until Marshall Brucer showed up.

Brucer

Dr. Marshall Brucer was the newly appointed head of the medical division of the Oak Ridge Institute for Nuclear Studies (ORINS). At that time, Brucer was commuting between Galveston and Oak Ridge through Houston, as his previous appointment had been with the University of Texas Medical Branch in Galveston. In May 1949, he met with Grimmett in Houston.
In Brucer's words:

> *"Grimmett was radiation physicist at Houston's cancer hospital, not yet a citizen. I had just been appointed chairman of the Oak Ridge isotope research hospital and was looking for*

(Continued on page 49)

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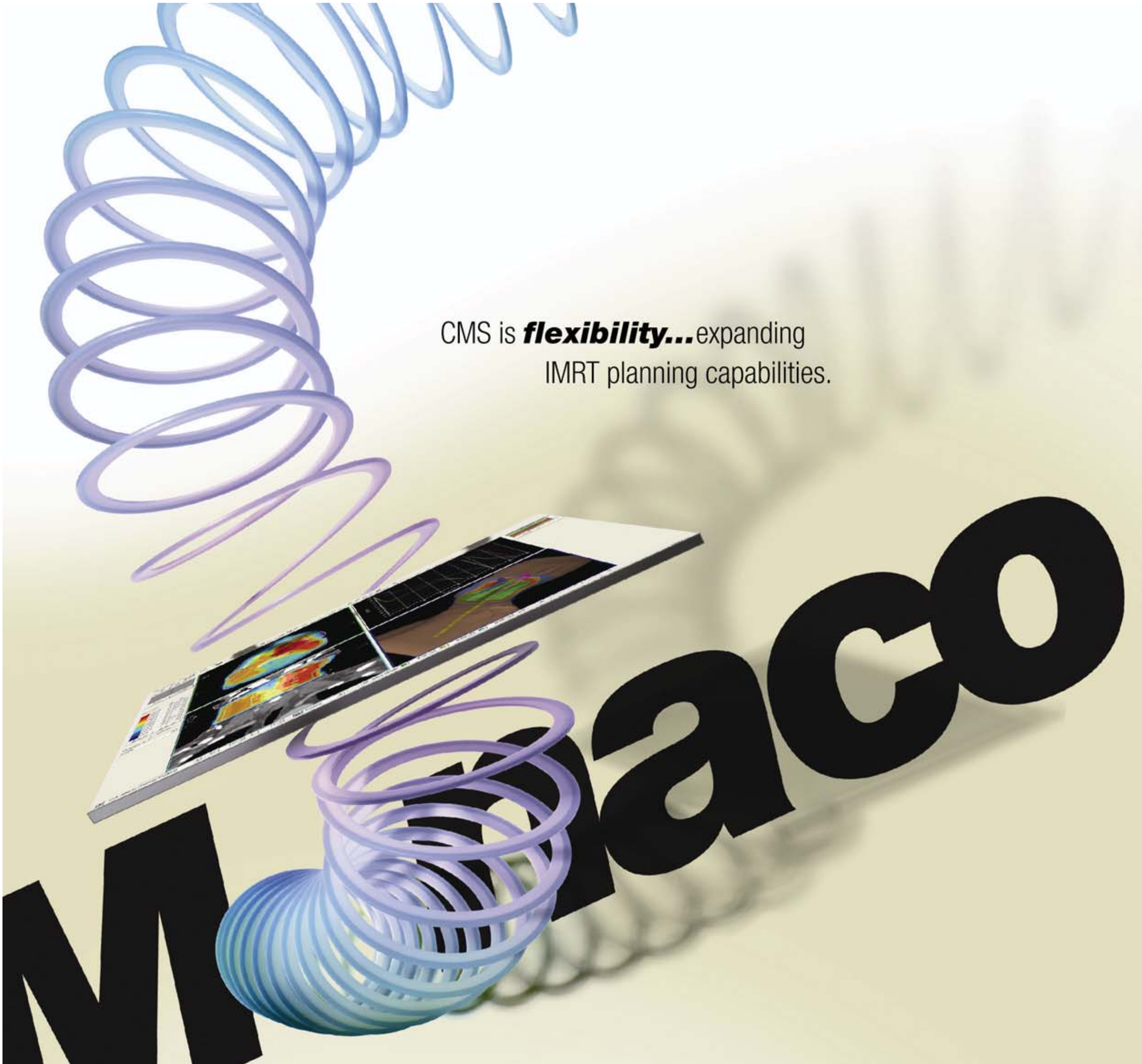

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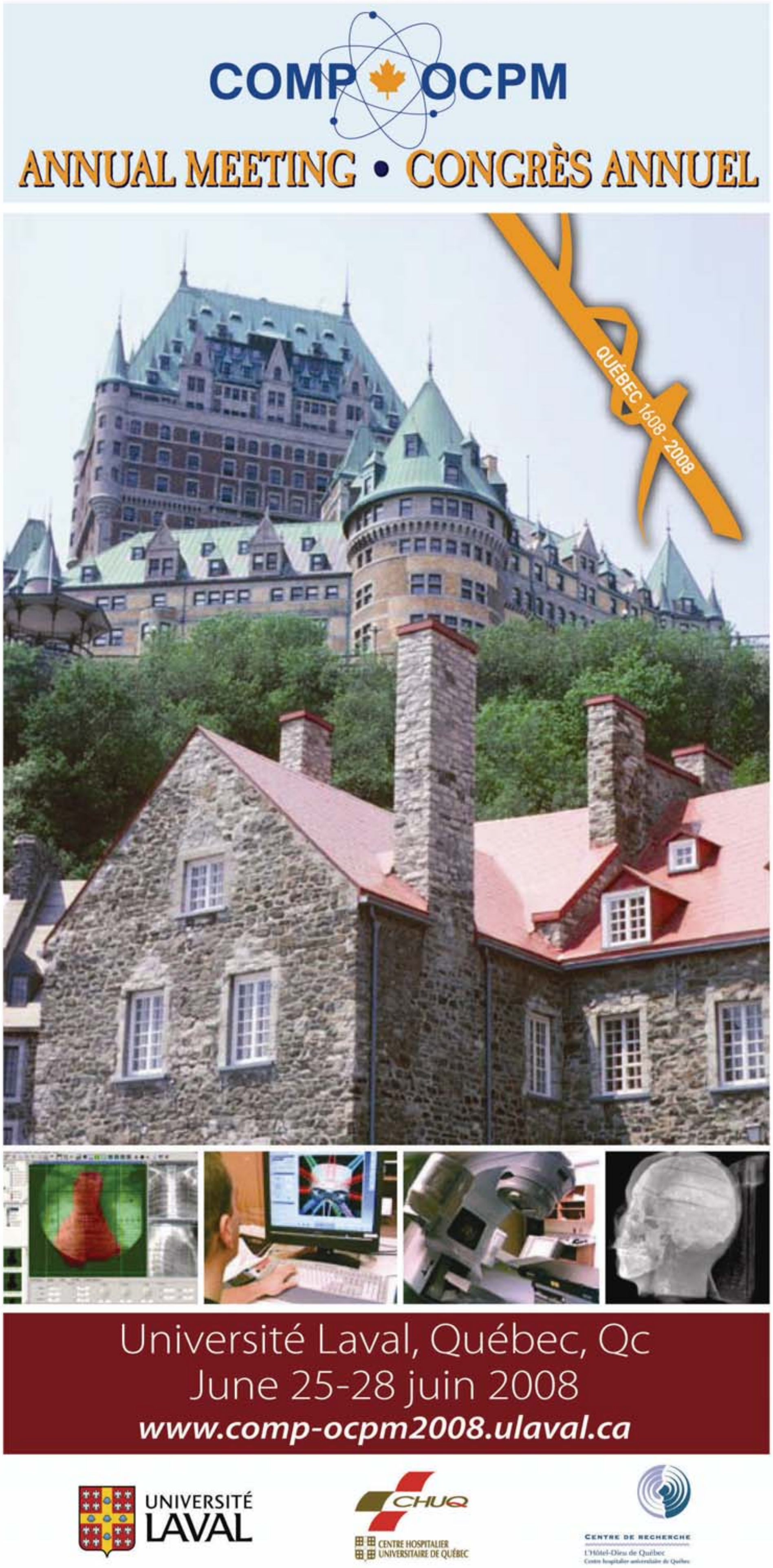
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ideas. I stopped off to see Grimmett on my way to the super-secret city of Oak Ridge and was given a complete history of all the warts on the radium bomb. Co-60 might be, Grimmett said, the answer to cancer. I invited him to Oak Ridge." (Brucer,1990)

Initial Concept

On August 12, 1949, Grimmett wrote a memo on the proposed work for the new physics department, including a "Proposal for the Use of Cobalt^{60} in Radiotherapy." He wrote:

> *"In a short paper to be given at Oak Ridge in the beginning of September 1949, details will be given of some methods of using cobalt 60 as a substitute for radium in radiotherapy of cancer."*

He described three areas that he would discuss: an improved cobalt-60 needle, "Cosine Law" applicators, and a telecobalt unit. He outlined what he would say about the cobalt unit:

> *"Proposals will be put forward for methods of utilizing up to 50 curies of cobalt 60 as a mass irradiation unit. Principles of design will be discussed, with special reference to protection of patient and operator. Designs of a machine in which the cobalt 60 can be transferred pneumatically to and from the storage safe will be shown.*
> *Estimated costs, $25,000 to $30,000(exclusive of building)."*

It is clear that at this stage, Grimmett was thinking about building a unit very similar to his radium units, simply substituting cobalt-60 for radium.

The machine shown in the sketch will furnish a powerful beam of penetrating gamma radiation from a small slab of the radioactive isotope Cobalt-60, for the external irradiation of cancerous lesions. The Cobalt-60 source will have a strength of 1000-curies, equivalent in gamma radiation to 2000 grams of radium. It will be produced in the atomic pile, and loaded into a massive lead block, to screen off the radiation.

Change of Plans

Grimmett spent the end of August and the beginning of September 1949 in Oak Ridge. He and Brucer met with Paul Aebersold, who was head of the isotope division of the Oak Ridge National Laboratory.

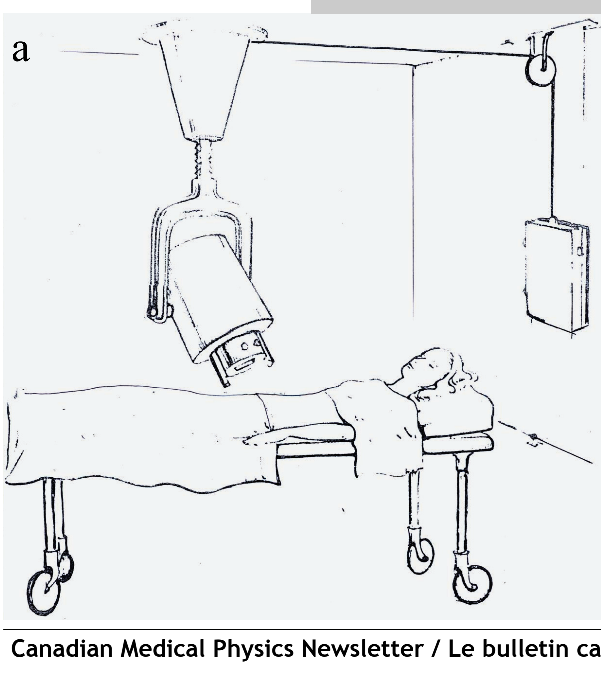
Brucer recalls that Grimmett initially asked for 10 curies of cobalt-60. This was probably because it was analogous to the 10 grams of radium that was then being used in the radium irradiators that Grimmett had designed before the war. Abersold thought that a few hundred curies might be available, and Brucer rounded it out to an even 1000 curies (Brucer, 1990).

With the possibility of obtaining 1000 curies of cobalt-60, Grimmett knew that a design similar to his pneumatically transferred radium unit would not be viable. He therefore turned to some of the ideas that had been incorporated into an early 4-gram radium unit at Westminster Hospital with which he had been associated (Wilson, 1948). In this unit, the treatment head was a sphere approximately 16 cm in radius and was suspended via a yoke from the ceiling with a counter-weight mechanism (a similar sphere) to allow the treatment head to be easily raised and lowered. When the unit was to be loaded, the treatment head could be positioned over a safe and lowered until it docked with the safe. The source was attached to a rod that was used to remotely move it in or out of the treatment head. Grimmett envisioned a similar situation for the cobalt unit, but now everything would be on a much larger scale. The treatment head would be a cylinder of a high-density metal approximately 45-cm long and 35 cm in diameter. The yoke and counter weight would have to be similarly increased in size. The source would be kept within the treatment head mounted on a wheel that would allow it to be rotated to an opening to obtain a beam of gamma rays for treatment or rotated 180^0 to block the rays. When the source was loaded into the unit, the treatment head could be position over a similar cylindrical safe in which the source could be transported, and the source could be inserted or extracted from the treatment head by a rod that could be attached to the source. In late 1949 Grimmett described his proposal this way:

" <u>A COBALT-60 IRRADIATOR FOR CANCER TREATMENT</u>

The machine shown in the sketch will furnish a powerful beam of penetrating gamma radiation from a small slab of

(Continued on page 50)



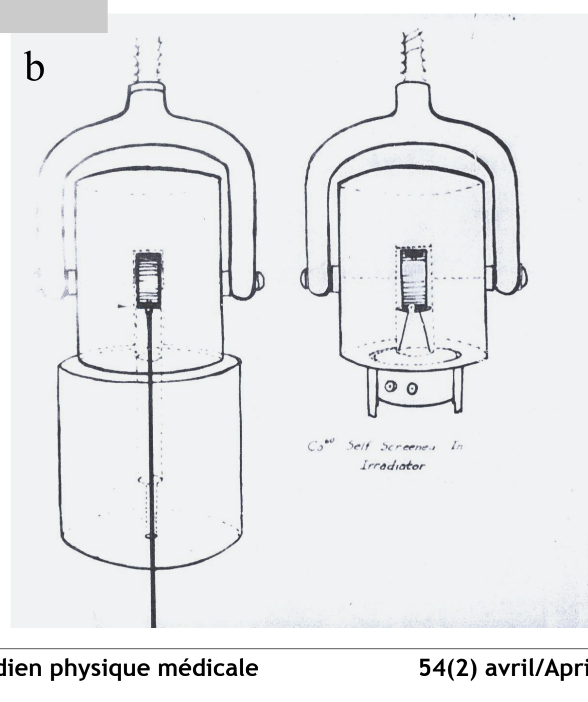


Figure 3a: Grimmett's initial overall concept of the cobalt unit,1949.

Figure 3b: Grimmett's initial concept for loading the source into the treatment head from the transport safe, 1949

(Continued from page 49)

> *the radioactive isotope Cobalt-60, for the external irradiation of cancerous lesions.*
> *The Cobalt-60 source will have a strength of 1000-curies, equivalent in gamma radiation to 2000 grams of radium. It will be produced in the atomic pile, and loaded into a massive lead block, to screen off the radiation. The Cobalt-60 will be mounted on a disc of uranium, which can be rotated so as to let radiation out of the hole in the lead block when desired.*
> *In effect, this machine will be comparable to a super-voltage X-ray set working at about 2 Million volts. The beam of radiation is expected however to show distinct superiority over the conventional super-voltage X-rays. The skin reaction will probably be less, and the constitutional effects on the patient smaller.*
> *It will be possible to ensure adequate safety for both patient and operator."*

The sketches Grimmett refers to were recently found, and two are shown in Figures 3a and 3b.

The Joint Project

Grimmett knew there was a problem however: there was no suitable space in Houston to house such a unit.

It was during Grimmet's visit with Brucer in Oak Ridge that the two began discussing a joint project between ORINS and M. D. Anderson Hospital to produce a cobalt unit. After Grimmett's return to Houston in September, Dr. Clark wrote Brucer thanking him for *"... the excellent reception given to Doctor Grimmett in his recent visit to Oak Ridge."* He went on to say, *"I think the Cobalt 60 problem would be an ideal one for coordinating effort."* Brucer planned to visit Houston in October of 1949 and Clark was looking forward to that visit (Fig. 4). Apparently the visit went well, and cooperation between the two institutions took a step forward. On November 8, 1949 Brucer wrote Clark:

> *"I presented the general plan of cooperation between the M.D. Anderson Hospital and the Institute* [ORINS] *and explained some of the details of the problems we will encounter to the Board of Directors of the Institute yesterday. Dr. Painter* [President of the University of Texas] *sent a very nice letter giving the complete approval of the University of Texas, and the Board has therefore given its blessing to the proposal.*
> *I am now proceeding on the assumption that everything is cleared for us to write up a letter of agreement and to investigate how we can get the million volt irradiator bought as quickly as possible.*
> *Many thanks for your kind hospitality during my stay in Houston."*

Ten days later, Clark wrote to Brucer saying "*the proposal for the coordinated project between the M.D. Anderson Hospital and your institution for the use of radioactive cobalt in the treatment of cancer patients"* had been sent under separate cover.

It was now necessary for this joint proposal to be presented to the U.S. AEC in order to get approval for the production and use of the radioactive cobalt-60. A joint meeting was therefore setup for December 19 and 20, 1949, in Oak Ridge between M. D. Anderson Hospital, ORINS, and the AEC. Arrangements were made for

Figure 4. Planning for the cobalt-60 unit, 1949. Seated R. Lee Clark, Leonard Grimmett, Gilbert Fletcher. Standing Marshall Brucer (bending over), Roy Heflebower (MDAH Assistant Director for Administration).

Drs. Clark, Fletcher, and Grimmett to go to Oak Ridge and along with Dr. Brucer of ORINS to meet with Dr. Holland, Director of the Office of Research and Medicine of the AEC, and Dr. Abersold, Chief of the Isotope Division of the AEC. In preparation for this meeting Grimmett sent Brucer his notes on cobalt-60 along with the drawings of his proposed unit, which Brucer was planning to incorporate into booklets about the project to be presented at the meeting.

By the end of 1949, the medical division of ORINS and M. D. Anderson Hospital had prepared a joint proposal for the AEC for the design and construction of a 1000-curie cobalt-60 therapy unit. The proposal outlined, in some detail, the project and how the work would be divided between the two institutions. They agreed to:

> *"…cooperate in the design, construction and preliminary experimental work necessary to the production of a 1000 curie telecolbalt cancer therapy unit…*
> *It is agreed by the two organizations that they will cooperate in testing it and measuring the physical and biological characteristics of the therapy unit."*

The preliminary experimental measurements and initial therapy of cancer patients were to be done at Oak Ridge. This reflected the situation in Houston at the time. There were no suitable sites at the Baker Estate, where M. D. Anderson Hospital was temporarily located, to put the unit. Groundbreaking for the hospital's new building had not yet taken place and would not take place until December 20, 1950, one year to the day after the meeting outlining the agreement between ORINS and M. D. Anderson Hospital. How quickly the new building could be constructed was in question because of a shortage of building material due to the Korean War. As it turned out the space for the unit in the new building would not be ready for four years.

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Per the agreement reached at the December 20, 1949 meeting, M. D. Anderson Hospital would make available sufficient funds to cover the costs of materials and fabrication (approximately $45,000), ORINS would make available sufficient funds for biological materials (approximately $10,000) and pay for the housing of the unit at Oak Ridge. Oak Ridge would determine how much shielding would be required in the walls of the room housing the unit, information that was needed in designing and building the new facility in Houston where the unit would eventually be housed.

The Washington Meeting

As suggested by the group in December, ORINS and the Isotopes Division of the AEC called a meeting on February 15, 1950 in Washington, D. C., specifically to discuss and solicit designs for a cobalt-60 irradiator. Fletcher and Grimmett attended the meeting on behalf of M. D. Anderson Hospital along with thirty-one other attendees from around the country and Canada. About half were radiologists, one-third physicists, and the rest from various government agencies and industry. Grimmett made extensive notes at this meeting, which have been used in the following summary.

Harold Johns was one of the attendees, and as far as is known, this was the only time that he and Grimmett ever met. Both men presented their designs for a cobalt-60 unit. The similarities between the designs were apparent, although up to that point neither was aware of the other's work. One of the purposes of the meeting was to select a design for the U. S. cobalt-60 unit. Grimmett's design was selected over one submitted by Tracerlab. Presumably Johns' unit was not eligible because it was Canadian, and thus not of U.S. design. The big surprise revealed at this meeting, however, was the availability of cobalt-60.

The Cobalt-60 Crisis

Dr. Paul Abersold from the AEC and Dr. Allen Lough from Oak Ridge opened the meeting with a discussion about the limited supply of cobalt-60 and what would be available from the Oak Ridge reactor. Lough presented the list of cobalt-60 sources being prepared at Oak Ridge, including their expected activity, specific activity, and physical dimensions. He thought that the ultimate maximum specific activity expected from the Oak Ridge reactor would be 2 curies per gram. The cost of a 500-curies source would be $2,600. Grimmett's design called for a 1-cm x 4-cm x 4-cm cobalt-60 source of approximately 1,000 curies. This was a critical factor, because it meant that the specific activity of the source had to be around 7 to 8 curies per gram, far in excess of the 2 curies per gram promised by Dr. Lough. It was apparent, therefore, from the beginning of the meeting, that the supply and availability of suitable sources of cobalt-60 from Oak Ridge for treatment machines was in question. In fact, Abersold went further and said that future deliveries of cobalt-60 could in no way be guaranteed because irradiations for medical purposes did not have high enough priority over other projects. The clear implication was that the top priority for the reactor was military use.

Dr. M. H. Thomas, then chief of the Radioisotope Branch at the Canadian AEC Chalk River reactor in Ontario, Canada, described the availability of cobalt-60 in Canada, which was in stark contrast to that at Oak Ridge. At Chalk River, specific activities in the range of 2.3–6 curies per gram were available, and sources that were currently being irradiated would have higher specific activities, some in the range of 27–40 curies per gram and others in the range of 18–33 curies per gram, yielding a total activity of 3500 curies. There were two cylinders of cobalt (3.8 cm in diameter and 3.8 cm high) being activated for six months that were expected to have a specific activity of 14 curies per gram yielding a total activity of 2520 curies that Thomas estimated as being equivalent to 1200 curies of unshielded cobalt-60. The cost of these sources would range from $3000 to $4000 each. He reported that the Canadian AEC would consider the activation of any specific cobalt source submitted to them, provided those sources met the Canadian requirements for insertion into their reactor, but he explained that deliveries of cobalt-60 could not be guaranteed as civilian production was a second-order priority, again presumably to military use.

Dr. Grimmett described his design in a paper entitled, "The Use of Coblt-60 in Medicine" presented at M. D. Anderson's third annual symposium on fundamental cancer research in May 1950, and a wooden mockup of his 1000-curie irradiator was displayed at the meeting. The paper was then published in the 1950 winter (Oct.-Dec.) issue of the *Texas Reports on Biology and Medicine* as "1000-Curie Cobalt-60 Irradiator" (Grimmett,1950). This was the first published paper on the design of a cobalt-60 unit.

Thomas announced that the Eldorado Company in Canada was planning to market a 1200-curie cobalt-60 unit for medical purposes at a cost of $25,000 and showed a preliminary drawing of the unit; however, no further details were given. Abersold then reminded the attendees that under existing U. S. laws at that time, all purchases of radioactive isotopes from outside the country had to be approved by the U.S. AEC.

Impact on the M. D. Anderson Hospital Unit

When Drs. Fletcher and Grimmett returned to Houston they reported, that at the meeting, the choices of a design for the cobalt-60 unit had been narrowed to those submitted by M. D. Anderson Hospital and Tracerlab.

Grimmett summarized the effect that the meeting would have on the design of his unit, addressing the question raised by the problems associated with the supply of cobalt-60. He suggested that the Canadian AEC should be asked, through Dr. Brucer, if they would activate eight pieces of cobalt, each 2 cm x 2 cm x 0.25 cm, and an agreement was made for the General Electric Company to build the unit in Milwaukee, WI.

Grimmett's Paper and the Problem of Getting Cobalt-60

Dr. Grimmett described his design in a paper entitled, "The Use of Coblt-60 in Medicine" presented at M. D. Anderson's third annual symposium on fundamental cancer research in May 1950, and a wooden mockup of his 1000-curie irradiator was displayed at the meeting. The paper was then published in the 1950 winter (Oct.-Dec.) issue of the *Texas Reports on Biology and Medicine* as "1000-Curie Cobalt-60 Irradiator" (Grimmett,1950). This was the first published paper on the design of a cobalt-60 unit.

The paper was a reprieve of his 1937 *Nature* paper. He showed a comparison of the radiation spectrum of a 3-MeV X-ray tube

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with the gamma rays of cobalt-60 and radium. By this time, Grimmett knew all the appropriate characteristics of cobalt-60. The values he quoted for the gamma ray energies, half-life, and exposure rate constant were very close to the accepted values in use today. The unit, however, was a far cry from the simple suggestion he made in his 1937 paper that the artificial radioactivity *"... could be inserted…into a radium unit of conventional design and used for treatment in place of radium."* With 1000 curies, the source could be moved further away from the patient surface than the 5–10 cm required for the radium units; Grimmett chose 50 cm. This unit would therefore have a superior depth-dose compared with the kilovoltage X-ray machines then in use, fulfilling an advantage he had suggested in the 1937 paper. He concluded that, *…Cobalt-60 may be considered 'equivalent' to a 2 MeV X-ray tube."* He also designed the unit with a small source size, a 2-cm cube, arguing that with the extended treatment distance and a smaller source size, the radiation beam produced by the unit would have a much smaller yet well-defined penumbra—features the radium units did not have. He also understood that it would be inherently dangerous to move 1000 curies from a storage safe to the treatment unit pneumatically, as he had done with his radium units.

> *"The pneumatic system of propelling the radioactive material by air pressure to and from a storage safe was considered and rejected because it may on rare occasions break down. A breakdown with 1000 curies of Cobalt-60 would be intolerable."*

The new unit, therefore, was self-contained with sufficient shielding to make it safe to work around while setting up patients, with the leakage radiation not exceeding the then permissible dose rate of 0.3 roentgens per week.

In the paper, he alluded to the problem of activating a small volume of cobalt to the high activity levels required and concluded that, *"To get the desired activity into this small volume, it will be necessary to use a high neutron flux, such as is available in the Canadian pile at Chalk River."*

This turned out to be a serious problem. Although 1000 curies had been suggested as the activity of the source at the initial meeting between Grimmett, Brucer, and Abersold the previous year in Oak Ridge, the fact of the matter was that 1000 curies was not available and certainly not in the small size required for the cobalt-60 unit, nor could Oak Ridge produce such a source in a reasonable amount of time. Brucer therefore worked on getting the cobalt source irradiated in the Canadian reactor. He and Grimmett had finalized the source configuration as 2 cm x 2 cm x 1 cm with four individual wafers of cobalt, each 2 cm x 2 cm x 0.25 cm. This was half the size of Grimmett's original suggestion of a 2 cm x 2 cm x 2 cm source; such a large source would have had too much self-absorption, so the source height was cut in half, which again required the specific activity to be increased. Obtaining high-grade cobalt-59 was hard enough, but nothing compared to the bureaucratic nightmare imposed by the AEC and its concerns for secrecy and rigid import-export regulations before the stable cobalt-59 wafers could be delivered to the Chalk River reactor in June 1950. The anticipated time for the source to reach 1250 curies was ten months.

He was impressed by the small size of the unit that had resulted in the use of Hevimet. But he and Kerman did not like the positioning of the mechanism for rotating the source that was planned for the side of the unit. They believed that this would interfere with the clinical set-up for some patients.

Progress

Much of the unit was to be fabricated out of a tungsten alloy known as Hevimet, the same material Grimmett had used in England to shield the radium units. On March 27, 1951, General Electric informed Grimmett that they were having trouble machining the Hevimet and that some design changes might be necessary. On April 4 and 5, 1951, Grimmett visited the General Electric factory in Milwaukee, with H. Kerman, the radiation oncologist from the University of Louisville Medical School who was on loan to ORINS, to observe the progress being made in the construction of the machine. Grimmett reported in detail on this visit:

Figure 5. The finished unit,1951, being inspected by Gilbert Fletcher, Marshall Brucer, and Dale Trout (General Electric).

> *"We found much to praise, and little to criticize in the progress which G.E. has made. Our objections were carefully weighed, and modifications proposed to meet them."*

He was impressed by the small size of the unit that had resulted in the use of Hevimet. But he and Kerman did not like the positioning of the mechanism for rotating the source that was planned for the side of the unit. They believed that this would interfere with the clinical set-up for some patients. Grimmett therefore proposed a one-sided suspension mount, with the source-rotating

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mechanism placed on top of the unit. This eventually became the design that was used.

Questions About the Source

The project was moving along, and the unit was scheduled for delivery by June 9, 1951; however, the cobalt-60 sources were not yet up to full activity, and a controversy over the sources was brewing. There were frequent rumors that the Eldorado Mining Company was offering, on the open market, cobalt-60 sources and teletherapy units for delivery in 1951. But only three high-activity sources were known to be in preparation: One each for the two Canadian treatment units and the third for the ORINS/M. D. Anderson Hospital machine. The ORINS/M. D. Anderson Hospital group became concerned that they might lose out on their source, so much so that Kerman and Brucer went to Ottawa to sort out the situation, There they were assured that they were going to receive their source as planned. They took the opportunity while in Canada to go to Saskatoon and visit with Harold Johns and Sandy Watson, the radiation oncologist, to see John's cobalt-60 unit.

Kerman reported that:

> *"The unit's mechanism was very similar to that designed by Grimmett. The head was larger since Johns was using lead shielding and Grimmett had specified Hevimet. Johns collimating device seemed superior to the heavy cones that were… designed for the Grimmett unit."* (Kerman, 1995)

The ORINS/M. D. Anderson Hospital sources were calculated to have a combined strength of only 800 curies by April 1951 and would need additional irradiation; however, when they were removed in June their activity was found to be only 650 curies and it would take an additional 150 days to reached the desired strength of 1250 curies. It was therefore decided to leave then in the reactor for another six months to come up to a higher activity.

The delay in the delivery of the ORINS/M. D. Anderson source required some revisions in the plan. The machine was shipped from Milwaukee to Oak Ridge, and because it was ready for testing, an arrangement was made in August 1951 to borrow a 200-curie source that had been prepared at Oak Ridge for Dr. Max Cutler of the Chicago Tumor Institute (Fig. 5).

In July 1952, the ORINS/M. D. Anderson source was finally released from Chalk River to Oak Ridge where the unit underwent further testing for another fourteen months. By September 1953, the construction of the new hospital in Houston was far enough along that the cobalt-60 unit could finally be shipped to Houston. By February 1954, patient treatments on the unit began a few weeks before the new hospital formally opened.

It is ironic that on the same day the *Newsweek* article was published, Monday, May 28, 1951, the *Houston Chronicle* announced Grimmett's death.

Tragedy

In the May 28, 1951 edition of *Newsweek*, the major article in the Medicine section was entitled "Cobalt 60 Therapy." In the article it stated that:

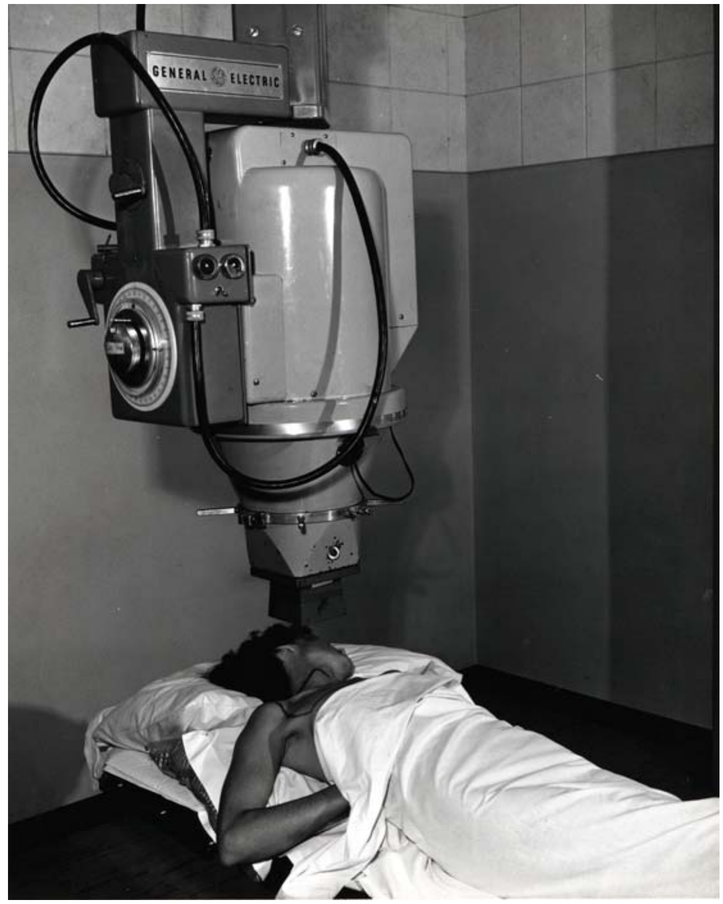

Figure 6. The MDAH cobalt unit in use in the hospital.

> *"…the medical division of the Oak Ridge Institute of Nuclear Studies and the General Electric X-Ray Corp. of Milwaukee are now cooperating in designing and testing a 1000-curie radiocobalt therapy unit, which has been authorized by the Atomic Energy Commission."* (Newsweek, 1951)

The article went on to say:

> *"When its safety has been determined, the unit will be installed at the M.D. Anderson Hospital for Cancer Research, Houston, Texas. There a series of long-range studies will be made, pointing to the development of special techniques for irradiating deep-seated tumors."*

It is ironic that on the same day the *Newsweek* article was published, Monday, May 28, 1951, the *Houston Chronicle* announced Grimmett's death. The headlines were:

> *Doctor Grimmett, Cancer Expert, Dies Suddenly*
> *Dr. Leonard G. Grimmett, 49, eminent physicist whose work in cancer research at M.D. Anderson Hospital, opened a whole new field of treatment of cancer, died of a heart attack at 1:10 a.m. Sunday at his home, 3238 Ewing."*(Houston Chronicle, 1951)

Grimmett never got to see his cobalt-60unit in use. It was eventually loaded with a 2000-curie source, and the treatment distance was extended to 75 cm (Fig. 6), and was used clinically at M. D. Anderson Hospital until 1963.

(Continued on page 54)

CAMPEP Board Retreat: March 3-4 2008

Submitted by: Peter Dunscombe, Vice President CAMPEP
& Ervin Podgorsak, Board Member, CAMPEP

This is the second year that the CAMPEP Board plus Committee Chairs (www.campep.org) have held a retreat. Regular meetings of the Board are held at the summer AAPM and fall RSNA annual meetings but the time available is generally insufficient to deal with the many complex issues arising in the basic education, training and continuing education of medical physicists. This years' retreat was held at the M.D. Anderson Hospital in Houston. Besides the Board Members and Committee Chairs, representatives of the AAPM, ABR and AAPM staff were in attendance.

Dr. John Hazle, CAMPEP President, will provide a full report of the retreat later. In the meantime we will outline the issues which were discussed.

The accreditation of medical physics graduate education programs (M.Sc. & Ph.D.) is proceeding smoothly. There is growing interest from educational institutions across North America in having their programs accredited. The number of residency programs applying for accreditation is increasing in preparation for changes in ABR examination eligibility criteria slated to take effect in 2014 (www.theabr.org/Policy_Pri_CAMPEP.htm). However, it is felt that the current guidelines for preparation of accreditation applications are not as clear as they could be. The guidelines will be reviewed. The accreditation of Continuing Education programs (the COMP annual meeting is one of these) is a very active area which has been heavily resourced, particularly by the AAPM. Further developments to enhance the ease of use are in the works.

Accreditation of professional doctorates, as means of meeting the demand of ABR eligible medical physicists from 2014 onwards, was a topic of lively discussion. Professional doctorates, of which currently there are two such programs either running or under development in the US, are built upon Masters level coursework and a clinical residency.

The retreat wound up with a discussion of the budget particularly with regard to the medium term financial stability of the CAMPEP and its contribution to the quality of patient care in radiation therapy.

John Hazle will expand on all of these issues when his full report of the CAMPEP retreat is published.

Cobalt-60 The M.D. Anderson Perspective...continued

(Continued from page 53)

Conclusion

In the final paragraph of his 1950 paper, Grimmett wrote:

> *"It is our eventual hope to produce a simple, cheap, and reliable machine, needing no servicing or replacement, apart from the replenishing of the source every five years or so, which will enable monochromatic gamma-rays to be tried for the first time in cancer treatment. The cost is difficult to estimate at this stage, but will probably be in the region of $30,000. It would seem to be a sound way of using atomic products, which should bring the benefits of high-voltage radiation within the reach of the ordinary hospital."*(Grimmett, 1950)

Grimmett's predictions about the use of cobalt-60 units proved to be true. Thousands of units have been built and used worldwide and millions of patients have been treated on them. Hundreds of units are still in use.

Acknowledgments

Unless otherwise noted, the figures, photographs, and italicized quotations are from institutional archives and manuscript collections held in the Historical Resources Center, Research Medical Library, University of Texas M. D. Anderson Cancer Center. The assistance of archives staff is greatly appreciated.

The help of the staff of the UNESCO archives in Paris is also acknowledged.

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Letter to the Editor: CNSC, Politics, and Safety

Submitted by: Marco Carlone & Alasdair Syme
Cross Cancer Institute, Edmonton AB

The subjects of radiation protection and licensing of nuclear facilities rarely capture the public attention. However, recently there were some controversial developments regarding Nuclear Safety at the Chalk River nuclear reactor that were reported in most major Canadian news agencies. These events provide an opportunity for the Medical Physics community in Canada to contribute positively to public understanding of nuclear safety, how the risks associated with nuclear materials are managed, and how they are counterbalanced by the benefits to society that they bring.

The National Research Universal (NRU) reactor at Chalk River has been in service for more than 50 years. It was originally scheduled to be decommissioned at the end of 2005, however delays in the construction of reactor facilities that were to replace NRU forced AECL to request permission to continue its operation beyond 2005. The CNSC granted the extension (from August 1, 2006 until October 31, 2011) but required AECL to implement seven critical safety upgrades to the facility. After AECL informed the CNSC that the upgrades had been performed, the license was granted. Over the course of a number of meetings and discussions between AECL and the CNSC, AECL revealed that they had not in fact implemented one of the requirements of the license. The CNSC requested a safety assessment be performed by AECL. On November 19, 2007, AECL shut down NRU for regularly scheduled maintenance. During the shutdown, AECL agreed that the operation of the reactor without this system in place posed a potential risk and as such, decided to extend the shutdown of NRU until the issue could be resolved*. This is contrary to some media reports that suggested that the CNSC shutdown the reactor. It is entirely possible, however, that after AECL revealed the safety risk, the CNSC would not have permitted the restart of the reactor (at least not without a complete safety evaluation).

The unplanned extended shutdown of the NRU resulted in considerable consequences since it is one of the world's leading suppliers of medical radionuclides, including ^{99}Mo, which is used to generate ^{99m}Tc, an often-used radionuclide in Nuclear Medicine imaging. The result, according to news reports, was a world wide shortage of this and other radionuclides, causing delays and cancellations of many medical exams and treatments.

In order to resolve this difficult situation, the Federal Government intervened, and, by an act of Parliament (bill C-38), ordered the NRU to be re-opened. In its public comments, the Federal Government justified its decision by stressing that the social consequences of shutting the reactor were severe, and that human quality of life was jeopardized by the lack of access to needed medical exams. The tension caused by this development escalated, and this lead to the dismissal on January 16, 2008 of the head of the CNSC, Linda Keen, by Natural Resources Minister Gary Lunn.

We consider that there are two issues that are of interest.

Firstly, there is a political issue regarding the Federal Government's relationship with the operation of an arms length commission. The CNSC is responsible for upholding the *Nuclear Safety and Control (NSAC) Act*, and is supposed to operate at arms length from the federal government. This principle was clearly violated in this case and the implications of these actions should certainly be debated. However it is not necessarily an issue of importance to COMP and its membership.

However, there is a second issue regarding radiation safety which we believe should be of importance to COMP and its members. As Medical Physicists, we have in-depth knowledge of the Canadian Nuclear Safety legislation and the principles behind the legislation. The *NSAC Act* became effective May 31, 2000, and the associated Radiation Protection Regulation is largely based on recommendations of the ICRP in their report 60. Central to both the legislation and the ICRP recommendations is the concept of ALARA, which states that the magnitude of individual doses, the number of people exposed, and the likelihood of incurring exposure be kept as low as reasonably achievable, social and economic factors being taken into account.

Both the ICRP recommendations and the *NSAC Act* specify methods to keep doses low. These methods include management control over work practices; personnel qualification and training; control of occupational and public exposure to radiation; and planning for unusual situations. However, these documents provide very little guidance and few recommendations as to how to implement the complimentary side to ALARA, which is that social and economic factors should be taken into account.

In our view, it is this deficiency in the implementation of the *NSAC Act* which has contributed to the controversy regarding the recent situation at the Chalk River Nuclear facility. The lack of radionuclides for medical imaging exams has clear social and economic consequences. How to quantify these consequences, and determine how they balance the risks of a nuclear safety concern are not well defined.

While the CNSC is expected to act independently of the government, the government expects that the nuclear industry will still function under the regulation of the CNSC. Although Minister Lunn did not use the acronym specifically, his letter to Linda Keen implied that the CNSC had not appropriately weighted the social and economic consequences component of the ALARA principle in its dealings with AECL. Whether or not this is true in this particular case is beyond our ability to assess. It is nonetheless of interest to those who work in Class II nuclear facilities because our interactions with the CNSC also come with social and economic consequences. The more stringent the regulators become, the greater the cost incurred for the implementation of the regulations. We would suggest that while it is fair for the CNSC to introduce new regulatory requirements, it is also fair for the affected stakeholders to ask the CNSC to justify the requirements by reviewing the expected reduction in detriment in the

(Continued on page 56)

(Continued from page 55)
context of the social and economic consequences they will incur.

It is very difficult to determine the point at which efforts to reduce dose become counter productive to society, and impose more harm in terms of social and economic terms than good in terms of reduction of dose. The example of the closure of the NRU reactor takes this dilemma to an extreme point, and so it should not be surprising that it resulted in so much controversy. The debate that followed the NRU closing clearly posed the question: Were the safety considerations of the NRU reactor more dangerous to society than the lack of radionuclides that resulted when it was shut down? Although we did not hear the term ALARA in the media reports, it is clear that this was the subject of the debate.

With the public now aware of this problem, an opportunity presents itself. Is this a good time to propose changes to the way the ALARA principle is realized? This could be accomplished through an amendment the *NSAC Act* or through changes to the implementation of the Act by the CNSC. The objective of these changes would be to ensure that the regulation of nuclear safety achieves a proper balance between risk and benefit; in other words, to provide more emphasis on the social and economic factors that should be considered when keeping exposure ALARA.

COMP is the advocacy body for Medical Physicists in Canada. COMP and its members have a clear stake in nuclear safety and how it is managed by the CNSC. While most COMP members are more familiar with Class II Nuclear Facilities, the underlying basic-principles of radiation safety apply to both Class I and II facilities.

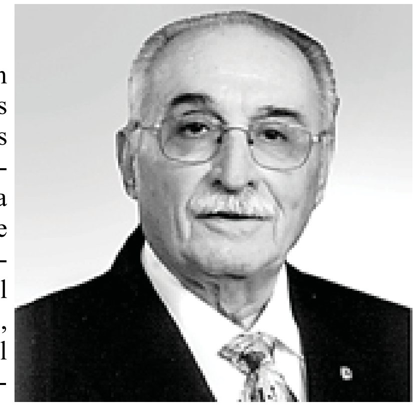
By our code of ethics, we have a duty to promote and safeguard the interests of the public and to advise authorities, governments, and agencies on public policies affecting the safety, quality, and economics of all applications of physics in medicine. This includes nuclear safety. We believe that COMP should use this opportunity to actively engage the public, and public policy makers on the fundamental principles of Nuclear Safety, and how the public interest could be better served by a different implementation of the ALARA principle.

Marco Carlone & Alasdair Syme
Cross Cancer Institute
Edmonton, Alberta

[* Information taken from the letter written by former CNSC Head Linda Keen to Minister of Natural Resources Gary Lunn]

In Memoriam

Dimitrios "Smokey" Smocovitis (1929-2007)



Passed away at sunset on December 17th with his family and friends at his side after a courageous battle with cancer. It was a familiar foe: for 28 years he fought it as medical physicist in the Windsor Regional Cancer Center. From 1966, when the field of medical physics was still in its infancy, until his retirement in 1994, he was part of a team of cancer workers applying novel radiation therapies in its treatment. Before then, he was an inspirational gymnasium professor at Neapoli, Greece (1954-1955) and then the Greek community school in El Mansura, Egypt (1955-1962). He taught scores of students to lead lives full of integrity, honesty, and love and to pursue their passions especially in areas of science, medicine, and engineering. His interest in science, especially astronomy and physics, manifested itself early; he had a life-long respect for precision, and a technical virtuosity that lent itself just as readily to the laboratory as to the household. Born in Grammeni (near Lamia), Greece in 1929, he came from a family of farmers, landowners and railroad engineers who respected education. He obtained his undergraduate degree in physics and astronomy from the National and Kapodistrian University of Athens in 1952. Between 1952-54 he served as Lieutenant in the Greek Army Corps of Engineers. In 1962 he emigrated to Canada obtaining an MSc degree in 1966 in medical physics from the University of British Columbia under the distinguished physicist Harold F. Batho. He belonged to the Canadian Radiation Protection Association, the American Association of Physicists in Medicine, the Canadian Association of Physicists, the Canadian Organization of Medical Physicists, the American College of Medical Physics and served as Secretary-Treasurer of the Division of Medical and Biological Physics of the Canadian Association of Physicists. In 1954, he married the love of his life for 53 years, Alexandra (nee Karabogias); they celebrated 50 years of their life together with friends and relatives in Windsor in August 2004. In addition to his wife, he is survived by his daughter, Vassiliki Betty of Gainesville, Florida, a brother, Anastasios of Larissa, Greece, and is predeceased by a sister, Ephrosyne, also of Larissa, Greece. After his retirement, he continued his studies in cosmology, science and religion, and the history and philosophy of science. He loved Albert Einstein, whom he came to resemble in later years, but chose instead a quotation from Bertrand Russell for his epitaph: "A good life is one inspired by love but guided by knowledge." It was a fitting tribute that he passed away at the Metropolitan Campus of Windsor Regional Hospital, where he had been a familiar figure for nearly thirty years, and under the care of an attentive group of physicians, nurses, caregivers, and friends. His family especially thanks Dr. David J. Paterson for thirty years of care. If desired, memorial donations may be made to Windsor and Essex Cancer Centre Foundation. Memories may be shared online at www.FamiliesFirst.ca

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Kanata, ON K2K 2P4
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Fax: (613) 599-1949
E-mail: nancy@medphys.ca

DEADLINE : APRIL 30, 2008

TThe results will be reported at the Annual General Meeting in Quebec in July 2008.
(See Articles IV.B(6&7) of COMP Bylaws)

DATE LIMITE : 30 AVRIL 2008

Les résultats seront rapportés à la réunion générale annuelle à Quebec en julliet 2008.
(Voir articles IV.B(6 et 7) des règlements de l'OCPM)

Nominee :

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Sponsors: 1)

2)

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La mise en candidature doit être signée par deux membres actifs et par le(la) candidat(e) qui indique par sa signature qu'il(elle) accepte la mise en candidature.

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