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Bulletin of the International Organization for Medical Physics

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## President's Message – Prof. Azam Niroomand-Rad, Ph.D., President, IOMP



Prof. Azam Niroomand-Rad, Ph.D.,  
President of IOMP

Alas, all good things must come to an end. It has been truly an honor and privilege for me to serve as your President since August 2003. The three-year term of elected IOMP members (including myself) will come to an end by mid-week during our Triennial World Congress (WC) meeting in Seoul, Korea (August 27 - September 1 2006).

In this last President's report, I would first like to thank all those people who have helped our organization overcome many unforeseen obstacles during our journey from Sydney to Seoul. Thanks to everyone's hard work, this has been quite a productive period for our organization. I am especially indebted to the members of Executive Committee (EXCOM), Committee Chairs / Members, and the MPW Editor for all their tireless efforts on our organization's behalf. With the ever increasing use of email communications and virtual meetings, the work load required of each position has dramatically increased. As such, the number of voluntary hours that have been poured into achieving our goals has been immense.

In the past three years, so many new initiatives have been launched that I cannot possibly cover them all in this short report.

I would, however, like to capture some of the more significant ones for ease of reference. Details of these initiatives are available in the minutes of our virtual meetings at our web site ([www.iomp.org](http://www.iomp.org)).

In summary:

- Our resubmitted petition to the International Labor Organization (ILO) for classification of medical physics profession on International Standard Classification of Occupations (ISCO) within sub-group 222 Health Professionals (except nursing) was preliminarily approved. The feedback received from a web-based questionnaire from national governmental agencies was very positive in supporting our petition. We are hopeful that the ILO will finalize their decision in 2007 in preparation for the ISCO-08.
- We adopted mid-term International Conferences in Medical Physics (ICMP) in collaboration with our regional Chapters. Our first such collaboration with EFOMP and Germany (as our 14th ICMP) was very successful. We hope to have our 16th ICMP in 2007/2008 if possible.
- We prepared our first "Strategy Planning Document (2006-2012)" for adoption and approval by the Council at the WC-2006 in Seoul. This document has been sent to all Council Members and is available at the IOMP web site for your review and comment.
- We increased our national adhering membership by two. Cameroon and Czech Republic have recently joined us. At present we are also working with our colleagues in Bahrain, Ethiopia, Kenya,

Libya, Tunisia, and UAE to assist them in formation of their national medical physics organizations.

- We created a position within Finance Committee known as "Corporate Liaison Officer" (CLO). As our first CLO, Dr. Mehrdad Sarfaras was able to re-establish our links with many vendors in US. At present, Dr. Saiyid M. Shah from Indiana has agreed to help us in this endeavor.
- We continued to publish Medical Physics World, thanks to Editor Dr. Ishmael Parsai. We are now aiming for paper-free publications by 2010.
- We established or re-established at least 8 new libraries and maintained 69 active libraries in 42 developing countries, under the care of Curator of Libraries: Dr. Allan Wilkinson.
- We continued to organize 6 IOMP Sym-

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# Secretary General's Report –

Peter H.S. Smith, B.A., Ph.D.

World Congresses are the major opportunity for those involved in IOMP to meet together, and at Seoul in August there will be a plethora of committee and other formal meetings, alongside the scientific and social programme. However, even more important in this age of virtual electronic meetings, is the chance for getting to know colleagues and having informal chats.

There will be two IOMP Council meetings – the first on the Sunday (27 August) in the afternoon and the second on the following Wednesday, also in the afternoon and immediately following the General Assembly. The General Assembly (mainly ceremonial but also an opportunity for general discussion) is open to all IOMP members (individual medical physicists who are members of their national organisations) but they may also attend the Council meetings.

One of the major discussion points at the Council meetings will be the future direction and priorities for the IOMP. Comments have now been received from Council members on the consultation document 'Strategy Planning Document' and these are being reviewed. A strategy document incorporating the comments received is being prepared and will be circulated to Council members for discussion and approval at Seoul. Several themes and priorities are already clear – one is that IOMP should provide a comprehensive on-line database of key medical physics scientific documents and that the IOMP website should be substantially upgraded and incorporate a resource centre for educational and training material. Much of the material will be through links to other sites. At a more general level, IOMP needs to become more relevant to the ordinary medical physicist and also provide additional help to both medical physicists and their national organisations in devel-

oping countries. Whilst finance is always a limitation (and new sources of funding must be found), the IOMP ought to be able to achieve more given that its membership is over 16,000. We must find additional ways of tapping into the goodwill and expertise within our membership.

There are an overwhelming number of scientific activities at the Congress - overall there are 25 tracks, 10 plenary speakers and a range of special programs and short courses. IOMP Chairs and others have been involved in organising a number of special sessions and programmes. There are two joint IOMP symposia – one with International Commission on Radiation protection (ICRP) and the other with the International Society of Radiology (ISR). Apart from the purely scientific tracks, there is a track devoted to education, training and professional matters.

The delayed '2005' virtual Council meeting was eventually held in January this year and the draft minutes of the meeting are on the IOMP website ([www.iomp.org](http://www.iomp.org)). The main reason for the delay was a special Council meeting last November which agreed that the elections for the officer posts for the 2006 – 2009 period should be held three months prior to the Congress by electronic ballot rather than at Seoul. It is also hoped that the new chairs will have been agreed upon, subject to ratification by Council, well before August so there should be no delay in the new Executive and Committees starting work at the Congress (handover to the new regime is at the General Assembly).

The Executive Committee had a virtual meeting in February and notes of that meeting are also on the IOMP website.

I look forward to meeting many of you at Seoul.

## MEETING ANNOUNCEMENT

**Organizer:** International Atomic Energy Agency (IAEA)  
**Title:** International Conference on Quality Assurance and New Techniques in Radiation Medicine  
**Place:** Austria Center, Vienna, Austria  
**Date:** 13-15 November 2006

For more information please direct your web browser to:

<http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=146>

### Officers and Council of IOMP - 2006

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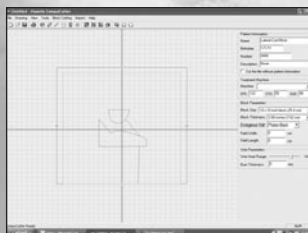
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## President's Message – (continued from page 1)

- posia, sponsored 3 scientific programs and endorsed one workshop under the guidance of the Science Committee Chair, Dr. Cari Boras.
- We continued to sponsor 7 and endorse 3 educational programs (with no financial support) under the guidance of Education and Training Chair, Prof. Slavik Tabakov.
  - We formed a new committee – International Commission on Medical Physics (ICoMMP) – to provide a link with other physicists via affiliations with the International Union for Pure and Applied Physics (IUPAP). All interested medical physicists are invited to participate in the first meeting of this committee in Seoul.
  - A new Award (IUPAP Young Scientist Award in Medical Physics) was established. This award will be granted for the first time in Seoul.
  - We continued negotiation with Medical Physics Journal to have it recognized as an IOMP Official Journal.
  - We co-sponsored the World Conference on Physics and Sustainable Development (WCPSD) in Durban, South Africa (November, 2005). The IOMP was recently identified as the custodian of \$10,000.00 in funds left over from this conference. We have been asked to use these funds as seed grants towards accomplishing the stated conference goals in Physics and Health. However, if there are any other projects that are consistent with the conference objectives – namely the application of physics in sustaining development in medicine / health – we encourage you to submit a proposal for seed money as soon as possible. For your reference, below is a list of the assigned Facilitators of the five projects identified in this theme:

1. Facilitator: Perry Sprawls for project entitled: “Physics and Engineering Resources for Healthcare and Development”.
2. Facilitator: Slavik Tabakov for project entitled: “Curriculum Development and Program Validation for Physicists in Medicine”.
3. Facilitator: Debbie van der Merwe for project entitled: “Development of Regional Training Centers for the Physics of Radiation Therapy”.
4. Facilitator: Arthur Boyer for project entitled: “Development of a web-based Training Tool for Radiation Therapy Physics”.
5. Facilitator: IOMP for project entitled: “Recognition of Physicists in Health”.

Lastly, I would like to emphasize that while the IOMP continues to be strong scientifically and professionally, its finances need to be strengthened. We cannot meet the ever-increasing needs of our members based purely on volunteer activities. We should aim for a permanent Head Quarter; independent of Secretary General Office. With assistance from professional services, we should maintain and improve on our web site. To improve our financial resources, there are two main avenues available to us: i) better collection of membership dues (please make sure your national membership dues are paid on timely manner), and ii) assistance from a greater number of Corporate Members (which we hope to achieve through the assistance of our new Corporate Liaison Officer, Dr. Shah).

We have made great strides over the past three years and, I am confident we will continue to do so under the leadership of incoming President Barry Allen and his team of Officers. I wish them (and the greater membership of our organization) every success.



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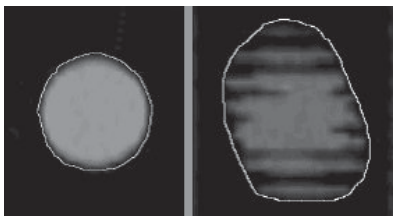
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AAPM October, 2004 poster

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# Report of the Scientific Committee – Cari Borrás, D.Sc., IOMP Science Committee Chair

The Chair of the Science Committee (SC) represented the IOMP, together with Dr. Slavik Tabakov, Chair of the Education and Training Committee, at the Second Steering Panel Meeting of the *International Action Plan on the Radiological Protection of Patients*, in Madrid, Spain, February 8-10, 2006. The Plan, led by the International Atomic Energy Agency (IAEA), is co-sponsored by several international intergovernmental organizations and scientific associations such as the IOMP. Its purpose is “to promote education and training, provide assistance, render services, foster information exchange and coordinate research in the areas of diagnostic and interventional radiology, nuclear medicine and radiation and interventional radiology, nuclear medicine and radiation therapy.” In its second meeting, the Panel reviewed the work performed by IAEA, including its publications and educational CD-ROMS on radiation protection in digital radiology, computed tomography, cardiology, PET/CT and pediatric radiology, and on accident prevention in radiation therapy. Although these materials are widely available, to make them accessible to tens of thousands of regulators and hundreds of thousands of health professionals is a major challenge. To bridge the information gap, the IAEA is developing a website which will have information on radiation safety aspects of medical exposures for health professionals, member states and patients. This development was considered the highlight of the Action Plan.

The second most important issue discussed in the Meeting was the fact that the *International*

*Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources* (BSS), the standards on which most regulatory agencies based theirs, is in the process of being revised. The Panel made recommendations for changes in the medical exposure requirements. Recognizing that patient protection is the responsibility of multiple health professionals, the new BSS should specify adequate personnel, the competence and level of responsibility of each staff member, and the role of medical physicists as “qualified experts”, a term which needs to be clearly defined.

Due to the rapid expansion of medical uses of ionizing radiation world-wide, as well as extensive changes in technology, the Panel recommended another international conference on patient protection, no later than in 2009.

The SC has also been very busy organizing three IOMP Symposia at the forthcoming World Congress on Medical Physics and Biomedical Engineering in Seoul, Korea August 27-September 1. One IOMP Symposium is on *Medical Physics in Africa* and will have speakers from the IOMP, the IAEA and institutions in Africa and in the United States. Proposals for an International Center for Medical Physics and for a Research Physics Center with a Medical Physics component will be presented, as will successful international projects already under way. Caveats about introducing high-tech equipment in developing countries and sources of financial support will be discussed.

The second Symposium is jointly sponsored by the IOMP and the International Commission on Radiological Protection (ICRP). It is patterned after the one in Nüremberg, at the ICMP2005, which was so successful. The theme is *Patient Radiation Safety Issues in Digital Imaging*, and there will be two speakers from the ICRP – one of them the ICRP’s Scientific Secretary – and two from the IOMP. The recent ICRP publications on medical exposures, especially in digital radiology, will be presented; patient dose reporting will be discussed, and the impact of digital imaging on radiation safety standards, explored.

The third Symposium is jointly sponsored by the IOMP and the International Society of Radiology (ISR). This will be a fourth joint scientific session to be held by the IOMP and the ISR. The previous occasions were at the International Congresses of Radiology in Cancun, Mexico (2001) and in Montreal, Canada (2004), and at the WC 2003 in Sydney. The theme is *Clinical and Physical Problems in Angiography*. Subjects involving benefits and risks in angiography, image quality requirements, patient dose management, and the challenge of developing countries in establishing angiography training standards, will be debated by ISR radiologists and IOMP medical physicists.

The possibility of holding another ISR/IOMP Scientific Session at the forthcoming International Congress of Radiology in Cape Town, South Africa, in September 2006, is being explored.

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## Report from the Education and Training Committee(ETC) –

Slavik Tabakov, PhD, Chairman IOMP - ETC

During the period October 2005 - March 2006, the IOMP Education and Training Committee voted for the support of the Workshop “Medical Physics Education and Training – a global perspective” – a satellite activity to the World Congress WC2006 in Seoul, South Korea. Short information about this Workshop (plus call for papers and financial support info) is available at another article in this issue of MPW.

Two other activities were also supported by the ETC:

1. Workshop on “Cyclotron -“PET/CT” in New Delhi, India (planned for 15-16 July 2006)

2. Course on “Advances in Radiation Therapy: IMRT and Images applications” in Buenos Aires, Argentina (planned for 22-26 September 2006)

A very successful activity in this period was the development, together with the WC2006 organizers, of a special track with 5 sessions on Medical Physics and Engineering Education & Training. This first large activity on the subject attracted more than 40 abstracts. This shows the increased importance of Education and Training and paved the way for future similar Tracks at other World Congresses. The sessions in this Track 25 “Education, Training and Professional Development” are:

1. Academic Educational Curricula and Programs
2. Practical Training Activities and Courses
3. Continuing Education and Professional Development
4. e-Learning Methods and Applications
5. Re-engineering the Educational Process for the Future

Track Co-Chairs are P Sprawls and S Tabakov. Sessions Co-Chairs are: D Fray, Sang-hee Nam, C Lewis, N Suhoverska, A Niroomand-Rad, S Cristophides, S Tabakov, A Krisanachinda, P Sprawls, M Rehani.

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# IOMP Treasurer's Three Year Report – *George Mawko, Ph.D., Treasurer IOMP*

## 1. Principal Changes over the last three years.

Shown in Section 3 below is a three year summary of the financial position of IOMP, taking in the World Congress year of 2003, to the completion of 2005. In this period there have been a number of significant changes to the way the finances of the organisation are administered and recorded.

Firstly, following the election of Professor Peter Smith as Secretary General, based in the UK, the administrative support was transferred to the IPEM office in the UK. The balance of funds was transferred from San Antonio to York (UK) and we now operate in three currencies, U S Dollars, Euros and Sterling. For the convenience of members; however, the accounts continue to be reported in U S Dollars. In addition, a substantial part of the cash funds are now held in an interest-bearing deposit account.

The format of the accounts has been changed to an Income and Expenditure basis to better reflect the financial impact of activities in the appropriate year, and also to give a better indication of the amounts owed by and to the Organisation. In addition, a start has been

made on integrating the financial affairs of Medical Physics World into the overall financial statements for the Organisation. It is intended to integrate the MPW banking arrangements into the other IOMP bank accounts during 2006.

Finally the opportunity has also been taken to subject the accounts to a more professional examination than previously. The 2004 and 2005 accounts have been subject to an independent examination by a qualified accountant, to provide improved assurance to the Officers and members of the financial integrity of the accounts.

## 2. Review of the Three Years

The three years from 2003 to 2005 have been successful financially for IOMP. Cash holdings have grown over the period from \$202,959 to \$239,076, this increase having arisen principally from a contribution from the 2003 World Congress, operating surpluses from Medical Physics World, as shown below, together with small operational surpluses in each year. Overall the cumulative surplus has grown by \$72,337 in the three years under report.

## Medical Physics World

	2003 \$	2004 \$	2005 \$
Income	30,740	34,423	47,015
Expenditure	26,240	27,836	33,026
Annual Surplus	4,500	6,587	13,989

The cumulative surplus over the last three years is \$25,076 and the Editor is to be congratulated on developing the financial robustness of the publication.

The change to an Income basis has enabled the situation on individual subscriptions to be monitored more effectively. Significant progress has been made in contacting all adhering bodies; however, it remains a constant battle to maintain contact, particularly with some of the smaller organisations.

Overall expenditure has remained stable over the three years at \$63,646 in 2003, \$64,540 in 2004, and \$63,667 in 2005. It is anticipated that expenditure will rise with the Organisation's involvement with the World Congress in Seoul in August 2006.

*(continued on page 12)*

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## Donation of Used Equipment - PRC Report for Jan.-June 2006 –

*Mohammed K. Zaidi, Program Manager, IOMP Professional Relations Committee.*

Dr. Gregory M. Price, M.S., DABR, Chief Medical Physicist, Altoona Regional Health System Altoona Hospital Campus, Department of Radiation Oncology, 620 Howard Avenue, Altoona, PA 16601-4899, USA has very kindly donated Prowess 2D RTP 3000 (Version 3.06). It has a standalone digitizer and Lumisys film scanner. It was used extensively for basic 2D treatment planning and irregular field planning and has the capability to do LDR brachytherapy planning. All manuals and software are included. The system is complete and in good working order. This TPS was shipped to Universidade do Estado do Rio de Janeiro, Rua Sao Francisco Xavier 524 - Pavilhao Haroldinho, Rio de Janeiro - CEP 20550-013, Brazil (Attn: Carlos E. de Almeida Ph.D. Professor of Medical Physics).

Fred Asprinio, Jupiter Medical Center, Radiation Oncology, Jupiter, FL, USA has very generously offered 3 units of Nuclear Associates 37-720 electrometer (dual channel) for diode measurements, Sun Nuclear PDM, patient dose monitor for diodes (4 channel), and Lumisys 75 film scanner. This equipment donation from Jupiter Medical Center,

Radiation Oncology was shipped to Norberto A. Abella Jr., Medical Physicist, Radiology Department, University of Perpetual Help Rizal Medical Center, Alabang-Zapote Road, Las Pinas City, 1740, Shipping port MANILA, PHILIPPINES.

### Used equipment needed:

Linear accelerator, mammography, automatic film processor, treatment planning systems, block cutter, patient dose monitor and ultrasound machine.

### Shipping arrangements:

The institutions that need used equipment should mention in their response that they would pay or make arrangements for shipping at a very short notice. The equipment donated to IOMP Used Equipment Donation Program is generally in good working condition as per report obtained from the medical physicist. The medical physicist is responsible to collect all necessary components, provide connection diagrams, user's manual etc., and get them packed in box sturdy enough to meet international shipping requirements and handover to the shippers. IOMP doesn't

guarantee usefulness of the donated equipment. The donation of used equipment to IOMP is sometimes tax deductible.

Dr. Ajai Kumar Shukla from India is helping me in IOMP efforts to deliver used equipment from generous donors to those who need them badly. He can be reached at Department of Nuclear Medicine, SGPGIMS, Raebarelli Road, Lucknow (UP), 226014, INDIA. His phone number is 91-0522-2668700 extension 2615 and email address [isakshukla@sgpgi.ac.in](mailto:isakshukla@sgpgi.ac.in).

Please visit our webpage as it has space for the used equipment program. Most of the equipment comes to me at a very short notice, so it may not be listed there.

If you want to donate or want some used equipment donated to your organization, please contact Mohammed K. Zaidi, Professional Relations Committee at our website [www.iomp.org](http://www.iomp.org) or [iomp06\\_mz@yahoo.com](mailto:iomp06_mz@yahoo.com).



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## Editor's Corner – E. Ishmael Parsai, Ph.D., MPW Editor

In this column we aim at providing the MPW readers some current news and information related to the fields of Medical and Health physics. Often list of references to review articles, useful websites, and summaries of current innovative advances will be provided. As always, your suggestions to enhance this column are welcomed. In addition, if you have other ideas or issues that you believe should be brought to the attention of the MPW readers, please send them to the MPW editor, Dr. Parsai, at: [eparsai@meduohio.edu](mailto:eparsai@meduohio.edu).

### Latest news on Breast Cancer:

#### Initial Results of the Study of Tamoxifen and Raloxifene (STAR) Released: Osteoporosis Drug Raloxifene Shown to be as Effective as Tamoxifen in Preventing Invasive Breast Cancer

Initial results of the Study of Tamoxifen and Raloxifene, or STAR, show that the drug raloxifene, currently used to prevent and treat osteoporosis in postmenopausal women, works as well as tamoxifen in reducing breast cancer risk for postmenopausal women at increased risk of the disease. In STAR, both drugs reduced the risk of developing invasive breast cancer by about 50 percent. In addition, within the study, women who were prospectively and randomly assigned to take raloxifene daily, and who were followed for an average of about four years, had 36 percent fewer uterine cancers and 29 percent fewer blood clots than the women who were assigned to take tamoxifen. Uterine cancers, especially endometrial cancers, are a rare but serious side effect of tamoxifen. Both tamoxifen and raloxifene are known to increase a woman's risk of blood clots. STAR, one of the largest breast cancer prevention clinical trials ever conducted, enrolled **19,747 postmenopausal women** who were at increased risk of the disease. Participants were randomly assigned to receive either 60 mg of raloxifene (Evista®) or 20 mg of tamoxifen (Nolvadex®) daily for five years. The trial is coordinated by the National Surgical Adjuvant Breast and Bowel Project (NSABP), a network of cancer research professionals, and is sponsored by the National Cancer Institute (NCI), part of the National Institutes of Health.

"This optimistic news from STAR is a significant step in breast cancer prevention," said Dr. Niederhuber who is currently providing leadership at NCI. "These results, once again, demonstrate the critical importance of clinical trials in our efforts to establish evidence-based practices." "In 1998, the landmark Breast Cancer Prevention Trial showed that tamoxifen could reduce the risk of invasive breast cancer in premenopausal and postmenopausal women by nearly 50 percent," said Dr. Wolmark, the chairman of the NSABP trial. "Today, we can tell you that for postmenopausal women at increased risk of breast cancer, raloxifene is just as effective, without some of the serious side effects known to occur with tamoxifen." Women taking either drug had equivalent numbers of strokes, heart attacks, and bone fractures. Both raloxifene and tamoxifen are known to protect bone health; it is estimated that half a million

postmenopausal women are currently taking raloxifene by prescription to prevent or treat osteoporosis. Additionally, the initial results from STAR suggest that raloxifene does not increase the risk of developing a cataract, as tamoxifen does.

"Although no drugs are without side effects, tamoxifen and raloxifene are vital options for women who are at increased risk of breast cancer and want to take action," said Dr. Ford, an associate director for clinical research in NCI's Division of Cancer Prevention. "For many women, raloxifene's benefits will outweigh its risks in a way that tamoxifen's benefits do not." The STAR researchers also tracked known menopausal side effects that occur with both drugs and monitored the participants' quality of life. The data show that side effects of both drugs were mild to moderate in severity, and quality of life was the same for both drugs. Participants in STAR are now receiving information about which drug they were taking. Women assigned to raloxifene will continue to be provided with the drug until they have completed five years of treatment. Those women assigned to tamoxifen can choose to continue taking tamoxifen or to receive raloxifene to complete their five years of treatment.

Study details include:

- STAR enrolled 19,747 women. This data analysis is based on the 19,471 women for whom complete study information was available.
- The numbers of invasive breast cancers in both groups of women were statistically equivalent. Among the 9,745 women in the raloxifene group, 167 developed invasive breast cancer, compared to 163 of 9,726 women in the tamoxifen group.
- More than half of the women who joined STAR had had a hysterectomy and, therefore, were not at risk of uterine cancer. For those women with a uterus, 36 of 4,732 who were assigned to take tamoxifen developed uterine cancers (mainly endometrial cancer) compared to 23 of 4,712 women who were assigned to take raloxifene.
- In STAR, women in the raloxifene group had 29 percent fewer deep vein thromboses (blood clots in a major vein) and pulmonary embolisms (blood clots in the lung) than women in the tamoxifen group. Specifically, 87 of 9,726 women in the tamoxifen group had a deep vein thrombosis compared to 65 of 9,745 women taking raloxifene. In addition, 54 of 9,726 women taking tamoxifen developed pulmonary embolisms compared to 35 of 9,745 women taking raloxifene.
- The number of strokes occurring in both groups of women was statistically equivalent: 53 of 9,726 women in the tamoxifen group and 51 of 9,745 women in the raloxifene group had a stroke during the trial. There was no

difference in deaths from strokes: 6 of 9,726 women in the tamoxifen group and 4 of 9,745 women in the raloxifene group died from this event. Women at increased risk of stroke (those with uncontrolled hypertension or uncontrolled diabetes, or a history of stroke, transient ischemic attack, or atrial fibrillation) were not eligible to participate in STAR.

- While tamoxifen has been shown to reduce, by half, the incidence of lobular carcinoma in situ (LCIS) and ductal carcinoma in situ (DCIS), raloxifene did not have an effect on these diagnoses. (LCIS and DCIS are sometimes called noninvasive breast cancers.) Of the 9,726 women taking tamoxifen, 57 developed LCIS or DCIS, compared to 81 of 9,745 taking raloxifene. This result confirms data reported in 2004 in a large study of raloxifene, the Continued Outcomes Relevant to Evista (or CORE Trial).

Women who participated in STAR were postmenopausal, at least 35 years old, and had an increased risk of breast cancer as determined by their age, family history of breast cancer, personal medical history, age at first menstrual period, and age at first live birth. Before participating in the study, the women were instructed about the potential risks and benefits of tamoxifen and raloxifene and then were asked to sign an informed consent document.

STAR investigators will present additional data at the 42nd annual meeting of the American Society for Clinical Oncology (ASCO) from June 2-6, 2006, in Atlanta, Ga. This is an important and long awaited trial and it is expected that further discussion and analysis at the ASCO annual meeting will address the observed differences in toxicity and prevention of non-invasive breast cancers with the two treatment approaches. The maker of tamoxifen, AstraZeneca Pharmaceuticals, Wilmington, Del., and the maker of raloxifene, Eli Lilly and Company, Indianapolis, Ind., provided their drugs and matching placebos for the trial without charge to participants. Eli Lilly and Company also gave NSABP support to defray recruitment costs at the participating centers and to help local investigators conduct the study.

#### Saw Palmetto Fails to Improve Benign Prostatic Hyperplasia

An extract of the saw palmetto plant was no more effective than a placebo in reducing symptoms associated with benign prostatic hyperplasia (BPH), a randomized clinical trial has found. BPH is caused by an enlarged prostate gland, and millions of older men, particularly in Europe, use over-the-counter saw palmetto products to treat the condition.

The double-blind, randomized trial included 225 men over age 49; half took 160 mg of saw palmetto twice daily, and the others a placebo. After a year, the groups were similar in lower urinary tract symptoms and other objective measures of BPH, the researchers report in the February

9, 2006, issue of the New England Journal of Medicine. The study, led by Dr. Stephen Bent of the University of California, San Francisco, was funded by the NIH and the National Center for Complementary and Alternative Medicine. The negative results contrast with a number of earlier studies suggesting that saw palmetto may improve urinary symptoms caused by BPH.

To explain the discrepancy between the positive and negative findings, the researchers point out that some earlier studies had design flaws. In addition, the patients in the new study may have shared attributes that made them unlikely to respond to saw palmetto. Alternatively, the level of the active ingredient in their extract may have been too low to be effective (the active ingredient, if one exists, is not known).

The study was well designed, adequately powered, and avoided the pitfalls of previous studies by treating participants for a year, optimizing the consistency of the herbal product, and measuring the adequacy of blinding, an accompanying editorial notes. The authors raise the possibility, however, that a different preparation or dose of saw palmetto might have been effective.

### **Sentinel Node Biopsy Improves Quality of Life in Early-Stage Breast Cancer**

In the May 3, 2006, Journal of the National Cancer Institute (JNCI), investigators reported results from the first multicenter randomized trial to compare postoperative quality of life between patients with early-stage breast cancer who underwent sentinel node biopsy and those who underwent standard axillary lymph node clearance.

Standard axillary lymph node clearance involves removal of all the lymph nodes in the armpit region. The procedure can cause considerable morbidity, and most women with early-stage breast cancer do not have metastases to their lymph nodes. In sentinel lymph node biopsy, a single node that is directly connected to the tumor site by the lymphatic system is examined for metastases. If none are found, no further lymph nodes are removed.

The ALMANAC trial randomly assigned patients to two groups: 1) standard axillary clearance or 2) sentinel node biopsy with delayed axillary clearance (or axillary radiation therapy if metastases were found). Patients in the standard axillary treatment group were significantly more likely to report moderate or severe lymphedema at one, three, six, and 12 months after surgery than were patients undergoing sentinel node biopsy. Patients in the standard axillary treatment group also had greater sensory loss and nerve damage up to 12 months after surgery. Self-reported quality of life was significantly higher at all time points for patients undergoing sentinel node biopsy than for the standard treatment group.

The authors conclude that sentinel node biopsy is a safe and effective alternative treatment for patients with early-stage breast cancer. However, they caution that data on "...relapse-free and overall survival following sentinel lymph node biopsy are required before this procedure can be

accepted as the standard of care."

#### References:

1. *NCI Cancer Bulletin*, vol. 3, # 7, Feb. 14, 2006.
2. *NCI Cancer Bulletin*, vol. 3, # 19, May 9, 2006.

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*The following has been compiled by:  
Mohammed K. Zaidi, Member, IOMP  
Professional Relations Committee.*

### **VACCINE FOR CERVICAL CANCERS:**

As reported earlier on this topic, Merck is hoping to win U.S. Food and Drug Administration approval for the vaccine, Gardasil and put it on the market as early as late 2006. They had also requested the European Agency for evaluation of medicinal product. Merck and GlaxoSmithKline have been awarded rights to develop the vaccine to protect ladies with cancer of cervix. Cervical cancer strikes nearly half a million women worldwide each year and kills nearly 300,000 and about 3700 in the USA. Virtually all cases are caused by infection with Human Papilloma Virus (HPV), which is spread through sex. It will be administered at a young age so that they are protected before they had any sex. The hepatitis B vaccine has dramatically reduced the number of infections that progress to liver cancer. It is also being researched to help cure genital warts in men and women and penile and anal cancers in men. Another research worked to show how the cells can destroy unwanted proteins, it will help scientists to develop new medicines for cancer and other diseases. It is reported that they will be able to manipulate the protein degradation system in two different ways – either to prevent it from destroying proteins that boost the immune system, or to get rid of proteins that help cause diseases [The Lancet Oncology, 6/12, 2005].

### **MOLECULAR IMAGING & NUCLEAR MEDICINE:**

Molecular imaging and nuclear medicine will lead to a much greater ability to characterize diseases, diagnose them at a very early stage, treat them effectively and monitor the effectiveness of such treatments: life threatening cancer, heart and other diseases that affect million each year. Molecular imaging in clinical practice is achieved by using PET/CT, brain imaging, pediatrics, oncology and therapy, thyroid cancer, cardiovascular nuclear medicine, radiation safety, molecular and clinical brain imaging. It has applications in oncology, neurology and pediatrics. This is the topic of this year Society of Nuclear Medicine (SNM) annual meeting which is going to be held during June 3-7, 2006 at the San Diego Convention Center [[www.snm.org](http://www.snm.org)].

### **CHOLESTEROL DRUG REVERSES HEART DISEASE:**

Dr. Steven Nissen of Cleveland Clinic reports that the high doses of a powerful cholesterol lowering drug seemed to actually reverse heart disease – not just keep it from getting worse – people in the study got their "bad cholesterol-LDL" to the lowest levels ever achieved and saw blockages in their blood vessels shrink as a result. High LDL cause deposits in the arteries. It is too early

to tell whether the shrinkage of artery deposits will mean fewer heart attacks, but doctors were excited by the possibility. Total cholesterol is the sum of HDL, LDL, and VLDL has been found to correlate with cardiovascular mortality in the 30-60 year age group. [Post Register, 03/15/2006, A3].

In the past, he reported Vioxx (rofecoxib) increasing the risk of heart attacks and strokes. Vioxx was pulled off the market when additional studies confirmed that daily, long-term use of the drug could increase the risk of heart attacks and strokes. Another drug "Pargluva (muraglitazar)", an experimental type 2 diabetes drug that can lower blood sugar while also increasing the level of HDL, the so-called good cholesterol, and decreasing triglycerides, a blood fat that increases the risk of heart disease. The paper was published online on October 20 by the Journal of the American Medical Association, just two days after the FDA had sent the drug's makers an "approvable letter" that said Pargluva could be approved if the company supplied more cardiovascular safety data. On October 27, Bristol-Myers Squibb announced that it would terminate its Pargluva development agreement with Merck and will continue discussions with the FDA, but said it might stop development of the drug [JAMA, 294, 2005; Cleveland Clinic Nov 2, 2005].

### **BLADDER CANCER:**

Measurement of telomerase activity in voided urine was developed to apply to large scale screening programs for detection of bladder cancer. It is a relatively simple, inexpensive, and accurate test. A case-control study was conducted in 218 men (84 healthy individuals and 134 patients at first diagnosis of histologically confirmed bladder cancer), frequency matched by age and recruited between March 2003 and November 2004 in Italy. Urine telomerase activity was determined using a highly sensitive Telomeric Repeat Amplification Protocol (TRAP) assay. Urine samples were processed for cytological diagnosis and TRAP assay. The diagnosis of bladder cancer was based on bioptic and cystoscopic examinations. The performance of the TRAP assay to detect urine telomerase activity was compared with urine cytology as an aid to early cancer detection. Quantification of urine telomerase activity was conducted in a blinded manner. Using a 50 arbitrary enzymatic unit cutoff value, they validated the results obtained in the pilot study. In the overall series, sensitivity was 90% (95% confidence interval [CI], 83%-94%) and specificity was 88% (95% CI, 79%-93%). Specificity increased to 94% (95% CI, 85%-98%) for individuals aged 75 years or younger. The same predictive capacity of telomerase activity levels was observed for patients with low-grade tumors or with negative cytology results. The present validation study demonstrated the ability of urine telomerase activity levels to accurately detect the presence of bladder tumors in men. This test represents a potentially useful noninvasive diagnostic innovation for bladder cancer detection in high-risk groups such as habitual smokers or in symptomatic patients [JAMA, 294, 2005, 1993; JAMA, 2006, 295, 249; JAMA, 2006, 295, 998].

# IOMP Treasurer's Three Year Report –

(continued from page 8)

## 3. Three Year Summary Income and Expenditure Account

	2003 \$	2004 \$	2005 \$
<b>Income</b>			
Subscriptions			
National Organisations	36,388	36,313	36,170
Corporate Members	1,500	2,000	2,000
	<u>37,888</u>	<u>38,313</u>	<u>38,170</u>
Medical Physics World	30,740	34,423	47,015
Donations	2,211	855	-
Interest	-	470	2,761
Congresses	29,614	-	3,000
<b>Total Income</b>	<b>100,453</b>	<b>74,061</b>	<b>90,946</b>
<b>Expenditure</b>			
Committees			
Awards & Honours	350	-	-
Education & Training	7,948	2,000	3,500
Professional Relations	5,173	1,011	1,185
Publications	1,833	-	-
Science	500	9,928	5,000
International Advisory Board	-	-	-
	<u>15,804</u>	<u>12,939</u>	<u>9,685</u>
Officers' Travel	-	2,298	3,090
Subscription to IUPESM	10,000	10,000	10,000
World Congress	2,424		
Medical Physics World	26,240	27,836	33,026
Support Costs			
Web hosting and Maintenance	300	1,752	1,572
Bank Charges	-	992	691
Administration	8,878	8,723	5,603
<b>Total Expenditure</b>	<b>63,646</b>	<b>64,540</b>	<b>63,667</b>
<b>Surplus For Year</b>	<b>36,807</b>	<b>9,521</b>	<b>27,279</b>
Cumulative Surplus Brought Forward	170,143	206,950	215,201
Currency Adjustment	-	(1,270)	-
<b>Cumulative Surplus Carried Forward</b>	<b>206,950</b>	<b>215,201</b>	<b>242,480</b>
<b>Represented By</b>			
Cash at Bank	202,959	213,732	239,076
Debtors	14,614	13,019	6,630
Payments in Advance	-	5,000	5,000
Total Assets	217,573	231,751	250,706
Less Creditors and Receipts in Advance	10,623	16,550	8,226
<b>Net Assets</b>	<b>206,950</b>	<b>215,201</b>	<b>242,480</b>

## Hyperbaric Oxygen

(continued from page 15)

radiation is given in several daily fractions is that the tumor shrinkage that occurs between radiation doses allows the tumor to recede and some cells which are chronically hypoxic to become reoxygenated. Van Putten and Kallman in 1968 were able to show that the proportion of cells not the absolute numbers of cells remained hypoxic during fractionated radiation therapy. Therefore with each dose of radiation the absolute number of resistant hypoxic cells decreases, and if an adequate number of individual doses are given, this number of resistant cells can be reduced to a negligible number and the tumor can be destroyed.

## Clinical Trials with Hyperbaric Oxygen Sensitization:

After Churchill-Davidson's pioneering work had demonstrated the possibility of simultaneous trials with concurrent radiation and hyperbaric oxygen, numerous clinical trials were conducted to further define the applicability of this therapy. Many of the trials were accomplished in the British Commonwealth countries including England, Australia and South Africa. U.S. investigators also accomplished several hyperbaric sensitizing trials.

Overgaard and Horsman (1996) conducted a recent review and meta-analysis of these trials. Seventeen trials were identified, and these included patients with tumors

## Status AAPM/IOMP Libraries May 2005 –

Allan Wilkinson, Ph.D.,

IOMP Curator of Libraries

We currently have 75 active libraries in 43 countries (see list below). Active status is maintained by returning an updated questionnaire every 2 years. The 2006 questionnaire is being prepared and will be sent out shortly. Most of the communications between the program curator and the libraries have now been converted to electronic format. In the past year there have been private donations of journals/books/reports to Brazil, India, Iran, Pakistan, and Sri Lanka. Several more donors have contacted us and we hope to identify suitable recipients shortly. In addition, 41 AAPM members donated their 2006 *Medical Physics* subscriptions to the Library Program. Also, each quarter, The Society for Radiological Protection mails their quarterly publication, *The Journal of Radiological Protection*, to all active libraries. Anyone knowing of sites with an interest in establishing a new library should contact the curator ([iompl@aapm.org](mailto:iompl@aapm.org)).

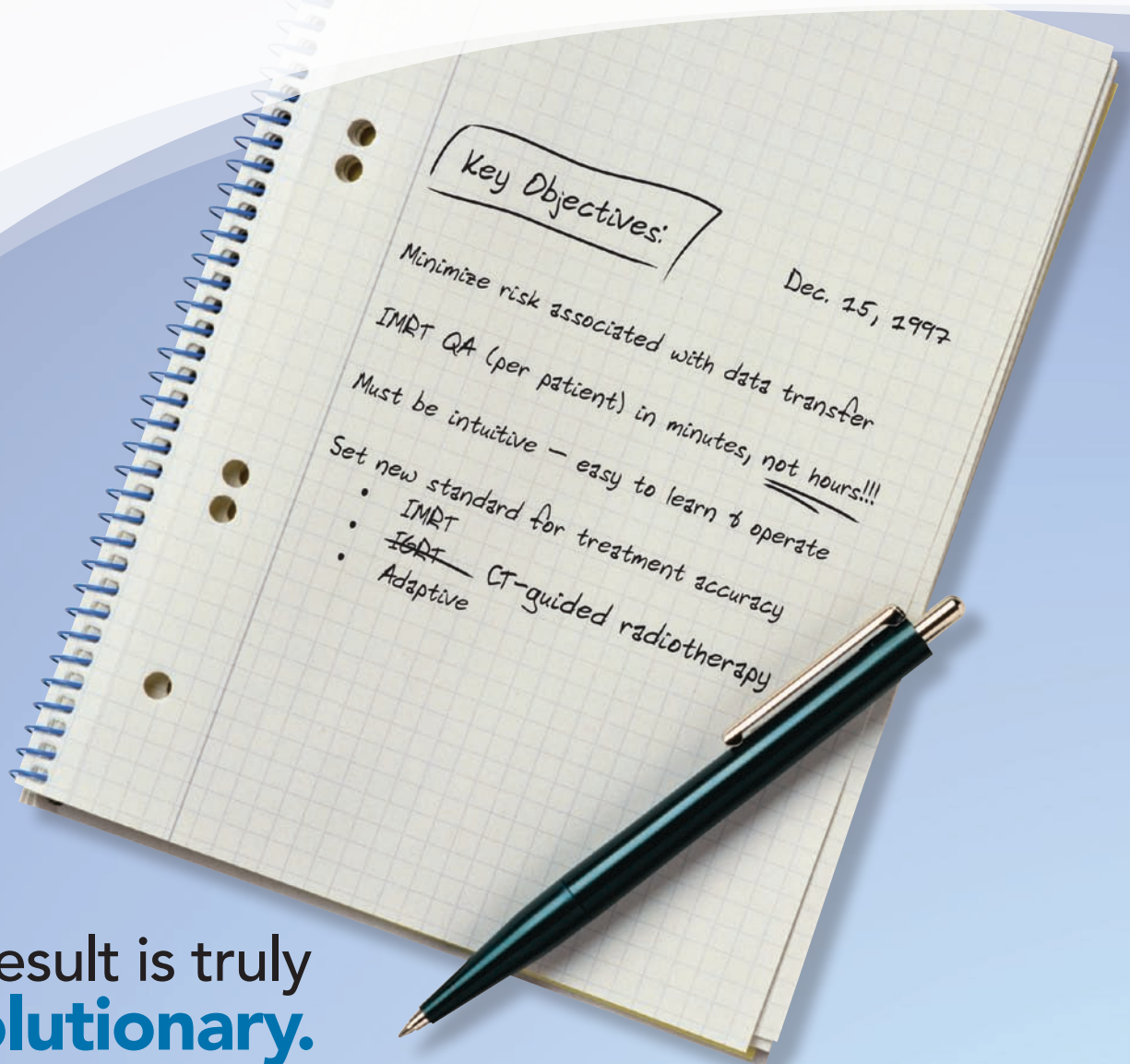
### ACTIVE LIBRARIES

Algeria, Argentina, Brazil, Brunei, Bulgaria, Camerons, China, Columbia, Costa Rica, Cyprus, Dominican Republic, Ecuador, Egypt, Estonia, Georgia, Hungary, India, Iran, Jamaica, Kenya, Lebanon, Mexico, Morocco, Myanmar, Namibia, Nepal, Nicaragua, Nigeria, Pakistan, Peru, Philippines, Poland, Russia, Sri Lanka, Sudan, Tanzania, Thailand, Tunisia, Turkey, Ukraine, Vietnam, Zambia, Zimbabwe

of the head and neck, cervix, bladder and bronchus. A total of 2026 patients entered these studies. Trials were randomized but were often quite small and suffered from the inclusion of unconventional radiation dose-fractionation schemes sometimes comparing treatment in hyperbaric oxygen with unconventional fractionation to treatment in air with conventional fractionation. For these reasons, it was not always possible to determine whether differences in outcome (tumor control and complications) were due to differences in dose delivery schemes or to the hyperbaric effect. – To Be Continued.

*In the next issue, PART - II of this article will present discussions on current status and innovative approaches in HBO medicine along with a selected list of references and websites.*

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# Calendar of Events – *Carter Schroy, Ph.D., MPW Associate Editor*

The following events can be found on the Medical Physics Calendar at <http://www.medphys.org/calendar/>. Please email your international events to the Calendar Editor, Carter Schroy, at [cbs970@gmail.com](mailto:cbs970@gmail.com) (or fax to +01 858-724-1447) for inclusion in MPW. Deadlines for MPW are April 1 and October 1 for issues that are mailed months later.

## 9-13 October 2006

12th Int'l Congress on Neutron Capture Therapy; Kagawa, Japan

<http://icnct-12.umin.jp/>

email: [ICNCT2006@antm.or.jp](mailto:ICNCT2006@antm.or.jp)

## 18-20 October 2006

Developing and Understanding a Hospital Based Proton Facility; Indian Wells, CA USA

<http://www.ptrg.org>

## 22-25 October 2006

First European Workshop on Monte Carlo Treatment Planning; Gent, Belgium  
"Introduction of MCTP into the clinic"

<http://www.EWG-MCTP.UGent.be>

email: [nick.reynaert@ugent.be](mailto:nick.reynaert@ugent.be)

## 26-27 October 2006

3rd Annual Memphis BioImaging Symposium; Memphis, TN, USA

<http://www.membis.org>

email: [gskeyes@utm.edu](mailto:gskeyes@utm.edu)

## 29-31 October 2006

1st Human, Life and Radiation Conference; Rafsanjan, Iran

<http://hlrjournal.f2g.net/hlr2006/>

email: [jamo23@lycos.com](mailto:jamo23@lycos.com)

## 5-9 November 2006

ASTRO 48th Annual Meeting; Philadelphia, PA USA

American Society for Therapeutic Radiology and Oncology

<http://astro.org>

## 13-15 November 2006

International Conference on Quality Assurance and New Techniques in Radiation Medicine (QANTRM); Vienna, Austria Organized by the IAEA; Co-sponsored by the AAPM, ASTRO, EANM and IOMP

<http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=146>

email: [r.perricos@iaea.org](mailto:r.perricos@iaea.org)

## 19-23 November 2006

IMRT and Other Conformal Techniques in Practice; Copenhagen, Denmark

<http://www.estro.org>

email: [info@estro.org](mailto:info@estro.org)

## 3-7 December 2006

Image-Guided Radiotherapy (IGRT); Brussels, Belgium

<http://www.estro.org>

email: [info@estro.org](mailto:info@estro.org)

## 3-7 March 2007

29th Annual Winter Institute of Medical Physics (WIMP); Frisco, CO USA

<http://www.utm.edu/WIMP>

email: [rltanner@utm.edu](mailto:rltanner@utm.edu)

## 4-7 June 2007

15th Int'l Conference on the Use of Computers in Radiation Therapy; Toronto, Canada

<http://www.iccr2007.org>

## 8-12 July 2007

Health Physics Society Annual Meeting; Portland, OR USA

<http://hps.org/newsandevents/meetings/>

## 22-26 July 2007

AAPM 49th Annual Meeting; Minneapolis, MN USA

American Association of Physicists in Medicine

<http://aapm.org/meetings/>

email: [apm@aapm.org](mailto:apm@aapm.org)

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## Workshop "Medical Physics Education and Training – a global perspective" – *Slavik Tabakov, Ph.D., Chairman IOMP-ETC*

This Workshop aims to provide a forum for medical physicists from all IOMP members' societies attending WC2006 to interact and exchange ideas and experience on activities and programs in medical physics education and training. The overall aim is to improve the quality and effectiveness of medical physics education and training and to foster new methods in this field. Another similar Workshop for Medical Engineering Education and Training is also planned for the WC2006. Directors of the Workshop "Medical Physics Education and Training – a global perspective" are: S Tabakov, A Krisanachinda, K Inamura, H-J Kim.

The Workshop will begin with a Special Poster Session, at which colleagues from various countries will present their programs, activities, innovative methods and other experience relevant to education and training. The Poster Session will be followed by the Workshop, at which the Workshop Directors

will present selected resumes of the posters. Following, a large Discussion will be held with all attendees aiming to identify practices/methods which could be applied at various countries and programs.

We encourage all participants attending WC2006 (with presentations either in the Education/Training Track, or in other Scientific Tracks) to bring additionally short posters describing the Education and Training activities in their countries.

In principle, the main information for a country to be presented will be: number of University courses/programmes in Medical Physics; short curricula (main subjects and teaching/laboratory hours); student interest and approx. number of graduates in total (and in the last 5-10 years); Practical Training activities; working perspective after graduation; any specific and innovative development of course/programmes.

We shall collect all these presentations and shall publish them in a booklet to support the global development of our professional education and training. This booklet will be similar to the book published in 1995 (Medical Radiation Physics – A European Perspective), now available free from [www.emerald2.net/mep](http://www.emerald2.net/mep). We expect this new booklet to similarly trigger increased activity in developing new education/training activities around the world.

All contributions to this Workshop (approx. 2 pages of information, as described above) have to be sent by 30 June 2006 to [slavik.tabakov@kcl.ac.uk](mailto:slavik.tabakov@kcl.ac.uk) and [kanchali@yahoo.com](mailto:kanchali@yahoo.com).

For colleagues from developing countries: IOMP ETC has some resources to help the attendance to this Workshop and the WC2006. Please apply to the above e-mails by 30 June 2006.

# Is there a Role for Hyperbaric Oxygen in Future of Radiation Oncology?– Part 1

John J. Feldmeier, D.O., Department of Radiation Oncology, Medical University of Ohio, Toledo, Ohio, USA E. Ishmael Parsai, Ph.D., Editor MPW

Hyperbaric Oxygen Therapy (HBOT) has stood alongside radiation therapy for decades. The word “Hyper” means increased and “baric” relates to pressure. Hyperbaric oxygen therapy is a form of treatment that allows a person to breath 100-percent oxygen at greater than normal atmospheric pressures. In contrast to the earth’s atmosphere which normally exerts 14.7 pounds per square inch of pressure at sea level (known as one atmosphere absolute (1.0 ATA)), the oxygen pressure in HBO treatment is increased to pressures two to three times normal atmospheric pressure. Patients breathe 100% oxygen under these pressures either by breathing the ambient gas (oxygen) in a monoplace chamber or by breathing 100% oxygen through a mask or oxygen hood in a large multiplace chamber where many patients are treated simultaneously. When we breathe air at normal sea level pressures, we are breathing a mix of gasses composed of approximately 80% nitrogen and 20% oxygen. While under HBOT, the increased pressure combined with an increase in oxygen to 100 percent, dissolves oxygen in to the blood and in all body tissues and fluids at up to 20 times normal concentration—high enough to sustain life with no red blood cells at all. While some of the mechanisms of action of HBOT as applied to healing and reversal of symptoms of certain diseases are still under study, it is known that HBOT:

Greatly increases oxygen concentration in all body tissues, even with reduced or blocked blood flow and;

Stimulates the growth of new blood vessels in tissues with reduced circulation, improving permanent blood flow to areas with small vessel narrowing; Other effects of hyperbaric oxygen include the mechanical compression of gasses entrapped in blood vessels or body tissues. This effect is the primary mechanism operative in the treatment of air embolism and decompression sickness. HBOT greatly aids the treatment of infection by enhancing white blood cell action and improving effects of germ-killing antibiotics. Possible additional effects which have been postulated by some but as yet are unproven include the following:

Rebound arterial dilation after HBOT may result in an increased blood vessel diameter greater than when therapy began, improving blood flow to compromised organs;

HBOT may lead to an adaptive increase in superoxide dismutase (SOD), one of the body’s principal, internally produced antioxidants and free radical scavengers; Wherever blood flow and oxygen delivery to vital organs is reduced, function and healing can potentially be aided with HBOT.

Hyperbaric oxygen is recommended by the Undersea and Hyperbaric Medical Society for 13 specific indications varying from decompression sickness (Bends) to diabetic foot ulcers. A common indication for hyperbaric oxygen is delayed radiation injuries including mandibular osteoradionecrosis,

radiation cystitis and radiation proctitis.

Typically, HBOT is administered in either a monoplace transparent, cylindrical, acrylic chamber, approximately 8 feet long and 3 feet in diameter or in steel multiplace chambers 25 feet or longer where the chamber environment is compressed with air. The patient is first made comfortable on a cot-like stretcher or chair after entry into the chamber. While in the monoplace chamber, the patient can see through the transparent enclosure, watch TV, listen to music, read, nap, or talk with the chamber operator, family, or whoever is outside. There are similar opportunities for patients in multiplace chambers. During treatment, usually lasting about two hours, the patient inhales pure oxygen with pressures in the chamber increased up to 3 times the 1 ATA baseline. At 3.0 ATA the pressure is equivalent to what a scuba diver would experience at 66 feet below the surface of the water. At the end of treatment, the patient is gradually decompressed to normal pressure and leaves the chamber.

Oxygen is the most efficient and least toxic of all radiosensitizers. Many studies have implicated tumor hypoxia as a major cause of failure to control the cancer with radiation. Two landmark publications in the 1950’s firmly established the “Oxygen Effect” as one of the most important principles of clinical radiotherapy: 1. Gray et al in 1953 described the importance of oxygen in tissues for the effective delivery of irradiation. These investigators were able to demonstrate in several in vitro models and one animal model with transplanted tumors that cell kill and tumor control were enhanced dramatically in well oxygenated circumstances compared to anoxic/hypoxic conditions. Most importantly they described the essential elements of the oxygen effect of which our understanding is unchanged even into the 21<sup>st</sup> century. The simultaneous presence of oxygen increases the efficiency of cell kill by a factor of 3.0 and that the vast majority of this increase occurs at lower pressures between 0 to 20 mmHg pressure tissue oxygen tensions. 2. In 1955, Churchill-Davidson et al published the first clinical experience applying these radiobiologic principles to the actual treatment of patients by delivering radiation treatments to patients breathing 100% oxygen at 3.0 atmospheres pressure in a hyperbaric chamber. Interestingly, all of their patients were subjected to barbiturate anesthesia to inhibit both convulsive and claustrophobic reactions, and all patients had small punctures in their eardrums to allow the pressure to equalize. A modified British naval steel monoplace chamber was used and radiation was directed through a 25 cm<sup>2</sup> “Perspex” port. The chamber was compressed with 100% oxygen with the average compression requiring 10 minutes. On average each treatment exposure required 40 minutes. Subsequent publications emphasized a so called “soak” in oxygen prior to delivering the radiation to allow

for maximal diffusion of oxygen into the tumor. In Churchill-Davidson’s report, eight patient treatment courses were completed. Four patients had breast cancer, and the other four had lung cancer. Each patient had a single treatment of 1,000 to 1,500 R with the tumor divided in half, one half treated in the chamber at 3.0 ATA and the other half treated in air after leaving the chamber. All the tumors were excised or at least biopsied 10 days to 3 weeks after irradiation. The tumor response in the hyperbaric half vs. the air half was compared. In 6 of 8 instances, tumor response was deemed to be more pronounced in the hyperbaric portion. The true landmark nature of this study was its demonstration of the feasibility (though with considerable time and effort expended) of accomplishing radiation in a hyperbaric chamber.

## Biology and Mechanism of the Oxygen Effect:

As noted above, early investigators had established the magnitude of the oxygen effect increasing the sensitivity of poorly oxygenated cells in oxygenated vs. anoxic conditions. How does oxygen enhance radiation induced cell kill? Ionizing radiation causes cancer cell death primarily mediated by free radical generation. These highly reactive free radicals if of sufficient energy will randomly interact with DNA molecules causing breaks in chemical bonds joining the DNA strands together. If not repaired, these changes in the DNA configuration will prevent successful reproduction. Thus, radiation causes cell kill (in most instances) to the potential daughter cells of existing cancer cells and mediates this damage through free radicals. At first glance it would appear that the increased concentration of molecular oxygen at the time of irradiation simply enhances the efficiency of cell kill by providing oxygen available for the formation of oxygen free radicals. Actually the process is felt to be more complex. Oxygen is said to “fix” or stabilize the radiation damage, i.e. to prevent repair in breaks induced in the DNA strands by combining with the free radical to form a chemical entity called an organic peroxide that results in a non-restorable form of the target material. Two issues are exceedingly important in this regard, 1.) timing of oxygenation relative to radiation exposure: Classic radiation biology indicates that oxygen must be present within microseconds of the radiation exposure to enhance its effects. Sophisticated experiments have been conducted in which cell cultures of bacteria and mammalian cells were exposed to blasts of oxygen at various times before and after radiation. These studies demonstrated that oxygen must be present during or no later than 5 milliseconds after their radiation exposure to provide sensitization, and 2.) the principle of reoxygenation as applied to fractionated radiation: One of the primary reasons that

(continued on page 12)

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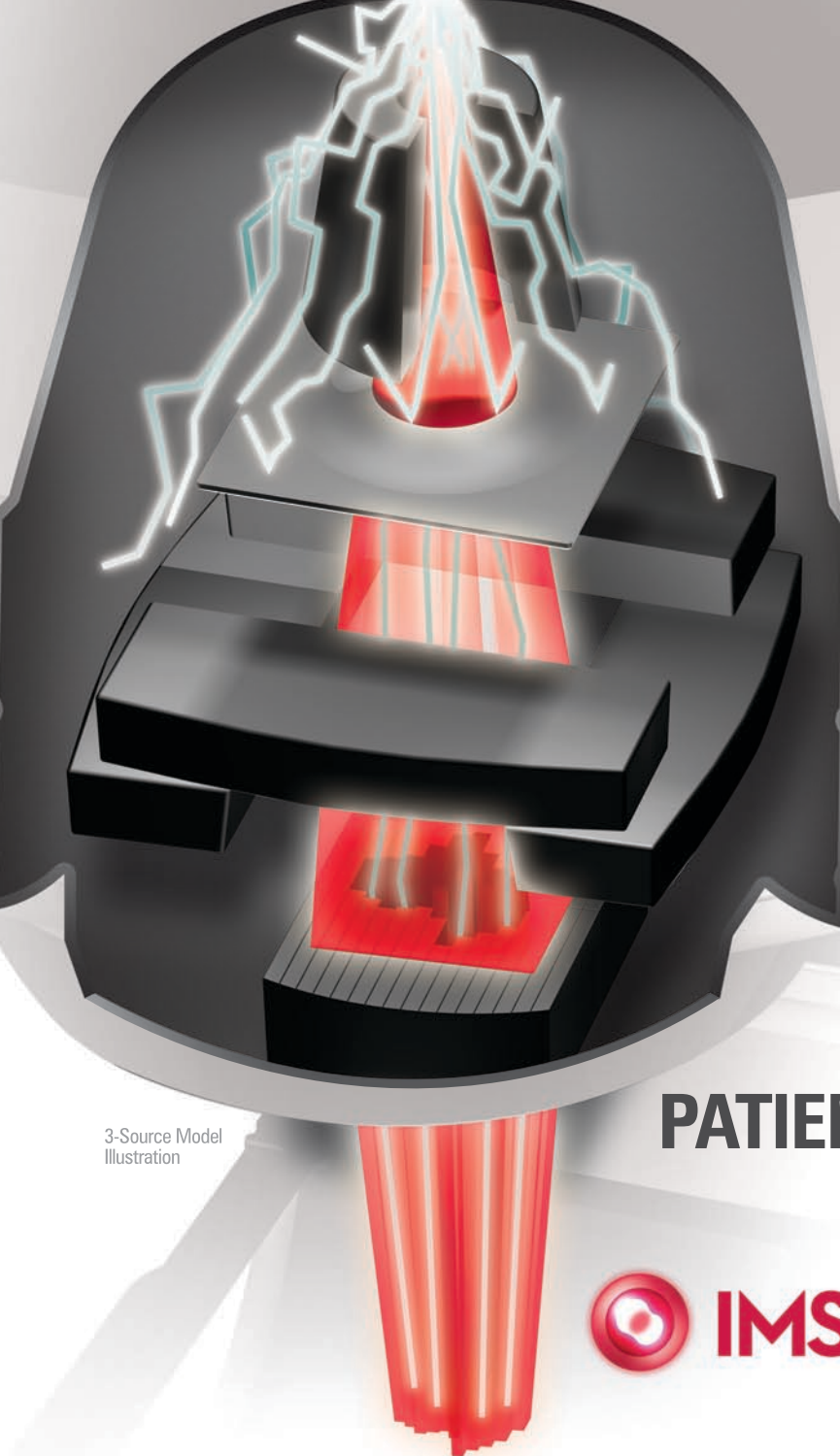
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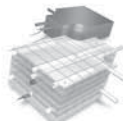
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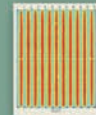
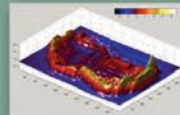
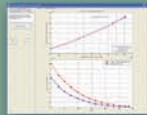
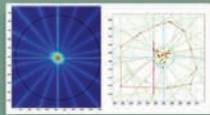
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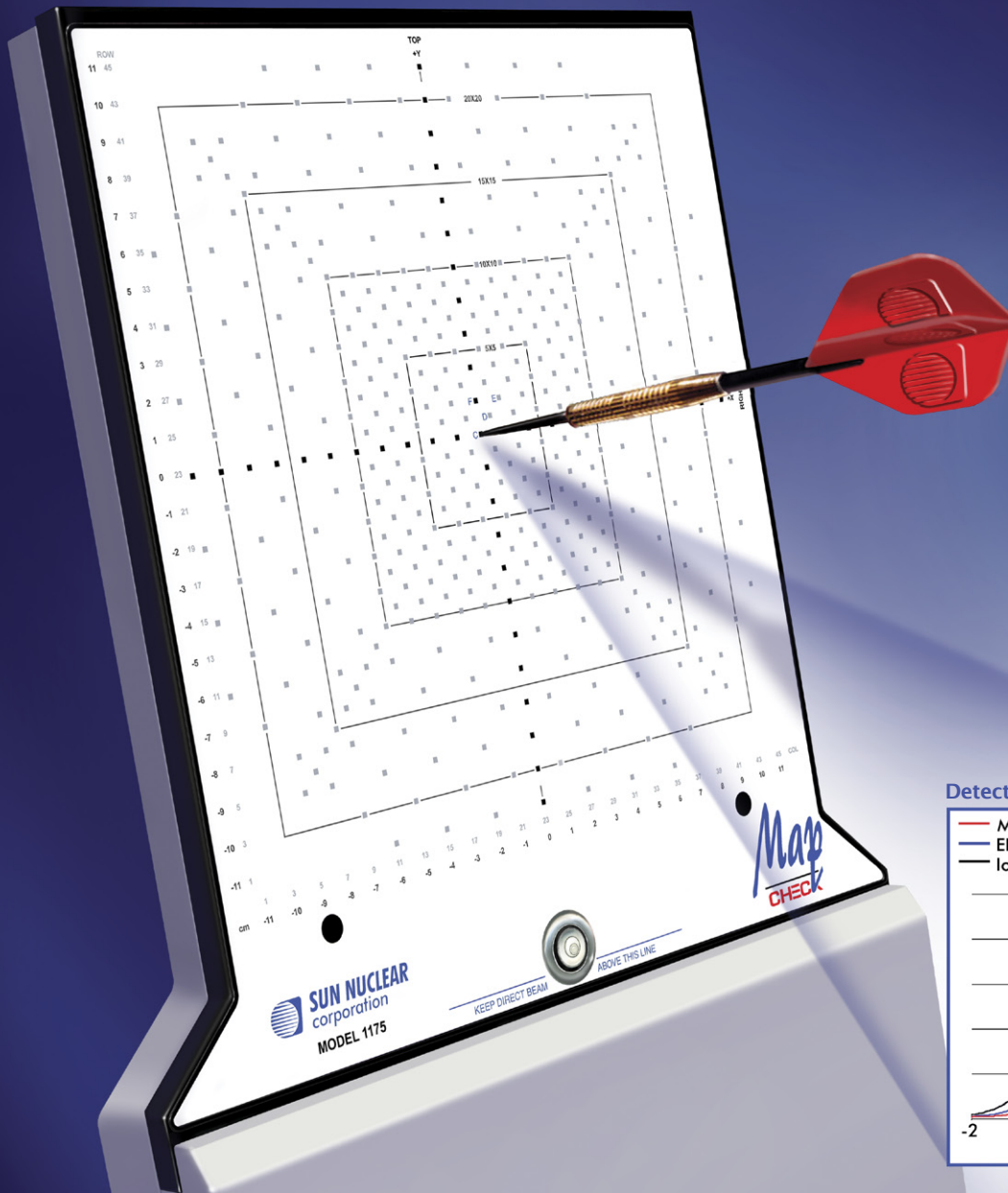
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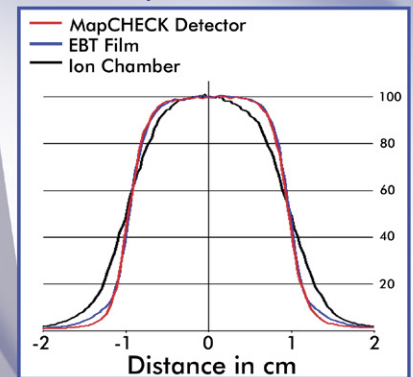


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