The Annual Newsline Review: The State of Nuclear Medicine 2004

From the Newsline Editor

What exciting times for us professionally: new therapies, hybrid imaging equipment, and greater integration of nuclear medicine services with clinical medicine than ever before. Teamwork is now a vital hallmark of our expanding nuclear medicine community. Physicists are helping us learn dosimetry techniques for more complex therapies. Technologists operate the sophisticated equipment and, to a large extent, educate patients and guide them through sometimes demanding procedures. Pharmacists and their assistants maintain the quality and availability of our lifeblood, radiopharmaceuticals. Yet the team is facing its greatest challenge: to do more work of higher quality with fewer resources. Reimbursements per procedure are decreasing almost every year, while costs continue to increase. It is the patients, of course, who now derive the benefit of nuclear medicine imaging and therapy techniques developed by a relatively small number of physicians, scientists, and technologists during the early years of the discipline. My message for all members of the nuclear medicine team is simple: Don't let the challenges wear you down. Our discipline, assessed in our fourth annual review of the past year, is as vital as ever and promises to do even greater things for our patients in the future. As you take a look at our review of 2004, you can see the directions our discipline will be taking next year.

Teamwork is now a vital hallmark of our expanding nuclear medicine community.

One current shortcoming is in the education of future physicians about the value of nuclear medicine and the many applications of nuclear medicine techniques. CT and MRI are now introduced in the first year of medical school as part of basic anatomy education. Why not work with curriculum committees in medical schools to use nuclear medicine images to enhance the teaching of physiology and molecular medicine for first-year students? What better way, for example, to demonstrate the effects of morphine on the sphincter of Oddi or bile physiology than to use nuclear medicine biliary imaging? And the possibilities of using PET and PET/CT to connect function to anatomy are endless.

This, I believe, is the beginning of a new era of partnering with our radiology and radiation oncology colleagues, both at the technologist and physician levels. The nuclear medicine and radiology certifying boards have made a giant step in agreeing to cross-certify technologists in CT and PET. Regardless of whether nuclear medicine imaging is performed by physicians with radiology or nuclear medicine backgrounds, the physicians providing the service will need enhanced skills in CT imaging. And body-imaging physicians will benefit from developing skills in PET. Hopefully, we physicians can follow the example set by imaging technologists and learn to work together so that we can all become better at what we do. Moreover, sharing our techniques with radiation oncologists will help us all provide better care to patients.

And so, to all of you who are members of our rapidly expanding and forward-looking nuclear medicine team, I wish a great and rewarding new year!

Conrad E. Nagle, MD
Editor, Newsline

A Year for Reaching Out

By the time you read this, 8 months of my 12-month term as president will have passed. From my perspective, this annual review should not be called the "year" in review but rather the "nanosecond" in review. When you are very busy, time flies by. Writing this review has enabled me to take a moment to reflect on some of the major activities of the Society over the past year. For many of our members, these activities go unnoticed, but they have a profound effect on the vibrancy of our Society and on the future of our specialty.

We are finding ways to work with other associations with whom we share common cause, pooling our resources to advocate for common interests.

Last fall the Society leadership and council representatives got together to work out a plan to reinvigorate our councils and encourage them to become vital and integral forces within the Society. One outcome of that meeting was a template for standard operating procedures that will give our councils a cohesive structure and a foundation for action. We are also working on developing a more stable source of council funding. The goal is to help the councils develop ways to efficiently share their medical expertise with the membership of the Society, to encourage research and education within their specialty, and to become a resource for other professionals and outside organizations.

As one part of our ongoing effort to make the day-to-day work of the Society leadership more effective, a redesigned Web site was launched at the end of 2003 and a new community area is being developed. Part of our vision for the Web site, and the community area in particular, is that it can become a far more efficient way for us to conduct the business of the society. Committees, councils, centers, and chapters can use the new community area to get more work done with less effort all year long rather than saving most discussion and decisions for marathon sessions at the mid-winter and annual meetings.

International organizations have been increasingly reaching out to us. We are very encouraged by the possibilities for international collaboration. At the same time, we are taking a close look at our international activities and developing a mechanism to determine which of the many, *many* worthwhile meetings, initiatives, and activities would be the most profitable for the Society to participate in.

Much closer to home, our relationship with the Technologist Section continues to be a source of strength for the Society just as the technologists in the field are a tremendous, indispensable asset for the practice of nuclear medicine. The Technologist Section now has an expanded role on the SNM Board of Directors, and their perspective has been most helpful.

Henry D. Royal

Reaching out to everyone who has or should have an interest in nuclear medicine has been a recurring theme this year. The Society is reaching out to other specialties, to patient groups, to the federal regulatory agencies, to Congress, and to state legislatures. We are finding ways to work with other associations with whom we share common cause, pooling our resources to advocate for common interests. We have collaborated with cancer patient advocacy groups as well as referring physician specialty organizations to educate them about the benefits of nuclear medicine for their patients.

We have also worked closely with our industry partners to understand their priorities and develop new ways that we can work together for the improvement of nuclear medicine. Recently, the Nuclear Medicine Industry Association chose the SNM as the recipient of seed money that will be used to establish the infrastructure that is needed to rapidly and efficiently conduct multicenter clinical trials involving diagnostic and therapeutic agents.

As an elected member of the Society's leadership, I have had the opportunity to watch the mostly behind-the-scenes activity of your leaders and the SNM staff, not only this year but for the past several years. Many of these individuals dedicate a great deal of their time to Society activities. They do it because they realize that we can accomplish much more as an association than we can as individuals. It seems appropriate in this 50th year of this Society to thank all of the present and past workers who have dedicated their time to promoting nuclear medicine so that the benefits of nuclear medicine are available to patients.

Henry D. Royal, MD
President, SNM

Technologist Section Meets Past Challenges; Faces More

The practice of nuclear medicine technology is thriving. Emerging technologies, such as fusion imaging, radioimmunotherapy, and enhanced software applications, are bringing great changes to the profession, as well as their fair share of controversy. Over the years, we have seen various applications, procedures, and instruments move from basic science to clinical practice, but never have we seen anything like the frenzy that PET/CT is stirring up. The current advances have brought a renewed interest in nuclear medicine that we have not seen since the advent of SPECT imaging and technetium-labeled cardiac products. To see how far the profession has come, it is important to reflect upon some of the challenges the health care sector has faced in the past.

In the early 1990s, managed care initiatives prompted hospital systems and individual departments to pay attention to the financial side of providing health care services. As hospital administrators realized the necessity of reining in skyrocketing costs, new opportunities were sought and new models implemented. Although some of these changes proved to be of great value, it is now obvious that there were unforeseen ramifications. To contain costs, alternative models of providing care emerged. Outpatient centers and specialty hospitals began popping up across the country, enticing hospital staff with enhanced benefits and salaries. At the same time, the Health Care Financing Administration (now the Centers for Medicare and Medicaid Services) implemented new systems for payment, capping reimbursements for services rendered. To stay viable, health care responded by consolidating services and programs. Multiple hospitals, clinics, and training programs closed as a result of the cost of maintaining these programs. This caused a backlash as fewer people were attracted to the health professions, choosing instead to pursue careers in other fields—most notably in the high-tech computer and dot.com arenas. The days of bounty in health care dried up.

Today, the health care sector is aggressively seeking opportunities to nudge the pendulum to swing in the other direction. It will take ingenuity and a great deal of sheer determination. We, as a profession, can make changes that will impact how the sector provides health services in the years to come.

Within nuclear medicine, we have seen a shift of power, as chief technologists are replaced with lead technologists who now report to radiology management/administration. Although the decision-making process has changed, this has created yet another viable career option for technologists seeking management and administrative roles. Today, many nuclear medicine technologists serve in radiology administration.

Lyn Mehlberg

We have also seen major purchasing groups and contracts dictate the options available for providing nuclear medicine services to our patients. Constraints, such as dwindling reimbursement, lack of adequate technologist staffing, and the shift from staffing full-time nuclear medicine physicians to staffing full-time radiologists who read nuclear medicine scans part-time, have dictated which procedures a department will perform and when. For technologists, a bidding war emerged. Hospital nuclear medicine technologist salaries have risen dramatically in the past several years, keeping up with the salaries of clinic technologists as well as temporary, traveling, and per diem technologists. Some observers suggest that the current shortage demonstrates the value of nuclear medicine technologists, and institutions seem to be acknowledging this.

As we look for solutions, it is obvious that collaboration with other like-minded organizations facing the same challenges is paramount in overcoming the many obstacles facing the profession.

PET/CT. The SNM Technologist Section (SNMTS) is collaborating with the various stakeholders of this technology to address education, training, regulatory, certification, and accreditation issues. The PET/CT Task Force has reviewed the draft curriculum for PET/CT and made recommendations to the American Society of Radiologic Technologists and SNMTS conjoint PET/CT Education Project Group. The PET/CT Task Force is also working with the SNMTS Scientific and Teaching Committee to facilitate multiple sessions in CT, PET, and PET/CT at the 2004 annual meeting in Philadelphia, PA.

Workforce. The SNM Workforce Task Force is addressing the current shortage through 3 work groups focusing on retention, recruitment, and data collection. Our 2003 Gateway meeting focused on developing a long-term plan based on a data collection mechanism to be used in forecasting and assessing trends within nuclear medicine.

Regulatory. The SNMTS instituted the State Health Policy Liaison program, a legislative network of more than 30 representatives from 28 states that works to link individuals at the state level with the national office. This program will facilitate collaboration at the state level for pursuing individual state licensure for nuclear medicine technologists and ensuring that nuclear medicine is represented in impending PET/CT licensure. The SNMTS has also been involved in various federal initiatives, including the Allied Health Revitalization Act and the Consumer Assurance of Radiologic Excellence Act. We have also worked to block the Department of Labor rollout of standards that could impact overtime pay for imaging professionals and the desirability of pursuing professional status.

Advanced Practice. The SNMTS has designated a task force to develop a model for advanced practice opportunities for nuclear medicine technologists. This group has drafted a white paper and gained support from the SNM Board of Directors to pursue this career model for professional advancement.

As you can see, 2003 brought great challenges as well as opportunities for the profession. The Technologist Section is dedicated to addressing these challenges and to continuing to shape our future as nuclear medicine technologists.

Lyn Mehlberg, BS, CNMT
President, SNMTS

From the SNM Executive Director

In addition to turning 50 this year, a most respectable age, the Society has completed, or is in the process of finalizing, some very important internal reorganization goals. We have restructured our specialty-based councils, created a new organizational structure that focuses on a technology that spans many specialties (the PET Center of Excellence is the first example), completed our old strategic plan and put in place a new one, and created a strategic alliance with the Education and Research Foundation that will improve our ability to provide grants, fellowships and other monetary awards to outstanding members of the nuclear medicine community.

With this revitalized internal structure we have laid the foundation for the Society to move outward. We have built a flexible and strategically oriented Society that is already building relationships with a number of other organizations and reaching out to still others.

Our new Strategic Plan, approved by the Board of Directors last June, calls for us to advocate for nuclear medicine wherever activity can benefit patients. This means reaching out to referring physicians, patient advocacy groups, oncologists, cardiologists, radiologists, and international organizations. It means working with industry to develop better technology, more effective tracers, and targeted radiopharmaceuticals. It means joining forces with other like-minded organizations to push the federal government for adequate reimbursement for nuclear medicine procedures, adequate funding for nuclear medicine research, and reasonable legislation to both promote safety and ensure adequate resources at a time when the public is especially sensitive to issues involving radioactivity. And it means keeping in constant touch with our own members to provide them with up-to-date education about the most effective diagnostic and therapeutic procedures as well as information about governmental issues that will directly affect their medical practice.


Virginia Pappas

In reaching out to our members we have initiated monthly Leadership Updates in the *JNM* that will keep our members more informed about the Society's accomplishments and plans for the future. Our Web site has also been restructured to provide a permanent resource for technical information, continuing education articles, and the Society's structure and governance. (For example, you can read the new Strategic Plan at www.snm.org/2003StrategicPlan.) But the Web's main strength is in rapid dissemination of information. We are taking advantage of that to provide our members and the general public with the latest medical, industry, and government news. Our new Communities area will allow members and various interest groups and governance organizations to share information, debate topics, and make informed and timely decisions.

Last year in New Orleans we celebrated the Society's 50th annual meeting. (The first annual meeting took place before the Society was officially incorporated in March, 1954). This year, in Philadelphia, we will celebrate the Society's 50th birthday. Dr. Mathew Thakur, our president-elect, and the 50th Anniversary Task Force have been planning a very exciting meeting that will start off with the Welcome Reception on the exhibit hall floor and an American Bandstand Event on Saturday night. On the serious side we have a comprehensive scientific program planned along with a CT imaging workshop, the popular Modern Imaging Technology Workshop, the nuclear medicine physician board review, technologist certification exam review, a 3-day CT workshop, and an emerging leaders seminar. Physician and technologist categoricals will include topics in nuclear cardiology, neurology, on-

cology, radioimmunotherapy, pediatrics, and fusion imaging, as well as a special coding and reimbursement categorical organized by the Technologist Section.

The annual meeting is a wonderful opportunity for professional enhancement and collegiality, and a great deal of important committee and council work goes on there as well. But your Society is working for you all year long, working to make the daily practice of medicine more effective, working to ensure that you are fairly compensated, working to spread the word about the benefits of nuclear medicine among your colleagues and patients, and working to provide you with the information you need to practice state-of-the-art medicine. Let us know how we are doing and what more we can be doing. Contact your chapter representatives, your council leaders, the Society leadership, or me. Contact information for the Society staff, leadership, and members is on the new Web site. It's there for you 24 hours a day, every day.

Virginia Pappas, CAE
Executive Director, SNM

Radiotracer Chemistry in 2003: Better Prediction Needed

A recent article in *Science* pointed out the need to complement the molecular genetic approach to understanding life with an understanding of living systems at the level of the whole organism (*1*). The article went on to call for the incorporation of pharmacology and physiology into our current molecular models to provide a more realistic and predictive biology. At the same time, others have commented on the bottleneck in translating basic research to clinical practice (*2*). The National Institutes of Health (NIH) Roadmap incorporates the need to dedicate resources to assure that basic research will lead to advances that make a difference to human beings and to redouble efforts in drug discovery (*3*,*4*). These ideas resonate with the fields of radiotracer chemistry and molecular imaging, because radiotracers are the tools both for studying biology at the level of the whole organism and for probing interactions between chemical compounds (including drugs) and living systems. Thus, radiotracers are major scientific drivers enabling investigations of molecular phenomena that are at the heart of understanding human disease and developing effective treatments. Outlined here are some of the notable achievements in radiotracer science for 2003.

Update on radiotracers having a high affinity for aggregated amyloid. Alzheimer's disease (AD) affects 35% of the population older than 85 years. The high incidence, lack of knowledge on causes, and lack of effective treatments have stimulated the development of radiotracers that bind specifically to aggregated amyloid, an early marker in the pathogenesis of the disease. One of these radiotracers, ^{18}F-FDDP, a malononitrile derivative, shows greater accumulation and longer residence time in plaque-rich cortical regions in patients with AD than in control subjects. ^{18}F-FDDP accumulation is correlated with cognitive impairment and also shows the expected inverse relationship with brain glucose metabolism (*5*). Nonsteroidal antiinflammatory drugs (NSAIDS) were shown to compete for ^{18}F-FDDP binding in human brain sections (*6*). This study is intriguing in light of the reported lower rate of AD in individuals who take aspirin and other NSAIDS and suggests that ^{18}F-FDDP may be useful in developing and evaluating antiaggregation therapies.

Lipophilic, neutral thioflavin T derivatives also have a high affinity for aggregated amyloid, and 1 of these compounds, ^{11}C-6-OH-BTA, shows high accumulation in cortical brain regions in AD (*7*). Like ^{18}F-FDDP, its binding also shows an inverse relationship with regional glucose metabolism. The binding specificity of 6-OH-BTA to plaque was verified in submicromillimeter resolution in a transgenic mouse model of AD during peripheral administration using multiphoton microscopy (*8*). This exemplifies the power of multimodality imaging to demonstrate specificity.

With the growing appreciation that optimal radiotracer quantification requires optimal kinetics, a series of neutral thioflavin T derivatives with high affinities for aggregated amyloid and a wide range of lipophilicities was studied in mice and in baboons to determine the relationship of lipophilicity to brain uptake and clearance (*9*). We are accustomed to using lipophilicity as a predictor of radiotracer uptake, but this study points out the importance of lipophilicity as a predictor of radiotracer *clearance* from nonspecific sites to enhance signal-to-noise ratio. This and other studies provide important new knowledge that can be expected to improve the selection of lead structures for further development (*10*).

Muscarinic M2 receptors. Radiotracer specificity is most commonly evaluated by examining whether binding is changed with the administration of a drug known to bind to the specific molecular target. However, knockout animals in which the gene for a specific molecular target

(receptor, transporter, enzyme) is removed offer an alternative tool for assessing specificity. For example, by comparing the putative M2 subtype-selective radiotracer ^{18}F-TZP in wild-type and M2 knockout animals, binding was unequivocally shown to be M2 specific (*11*). Because the cholinergic system, and specifically the M2 receptor, have been shown to decrease in aging and degeneration, ^{18}F-TZP PET studies were carried out to compare young and old subjects and to compare subjects bearing the apolipoprotein E (apoE) ϵ4 allele (an allele associated with higher risk for AD) with age-matched controls who did not carry the apoE ϵ4 (*12*). ^{18}F-TZP binding was higher in older than younger subjects and was also higher in the apoE ϵ4–positive subjects than in the control group (*13*). The authors speculated that with age and with the apoE ϵ4 allele, there is a decrease in acetylcholine (neurotransmitter involved in memory) and that this would be expected to decrease occupancy of the M2 sites by endogenous acetylcholine. This, in turn, would elevate the number of unoccupied receptors as well as radiotracer binding. Thus, ^{18}F-TZP offers promise as a tool for evaluating the efficacies of various therapies designed to elevate acetylcholine, similar to the use of ^{11}C-raclopride to measure changes in synaptic dopamine. In addition, pending more studies, ^{18}F-TZP could be used to identify subjects at risk for degenerative disease who would benefit from early acetylcholine-enhancing therapy or other drug treatment.

Nicotinic tracers. The 2 major binding sites for nicotine in the human brain are the $\alpha_4\beta_2$ receptor (nicotine receptor subtype associated with the reinforcing effects of nicotine) and the α_7 receptor. Since the mid-1990s, efforts have been made to develop radiotracers for these sites. Iodinated derivatives of azetidinyl compounds have been reported to bind with high affinity to $\alpha_4\beta_2$ receptors, and the first human studies showed high uptake and slow clearance from the thalamus and other brain regions known to be high in $\alpha_4\beta_2$ binding sites (*14*). Earlier baboon PET studies comparing ^{18}F-azetidinyl derivatives of A-85380 labeled in the 2 and 6 position of the pyridine ring showed different kinetics for the 2 isomers (*15*). The first human PET studies with 2-^{18}F-fluoro-A-85380 were reported this year along with whole-body dosimetry, and human studies are underway with 6-^{18}F-fluoro-A-85380 (*16,17*). As expected, binding of both radiotracers is high in the thalamus.

Norepinephrine transporter. The development of a radiotracer for visualizing and quantifying the norepinephrine transporter (NET), a major molecular target in the treatment of depression and attention deficit/hyperactivity disorder, has long been a goal of radiotracer chemists. Recent studies in mice and in baboons showed that the ^{11}C-labeled methyl analog of the antidepressant drug, reboxetine (methylreboxetine [MRB]) is a promising new radiotracer (*18,19*). Racemic ^{11}C-MRB binds reversibly in NET-rich regions of the baboon brain such as thalamus and cerebellum. An even more dramatic effect was seen after injection of (S,S)-^{11}C-MRB, the active enantiomer. Binding in the thalamus and cerebellum (but not the striatum) could be blocked by the selective NET drug, nisoxetine, for the (S,S) but not the (R,R) enantiomer. PET studies of the baboon torso revealed a blocking effect by desipramine (an antidepressant drug that blocks the NET) only in the heart (a NET-rich organ) after injection of the (S,S) but not the (R,R) enantiomer. These studies demonstrate that the use of (S,S)-^{11}C-MRB has the potential to be a new scientific tool for visualizing and quantifying the NET in brain and in heart.

^{18}F-FDG PET for therapy? While the remarkable *diagnostic* properties of ^{18}F-FDG in the brain and in cancer are well recognized, a recent study evaluated ^{18}F-FDG as a potential radiomolecular *therapy* agent in breast cancer animal models and, retrospectively, in patients with metastatic breast cancer (*20*). The authors have shown that positrons delivered by ^{18}F-FDG to mammary tumors have a tumoricidal effect on cancer cells. The study of breast cancer patients suggests that the tumor and normal organ dosimetry of ^{18}F-FDG makes it suitable to estimate the activity required for therapy of this malignancy.

Maternal–fetal transfer of drugs. An understanding of how drugs are transferred between mother and fetus during the gestation period is an important medical issue of relevance to both therapeutic drugs and drugs of abuse. However, ethical and safety considerations generally preclude such studies in pregnant humans. This year, the methodology for combining MRI and PET to identify fetal organs and measure radioisotope distribution in maternal and fetal organs was developed in the pregnant macaque using ^{18}F-FDG to demonstrate proof of principle (*21*). This shows the potential for noninvasively measuring fetal drug distribution, binding, and elimination and the transfer of drugs across the placenta, as well as the effects of a drug on specific cellular elements and physiologic processes during the gestation period.

Long-term needs. From the perspective of radiotracer design and development, the human body presents a complex set of barriers that compete with radiotracer delivery to the target organ and with binding to specific molecular targets. These include plasma protein binding, sequestration in cells, low-affinity and nonspecific binding, metabolism, the blood–brain barrier, and probably many others. In spite of at least 30 years of experience, our ability to predict which chemical compounds will have the bioavailability, specificity, and kinetics required to image and quantify specific molecular targets in the brain and other organs remains limited. Poor predictability has been a root cause of the low yield of useful radiotracers relative to the number of labeled compounds that have been painstakingly synthesized and evaluated over the years.

We clearly need a strong commitment to build a foundation of knowledge to increase the probability that the molecules that we choose to label will have a higher chance of success. Smarter choices will not only help to advance radiotracer development, but this knowledge may also expedite drug research and development, where the issue of drug bioavailability has received less attention than molecular interactions on the microscale. Although we may never be able to perfectly predict and understand how molecules behave in living systems, we can narrow the field of choices by trying to understand our failures better and by studying series of compounds using the modern tools of imaging, such as PET and microPET, as well as classic methods, such as autoradiography. Together these allow us to work backward from distribution and kinetics simultaneously in all organs in the body to determine how these relate to the physicochemical and pharmacologic properties of the molecule. Also, as we start to unravel polymorphic genes associated with diseases, the need for imaging radiotracers to help phenotype the role of those genes in the human body will become increasingly urgent.

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Physics Applications in Nuclear Medicine: A Jump Ahead

The year 2003 brought significant progress and a few breakthroughs in the area of physics applications in nuclear medicine. Existing technology was put to new uses, and progress was made in linking dosimetry to radiobiology in radiotherapy with internal emitters. Tools for performing calculations continued to proliferate, and the Internet continued to be a valuable and growing resource for daily use.

PET/CT. High-performance PET combined with clinical-quality CT has become a commercial reality, and many manufacturers offer systems that perform well. Two approaches are being taken. Both have the patient positioned on the same imaging table. The ones using x-ray tubes image the patient before or after the patient is imaged with PET. This approach provides diagnostic CT images and PET images taken at different times. Thus, differences in respiration or other temporally varying phenomena can lead to inconsistencies in the registered images. The alternate approach uses simultaneous acquisition of transmission and emission data. This has been

implemented with a ^{137}Cs (662 keV) transmission source onto a gadolinium orthosilicate imaging receptor that distinguishes the 662- from the 511-keV PET annihilation signals. This provides comparable attenuation coefficients and temporal simultaneity. No doubt other innovations are in the pipeline in this rapidly developing area of technological innovation.

Image processing. Image registration is a topic of expanding interest and effort as different imaging modalities struggle with common problems associated with registration of temporal sequence series within a modality or between modalities. The detection and characterization of lesions and processes is thereby augmented. In addition, growing attention is being given to the utility of this information in the operating room, with image-guided surgery and, ultimately, the possibility of remote-controlled operations. The National Institutes of Health are sponsoring such efforts through grants as well as by providing images for use in algorithm development (Retrospective Image Registration Evaluation Project; see www.vuse.vanderbilt.edu/~image/registration). A special issue on image registration was recently published by the Institute of Electrical and Electronics Engineers (IEEE) (*1*).

Detector technology. Continuing advances are being made in scintillators and solid-state imaging receptors. Many of the advances in imaging systems we now enjoy came more from improved imaging receptors than from image processing of lower quality signals. The development of lutetium oxyorthosilicate (LSO) was a significant advance over NaI, primarily for use in PET imaging devices. The low-level radiation inherent in LSO limits its use for optimal single-photon applications. New materials presented in October at the IEEE Nuclear Science Symposium and Medical Imaging Conference in Portland, OR, showed great promise for increasing light intensity and timing properties, and these should be favorable for both PET and SPECT applications. Lanthanum bromide (cerium doped), was among the most promising of the new materials presented. A tempering note is that it took 10 years for LSO to move from its early recognized utility to the point at which it became a commercial reality, and this is probably a realistic assessment of the time needed for any new material to get to the point when practical marketable devices become a reality (*2*).

Radiation dosimetry applications. Interest continued in the use of radiolabeled antibodies and other molecules such as radiolabeled peptides for therapy (*3*,*4*). Rapid progress was reported by several authors in the area of performing radiation dose calculations for patients based on fused anatomic and physiologic data, with dose estimates being calculated in 3 dimensions at the voxel level instead of the whole organ level, as has been the practice in internal dosimetry for so long. At a symposium last year on the subject of radiopharmaceutical dosimetry (*5*), authors from a number of countries demonstrated their solutions for performing such calculations (*6–10*), as has also been published in *The Journal of Nuclear Medicine* (*JNM*) previously by other authors (*11–15*). As a follow-up to this symposium, the first International Symposium on Radionuclide Therapy and Radiopharmaceutical Dosimetry will take place in conjunction with the annual European Association of Nuclear Medicine congress in Helsinki, Finland, September 4–8, 2004.

Attempts to link calculated doses to observed effect, particularly in the marrow, have been only mildly successful to date (*16*), but 2 articles in *JNM* in 2003 demonstrated significant breakthroughs in linking dose and effect. Siegel et al. (*17*) showed how measurements of a particular biomarker in blood could be used to correct model-calculated radiation doses and produce significant improvements in the dose/effect correlations. Shen et al. (*18*) demonstrated a method for performing patient-specific corrections for marrow mass and improving dose/effect correlations.

In addition to marrow toxicity, renal toxicity has been noted after administration of therapy levels of certain peptides and ^{166}Ho-DOTMP (*19–21*). The use of calculated dose to explain (and ultimately predict) effects remains problematic (*20*). The recently released Medical Internal Radiation Dose dosimetry model for the kidney provides a more detailed and stylized approach to dosimetry than was previously available (*22*). As noted above, however, the future clearly belongs to more patient-specific, 3D dosimetry based on image data. A special session on the topic of kidney dosimetry and toxicity was organized at the SNM annual meeting in 2003. At this session, DeJong et al. (*23*) showed that patient-specific dosimetry using CT-derived volume estimates for the kidneys was needed in their study with radiolabeled peptides to adequately explain dose–toxicity relationships.

As noted by DeNardo et al. (*16*), "There is agreement that radiation dosimetry (radiation absorbed dose distribution, cGy) should be utilized to establish the safety of a specific radionuclide drug during drug development, but it is less generally accepted that absorbed radiation dose should be used to determine the dose of radionuclide (radioactivity, GBq) to be administered to a specific patient (i.e., radiation dose-based therapy)." Dorn et al. (*24*) advocated a patient-specific approach to radiotherapy with ^{131}I to provide maximum therapeutic benefit. Many investigators, however, advocate performing therapy without any dose calculations, with all patients simply receiving the same amount of activity or activity per unit body mass or per unit surface area. Advocates of this approach cite the logistic difficulties of gathering data from patients and the relatively weak dose–toxicity cor-

relations observed to date in patient populations. With improved 3D dosimetry for other organs and establishment of better dose–toxicity relationships, internal dose should become truly relevant to patient care, as it currently is for external treatment planning for therapy, and suboptimal approaches should disappear with time.

Radiobiology. Much discussion in *JNM* in 2003 touched on issues related to radiation dose and response. As noted previously, a real improvement in linking marrow dose to effect was shown by Siegel et al. (*17*), emphasizing the importance of biology (and patient-specific biology at that) to the interpretation of calculated doses in therapy. The paper on patient-specific 3D dosimetry by Bodey et al. (*8*) was particularly innovative in that it expressed the biologically effective dose (BED) from internal and external radiation, which includes theoretical relationships regarding the radiation response of the tissues, not just the calculated absorbed dose. Both Sgouros et al. (*25*) and Koral et al. (*26*) reported poor correlations between calculated tumor dose and observed response (using a 3D dosimetric approach). Krenning et al. (*27*), however, have shown a compelling correlation between tumor dose and percentage of mass reduction, over a range of 0–600 Gy, and Michel et al. (*28*) found "generally consistent" relationships between calculated doses and toxicity for a number of radionuclides in an in vitro study. Hartman-Siantar et al. (*29*) noted the importance of including changes in tumor mass in radiation dose calculations, when evaluating dose–response relationships. A similar correction was also suggested recently by Martino et al. (*30*) in the calculation of thyroid dose during treatment for hypothyroidism. The use of ^{99m}Tc-annexin for imaging tumor apoptosis was reported by several authors (*31*,*32*). The area of small scale and microdosimetry continues to receive attention, but the role of such agents in therapy is a matter for continuing debate (*33*,*34*).

A vigorous debate continues in the scientific community over the effects of radiation doses at low levels. The interpretation and resolution of potentially conflicting data continue to be a problem. As was succinctly stated by Adelstein et al. (*35*), ". . .we are still ignorant of what really happens at low doses and . . . the case cannot be made facilely for responses either below or above the linear extrapolation." Current evidence concerning hormesis and the linear-no-threshold hypothesis was summarized by Brenner et al. (*36*):

> High doses of ionizing radiation clearly produce deleterious consequences in humans, including, but not exclusively, cancer induction. At very low radiation doses the situation is much less clear, but the risks of low-dose radiation are of societal importance in relation to issues as varied as screening tests for cancer, the future of nuclear power, occupational radiation exposure, frequent-flyer risks, manned space exploration, and radiological terrorism. First, what is the lowest dose of x- or γ-radiation for which good evidence exists of increased cancer risks in humans? The epidemiological data suggest that it is ≈10–50 mSv (1–5 rem) for an acute exposure and ≈50–100 mSv (5–10 rem) for a protracted exposure. Second, what is the most appropriate way to extrapolate such cancer risk estimates to still lower doses? Given that it is supported by experimentally grounded, quantifiable, biophysical arguments, a linear extrapolation of cancer risks from intermediate to very low doses currently appears to be the most appropriate methodology. This linearity assumption is not necessarily the most conservative approach, and it is likely that it will result in an underestimate of some radiation-induced cancer risks and an overestimate of others.

Electronic resources. The proliferation of electronic resources in the sciences continues at a rapid pace. It is impossible to adequately summarize all of the important Web sites and software applications or to track their progress. The effect on the daily practice of science and medicine in this area has been profound, and a few comments are in order.

For more than 2 decades, the Radiation Internal Dose Information Center in Oak Ridge, TN, was a resource for the nuclear medicine community for physics, dosimetry, and radiobiology data. During 2003, all funding for this program was officially ended by the Department of Energy. The response function of this center cannot be replaced, and its research interests have been diffused. As reported in Newsline last year, the RAdiation Dose Assessment Resource (RADAR) Web site (www.doseinfo-radar.com) was developed to freely disseminate some of the same kinds of information (standardized dose estimates, decay data, absorbed fractions, dose conversion factors, and information on radiobiology and dosimetry literature). Published articles support the scientific basis for the data on this site (*37*–*39*).

A number of interesting e-mail lists (NucMed, RadPharm, PET-mail, Medical Imaging [Archive-Comm-L], Radsafe, Dose-Net, and others) exist for exchanging information with other interested parties. Subscriptions are free, and digest versions (daily summaries of all posts) are usually available. A large number of Yahoo groups too numerous to mention also relate to this area of science and use a bulletin-board approach to information exchange.

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Radiopharmaceutical Review

The single new radiopharmaceutical approved by the FDA in 2003 was Bexxar, the trade name for tositumomab and ^{131}I-labeled tositumomab. This is a monoclonal antibody for the treatment of patients with CD20-positive, follicular non-Hodgkin's lymphoma, with and without transformation, whose disease is refractory to rituximab and has relapsed after chemotherapy. Bexxar is not indicated for the initial treatment of patients with CD20-positive non-Hodgkin's lymphoma, according to the manufacturer's package insert. Its use requires a diagnostic study using a low dosage, followed 7 to 14 days later by a therapeutic dosage based on dosimetric calculations obtained from the diagnostic study. The new billing code for Bexxar is G0274, and the CPT code is 79400. Bexxar joins the other nuclear medicine therapeutic product available for treatment of B-cell lymphoma expressing CD20 antigen: Zevalin (ibritumomab tiuxetan), labeled with either ^{111}In for the diagnostic dosage or ^{90}Y for the therapeutic dosage.

The Centers for Medicare & Medicaid Services (CMS) has permitted the PET imaging community to bill for restaging of papillary or follicular thyroid cancer after thyroidectomy and ^{131}I ablation employing ^{18}F-FDG if the ^{131}I scan has shown no subsequent uptake and the serum thyroglobulin is elevated. This is the only new use of ^{18}F-FDG allowed by CMS in 2003. The billing code for this procedure is G0296, and the third-party payer's CPT code is 78810.

The Belgian subsidiary Eastern Isotopes, Inc., of Sterling, VA, has partnered with the Italian-owned Bracco Corporation of Princeton, NJ, to provide unit doses of ^{82}Rb for use in myocardial PET perfusion imaging, thus eliminating the need to invest in a ^{82}Sr/^{82}Rb generator.

Bio-Nucleonics Pharma of Miami, FL, entered the radiopharmaceutical therapy market when the FDA approved its ^{89}Sr-chloride product to reduce the bone pain of osseous metastatic disease. ^{82}Sr is also marketed as Metastron by Amersham Corporation.

Both ^{57}Co-labeled vitamin B12 and intrinsic factor, the components of the Schilling test for diagnosing pernicious anemia and other forms of vitamin B12 malabsorption, have been withdrawn from the market because of manufacturing issues for a period that will probably exceed a few months. The SNM Committee on Radiopharmaceuticals is actively pursuing a solution to this issue.

The new Medicare bill, signed by President Bush in December, treats radiopharmaceuticals as drugs under the Hospital Outpatient Prospective Payment System (HOPPS), but, unlike other drugs, these will be paid at 95% average wholesale price per invoice, depending on the setting. The 4.5% Physician Fee Schedule reduction will be reversed, with 1.5% increases for the next 2 years.

The FDA Nuclear Medicine Coalition, in which the SNM has been most active, has brought together industry, consumers, and the Society with the SNM Washington legislative advisor, Arent Fox Kintner Plotkin and Kahn, PLLC. This coalition is working together to seek ways to expedite the approval of new radiopharmaceuticals, to develop an outreach strategy for consumer involvement, and to delineate a more efficient and effective deployment of resources in dealing with these issues.

In a separate SNM initiative, a Task Force on Radioisotope Availability has been formed to deal with the difficulties North American researchers are experiencing in obtaining reliable supplies of research radioisotopes.

Edward B. Silberstein, MD
Chair, SNM Committee on Radiopharmaceuticals

Joseph C. Hung, PhD
Chair, SNM Committee on Pharmacopeia

SNM Publications Growing in Scope and Reach

In 2003, SNM publications enjoyed a productive year. Most notable was the smooth transition of editor-in-chief duties for *The Journal of Nuclear Medicine* (*JNM*) from Martin P. Sandler, MD, to Heinrich R. Schelbert, MD, PhD. Under Sandler's leadership, *JNM* expanded its content and focus, added continuing education features, reached more members and subscribers, and achieved new levels of influence as evidenced by consistently high Thomson ISI impact factors. In 2003, *JNM* went to all-electronic submission and processing of manuscripts, streamlining a number of paper- or mail-dependent steps and decreasing turnaround times for articles in preparation. *JNM* can now be accessed, searched, and downloaded as complete text through the Highwire Press site. Sandler deserves the thanks of the entire nuclear medicine community for his work with *JNM*.

As the George V. Taplin Professor of Nuclear Medicine in the Department of Molecular and Medical Pharmacology at the University of California at Los Angeles (UCLA) School of Medicine and chief of the Nuclear Medicine Service at UCLA Medical Center, Schelbert brings both traditional clinical experience and an eye for the cutting edge of molecular imaging and treatment to the position of editor-in-chief. He has truly "hit the ground running"—with a first issue as editor that featured a new look and revised content and was accompanied by a comprehensive supplement on PET/CT (January 2004).

The SNM Publications Committee has taken a close look at its activities to ensure that these are parallel and complementary to the main initiatives of the Society. Like the Society, we realize the importance of serving the entire nuclear medicine community—physicians, technologists, physicists, research scientists, and even our referring clinicians. Our constituency is broad, and SNM publications will continue to serve its diverse needs.

Education has been identified as a primary outreach initiative of the Society, and publications will play an integral role in this effort. One immediate goal is to increase the continuing education (CE) features included in *JNM*. With the opportunities provided by a revamped SNM Web site, more CE material and examinations can be made available to a wider public.

Molecular imaging and targeted therapy, the foci of another Society initiative, promise to revolutionize nuclear medicine. Many of the most important discoveries in these areas are reported at the SNM annual meeting and in the pages of *JNM*. Through these and other venues, we have already begun to publish a definitive body of work that individuals both in and outside nuclear medicine can look to for credentialing purposes. Building on this effort and consolidating the results in accessible forms is a goal for the coming year.

The SNM should continue to develop material of practical use to its membership. A revised *SNM Practice Guidelines* was published in June 2003, and regular revisions will be issued to keep practitioners up to date on standards. Plans are underway to update and modernize the MIRD series so that it can be used effectively in teaching. An active book publication program, including new titles in the self-study series, is ongoing, with 2 new titles published in 2003 and 2 more planned for 2004. New publications are under consideration, including a proposal for a board examination review book.

Because the Society and its publications share goals, we have a distinct advantage in finding new approaches to publications and seizing the initiative in outreach efforts. *JNM* readers will be best served by maintaining their strongest elements. The addition of more subject-focused supplements and CE offerings will serve to consolidate and enlarge the library of information we will all need as our field advances. The international scope of our activities will continue to broaden. In 2003, the popularity of the Japanese-language version of *JNM* resulted in an extended licensing agreement for the publication.

Concentrating on our proven strengths—including *JNM*—and expanding our dedication to building and disseminating a definitive knowledge base for our rapidly growing specialty will provide valuable assets to the SNM and its leadership position in nuclear medicine.

Steven M. Larson, MD
Chair, SNM Publications Committee

From the Brain Imaging Council

The SNM Brain Imaging Council provides a forum whereby information relating to brain imaging may be discussed and disseminated and also provides a mechanism for the promotion and encouragement of basic brain imaging research and development. In 2003, the council continued to maintain and update the Normal SPECT Brain Perfusion Database (http://brainscans.indd.org), a searchable archive of regional cerebral blood flow studies in healthy human subjects for purposes of education and research. Images, including reconstructed SPECT scans in several file formats, can be viewed, and raw projection data can be downloaded along with demographic and scan parameter information.

The council has also begun to address one of today's most serious challenges to nuclear medicine. Nuclear medicine brain imaging techniques, which are providing extraordinary breakthroughs in diagnosis and patient management, are seriously underutilized, especially in North America. Clearly, new and comprehensive approaches are needed to educate both nuclear medicine practitioners and referring physicians about the advantages that these techniques confer.

At the 2003 SNM annual meeting in New Orleans, LA, council members organized and/or participated in a range of categorical courses and presentations on functional imaging in Alzheimer's disease, small animal brain imaging, SPECT brain imaging, and a broad range of neuroscience topics. Dean F. Wong, MD, PhD, from the Johns Hopkins University Medical Institutions (Baltimore, MD), delivered the 2003 Kuhl–Lassen Award lecture, a stimulating talk on brain SPECT. This marked the third year that the presentation of the Kuhl-Lassen award and lecture, sponsored by the Brain Imaging Council, have been incorporated into the regular educational programming of the meeting. A fresh slate of continuing education and categorical courses in brain imaging is planned for the 2004 meeting in Philadelphia, PA.

The council is also in the planning stages for organizing a 1- or 2-day international brain symposium that is intended to heighten awareness of the usefulness of nuclear medicine brain imaging techniques. The need for education (including public outreach) is great, and such a meeting would aid in the creation of an international community focused on these issues.

Another area of interest for the council is the need to increase the numbers of individuals involved in and aware of active research in brain imaging. In Europe, for example, new radiotracers are clinically available, with especially promising indications for Parkinson's disease. Rapid dissemination of this information is essential if these innovative tracers are to be transformed into productive neuroreceptor research and ultimately clinical applications in the United States. Similarly, the extraordinary potential of PET, SPECT, and related small animal imaging in drug development must be nurtured by enhanced investment in research and in methods of sharing results with a broader community.

More than any other aspect of contemporary nuclear medicine, brain imaging techniques have seized the attention of the public. Reports on neuroreceptor imaging in applications as wide ranging as addiction, Alzheimer's, attention deficit disorders, and even prayer were picked up and covered with interest in the popular media in 2003. The time is right for outreach efforts that will unite the international nuclear medicine community in addressing the underutilization of techniques that will provide the basis for 21st-century insights into the human brain. The Brain Imaging Council will continue to support the growth of this knowledge and encourage avenues of communication and education.

Masanori Ichise, MD
President, SNM Brain Imaging Council

From the Computer and Instrumentation Council

The SNM Computer and Instrumentation Council (CaIC) had an active and innovative year, with the introduction of new Web features and educational offerings. The council now includes more than 540 members with an interest in computers or nuclear instrumentation and applications in therapeutic, diagnostic, or investigational nuclear medicine.

As reported previously in Newsline (*J Nucl Med.* 2003;44[10]:19N), the CaIC exercised its special expertise by holding the first-ever SNM online election for 4 of its members in 2003. Michael K. O'Connor, PhD; Douglas J. Wagenaar, PhD; C. David Cooke, MSEE; and S. James Cullom, PhD, were elected by e-mail vote ballots. The election went smoothly, and response has been positive from membership and from other SNM councils interested in pursuing online elections.

In addition, in 2003 we began electronic publication of the CaIC newsletter, which is distributed to council members by e-mail. The increased ease of production and reduced cost of mailing enhances our ability to exchange ideas and technical information. The most recent issue of the newsletter contains 3 scientific articles from new CaIC Board members. We are hopeful that members will use the newsletter as an intermediate step through which talks and posters presented at the summer annual meetings can be published as short communications before appearing as full manuscripts in peer-reviewed journals. We welcome contributions that broaden the scope of the CaIC newsletter.

CaIC member and newsletter editor Gary Sayed organized an excellent and well-attended categorical seminar on small animal imaging at the SNM annual meeting in New Orleans last June. Also at the annual meeting, the CaIC Young Investigators Symposium featured 7 awards presented to young scientists within 5 years of their doctorates. The results were a tie for first place between Yuchuan Wang of Johns Hopkins University (Baltimore, MD) and Nils Schramm of the University of Marburg and Research Center, Juelich (Germany). The remaining 5 participants, receiving Honorable Mention awards, were Zixiong Cao (University of Florida, Gainesville), Amy Perkins (University of Pennsylvania, Philadelphia), Michael A. Miller (University of Indiana, Bloomington), Ole Munk (Aarhus University, Denmark), and Eric Turcotte (University of Washington, Seattle).

We are also currently working to help obtain new examination material for the American Board of Science in Nuclear Medicine. The new material will provide a mechanism for certifying practitioners of nuclear medical science in the areas of nuclear medicine instrumentation and physics, radiopharmaceutical science, and radiation protection (www.absnm.org).

The rapid pace of technology change continues to challenge those who would keep a finger on the pulse of computers and instrumentation in nuclear medicine applications. Moving our election and newsletter activities into electronic format was relatively easy. In contrast, nuclear medicine remains somewhat of an orphan when it comes to new developments in radiology-wide digital picture archiving and communication systems. Through dedicated efforts by our members (Jerry Wallis, MD, and Mark Madsen, PhD), we are working with industry to better integrate nuclear medicine images into radiology digital archive systems. As PET/CT systems continue to be purchased and installed at an ever-increasing rate, we look forward to working more closely with our x-ray–oriented colleagues and to finding new ways to test, calibrate, and better interpret these combined functional/anatomical images. The CaIC will continue to address these and other emerging topics through an evolving range of outreach and educational efforts.

I. George Zubal, PhD
President, SNM Computer and Instrumentation Council

From the Cardiovascular Council

The field of nuclear cardiology has experienced a tremendous growth in recent years, with the number of patients undergoing myocardial perfusion imaging procedures rising from 3 million in 1996 to 6 million in 2001 and preliminary estimates as high as 9 million for 2003. The rate of growth of myocardial perfusion imaging is about double that of stress echocardiographic procedures. One reflection of the rapid growth of the field can be seen in industry statistics: 11,600 gamma cameras were sold in 2001 alone. At the same time, implications for PET and novel radiotracers in nuclear cardiology are being explored around the world. The Cardiovascular Council (CVC), the council with the largest membership in the SNM, is excited about this continued growth.

The council is currently engaged in a number of programs, many of which were initiated by immediate past-president Josef Machac, MD. Among these initiatives is the strengthening of our relationships with other societies, including the American Society of Nuclear Cardiology (ASNC). In a joint effort with ASNC and other groups, the CVC has helped to organize a program on cardiovascular molecular imaging to be held under the leadership of CVC board member Dr. Albert Sinusas at the National Institutes of Health in Bethesda, MD, on May 3 and 4. The program grew out of a CVC-organized session at the 2002 SNM mid-winter meeting that focused on new approaches for targeted imaging of the cardiovascular system.

The cardiovascular scientific and clinical sessions at the SNM's 2003 annual meeting were infused with the excitement of new science and innovative approaches, including presentations on angiogenesis, thrombosis imaging, molecular and gene expression imaging, attenuation correction, prognostic imaging, radiotracers, and instrumentation. Clinical cardiac PET perfusion and metabolic imaging procedures were of great interest to attendees. Twelve continuing medical education courses on cardiovascular topics were organized to review the "bread-and-butter" topics in nuclear cardiology. These featured a range of distinguished presenters and were well attended. The Cardiovascular Categorical Course, held on June 21, was organized by Marcelo DiCarli, MD, the CVC president-elect, and addressed cutting-edge issues in the field. Nagara Tamaki, MD, PhD, of Hokkaido University (Sapporo, Japan), a member of the Board of Directors of the CVC, and I organized a session on international trends in nuclear cardiology. Speakers representing Asia, Europe, and Latin America provided a rare qualitative and quantitative comparison of the practice of nuclear medicine around the globe. A synopsis of the session will be published in the March issue of *JNM's* Newsline.

The 14th Cardiovascular Young Investigator Competition was held at the annual meeting, with more than 70 abstracts submitted for consideration. The 7 finalists' presentations were judged on the basis of scientific merit, organization, practicality, presentation style, and technical quality. The first prize of $500 was awarded to Y. Chen of the UCLA School of Medicine (Los Angeles, CA), whose presentation was titled "Micropet Imaging Of Rat Cardiac Gene Expression Using Bicistronic Adenoviral Vector-Mediated Gene Delivery."

The CVC Herrmann Blumgart Award, created to recognize outstanding achievement in nuclear cardiology and service to the CVC was presented to Robert C. Hendel, MD, a past president of the CVC and the new president of ASNC.

Education outreach efforts will remain a focus of the CVC, with numerous presentations scheduled for the 2004 mid-winter meeting and the 2004 annual meeting in June. A continued effort to work with and utilize the expertise of other councils and societies will enhance our ability to present a comprehensive range of presentations that span the growing diversity of nuclear cardiac applications.

One of the important activities of the CVC is participation in the formulation of procedure guidelines. Members of the CVC participated last year with the SNM Guidelines Committee in updating the guidelines on gated blood pool and myocardial perfusion imaging. These were then resubmitted to the Guidelines Committee and were approved by the House of Delegates. Members of the CVC also worked with the ASNC Quality Assurance (QA) Committee on new guidelines for PET imaging. The ASNC QA Committee initiated guidelines on technical acquisition and clinical display and on interpretation guidelines, headed, respectively, by Dr. Stephen Bacharach and Dr. Heinrich Schelbert. These guidelines are being published in the *Journal of Nuclear Cardiology* and *JNM*. The CVC looks forward to collaborating with other SNM councils, the QA Committee of ASNC, and other extramural organizations on future updates as well as new guidelines.

Salvador Borges-Neto, MD
President, SNM Cardiovascular Council

From the SNM Historian

The Society of Nuclear Medicine opened the celebration of its 50th anniversary in 2003 with a special plenary session on June 23 at the annual meeting in New Orleans, LA. A welcome guest at that session and throughout the meeting was Tyra Hutchens, MD, the only surviving member of the core group that founded the Society in 1953.

The SNM Mobile Coach was also launched last June as part of the anniversary celebrations. This completely self-contained educational module is making the rounds of SNM chapter meetings, hospital and university health fairs, nuclear medicine department public outreach events, and state and national meetings of image-related organizations. The modified mobile PET unit contains some historical information but more prominently features the contemporary benefits of nuclear medicine. Response has been positive at stops along its tour, which will culminate at the SNM 2004 meeting in Philadelphia, PA.

We have continued to build on the excellent archival and historical groundwork of the previous SNM historian, Dennis Patton, MD. He also expanded the canon of historical resources this year with the publication of a translation of Feld and de Roo's *History of Nuclear Medicine*. (See the October 2003 Newsline [*J Nucl Med.* 2003;44;(10);24N] for a review). He continues to research and report on topics of historic interest in the field.

The Society is preparing its own history, to be released at the 2004 meeting. The well-illustrated book will survey the development of the Society from its beginnings in the Pacific Northwest to its current status as the world's premiere nuclear medicine organization. Watch Newsline for more details on this book and information on ordering copies for your colleagues and departments.

In January of 2003 at the request of Newsline editor Conrad Nagle, MD, we began to publish portions of the texts of my Highlights Lectures, delivered every year since 1977 at the SNM annual meeting. We began with 1977 and will continue publishing these through 2004. It has been most interesting to look back at these lectures and identify the enthusiasms and high points of past years, as well as to take an analytical look at the unfulfilled promise of some technologies and the unexpected benefits of others. I have supplemented a number of these lectures with commentary, recollections on related events, and observations stemming from the benefit of hindsight. The earlier lectures were previously unavailable to researchers and scholars. Through the efforts of the SNM staff, the Highlights Lectures from 1983 on are being transcribed in their entirety and, as excerpts from each year appear in Newsline, that year's complete lecture will be made permanently available on the SNM Web site (www.snm.org/HistoryCornerArchives).

In cooperation with Newsline staff, I continue to write and stockpile history features on a wide range of nuclear medicine and radiation topics for future use, both in the pages of Newsline and other venues. Members of the Society and the nuclear medicine community with an interest in history are encouraged to get involved in actively collecting and writing about elements of our history. I welcome contacts and inquiries about artifacts, collections of books and papers, and other items of historical interest. Our challenge as we move beyond the celebration of our first half century is to identify practical but effective ways to continue to preserve the history of our unique field.

Henry N. Wagner, Jr., MD
SNM Historian

Government Relations in 2003

Much has happened over the last year: Congress passed and President George Bush signed a new Medicare law, the technologist licensure legislation was introduced in the House of Representatives and Senate, and amendments to ease highly enriched uranium (HEU) export for the production of medical radioisotopes were included in the 2003 Energy Act—which, unfortunately, did not pass.

In March 2003 representatives of the SNM and the American College of Nuclear Physicians (ACNP) met with key members of Congress on issues of importance to the nuclear medicine community. Some of the key issues discussed were:

- Reestablishing the FDA Medical Imaging Drugs Advisory Committee to advise the FDA on diagnostic radiopharmaceutical applications.
- Congressional involvement in the FDA approval process of new diagnostic radiopharmaceuticals.
- Reinstatement of funding for the Advanced Nuclear Medicine Initiative at the Department of Energy and creating a revolving fund to provide radioisotopes for research.

- Support of legislation that would require state licensure of nuclear medicine technologists and other professionals involved in radiologic imaging and therapy.

Senator Mike Enzi (R-WY) introduced S. 1197, the Consumer Assurance of Radiologic Excellence (Rad-CARE) bill, in the Senate. Similar legislation, HR 1214 (the CARE bill), was also introduced in the House of Representatives. Fifteen states and the District of Columbia currently do not regulate any radiologic personnel, while fewer than half the states regulate nuclear medicine technologists. These bills seek to reinforce the 1981 Consumer–Patient Radiation Health and Safety Act to improve the safety of radiologic procedures as well as lower health care costs by decreasing the number of repeat procedures attributable to errors committed by untrained personnel.

Michael Gelfand, MD, and Simin Dadparvar, MD, co-authored a letter to the *Washington Post* stating their support for Rep. Richard Burr's (R-NC) and Sen. Christopher S. Bond's (R-MO) amendments to the 2003 energy bill that would ensure a reliable supply of medical isotopes used by nuclear medicine professionals to diagnose and treat different forms of cancer. Many nuclear medicine procedures rely on medical isotopes that are exclusively produced in Canada and Western Europe. The amendments will establish a secure basis for exporting small quantities of HEU from the United States to isotope-producing nations for the sole purpose of radioisotope production. The HEU shipments would still have to meet strict requirements for export from the United States. This effort continued under current SNM President Henry Royal, MD, but the energy bill had not passed both houses when Congress adjourned at the end of 2003. Our efforts to pass legislation to safeguard access to isotopes used in research and nuclear medicine will continue in 2004.

At the end of 2003, President Bush signed into legislation a Medicare reform act that provides prescription drug benefits to senior citizens for the year 2006 and beyond. This bill also provides at least a 1.5 % increase in Physician Fee Schedule payments for 2004 and 2005, reversing an anticipated 4.5% reduction in 2004. Payments under Medicare for many drugs used by hospitals will be revised in 2004. Many 2004 drug payments will be reduced to 85% of the Average Wholesale Price. In 2005, reimbursement will shift to an average sales price or competitive acquisition. Radiopharmaceuticals that are used in hospitals will be exempted and will be paid at the current 95% Average Wholesale Price.

Representatives of SNM and ACNP met and exchanged letters with Nuclear Regulatory Commission (NRC) commissioners in a dialog on the dose reconstruction methodology used by NRC staff in evaluating exposures. Government Relations Committee Chair Jeffry Siegel, PhD, and Carol Marcus, MD, PhD, prepared a review of the process, which has been shared with the NRC and the Advisory Committee on the Medical Uses of Isotopes (ACMUI). SNM and ACNP also recommended that the commissioners seek additional expert advice on such matters, either from the ACMUI or outsiders—advice that is now being implemented.

The NRC closed out the year by publishing proposed revisions to the training and experience requirements under 10 CFR Part 35, the final rule on the Medical Use of Byproduct Material, and the recognition of medical specialty boards and their diplomates. Revisions to the rule must be finalized by October 2004, as the grandfathered board recognitions will expire at that time. Affected specialties and boards are preparing comments on the proposed revisions.

The FDA Nuclear Medicine Coalition, formally launched in Spring 2003 as a part of the Nuclear Medicine Industry Leaders Working Group, met twice in Washington, in May and December. The growing membership of the coalition currently includes representatives of industry with interests before the FDA, and also representatives of physician, technologist, patient advocacy, and other imaging-related constituencies. The coalition's first activity was to review and prepare comment submissions from coalition member organizations on the FDA's Revised Guidance Document (June 2003). The coalition successfully launched an ongoing outreach to patient advocacy organizations designed to involve these organizations in coalition activities (and those of the nuclear medicine community at large), and to also identify areas of mutual interest where the coalition and SNM could work with these organizations on their respective priorities.

William Uffelman
Director of Public Affairs, SNM

SNM and ERF: The Alliance and the Foundation

The word *philanthropy*, Greek in origin and strictly translated as "love of humankind," is generally equated with private giving. It is a tradition, characterized by Puritan minister Cotton Mather in 1710 as "a perpetual endeavor to do good in the world," that has become a major force in American society.

The pursuit of this perpetual endeavor was included in the SNM Education and Research Foundation (ERF) articles of incorporation, executed more than 30 years ago on March 27, 1973. The articles state, ". . .the corporation is to operate exclusively for educational and scientific purposes." Since that time, through the generosity of the nuclear medicine community, the SNM ERF has given more than $1.5 million. The money has supported pilot research grants, student and research fellowships, Cassen prizes, and teaching tools, including 2 major books and a recent basic science CD. In 2001, the ERF Board of Directors declared that, "The vision of the Foundation is to be an effective fundraising organization, primarily in support of the strategic plan of the Society of Nuclear Medicine." In 2003 the Society, the Technologist Section, and the ERF signed a "strategic alliance" that will facilitate that vision.

The immediate effect of the alliance was the creation of a development office that will be supported by SNM and the ERF. Kathy Bates was retained as our new director of development and began work late last fall. This was an important, critical, and welcome step that will lead to a more sophisticated and long-range approach to the ERF 's major role, that of raising funds. The initial task of the development director was to launch a conjoined appeal in celebration of the SNM's 50th anniversary. Donors will be recognized at the SNM annual meeting in June 2004.

The culture and role of a philanthropic organization's Board of Directors differs from that of a professional organization such as the SNM. The ERF Board's fundamental purpose is to be a catalyst for raising funds. The current Board structure will be decreased in size, and no member will be on the Board solely because he or she holds office in SNM. The Board will consist of 2 members appointed by the SNM, 2 members appointed by the SNM Technologist Section (SNMTS), and 7 members elected by the ERF Board (4 members-at-large plus 3 officers). It is anticipated that the Board will meet several times this year for the sole purpose of better understanding its responsibilities for resource development. The names of the new ERF board members will be announced at the SNM mid-winter meeting.

In the past, the ERF has selected all awardees and grant recipients. Now, the ERF will award the Benedict Cassen Prize and Benedict Cassen Postdoctoral Fellowships, and the SNM will select all other recipients, with the exception of the Paul Cole Student Technologist Scholarships, which will be awarded by the SNMTS. (See page 64A for more information on the awards currently available.) The number and size of awards and grants will be predicated yearly upon the success of the ERF's fundraising activities.

The impact of these changes should be noticeable. Internally among staff and leadership these changes have improved communication. An ERF delegate will hold nonvoting positions on the SNMTS National Council and the SNM Board of Directors, which will further promote mutual awareness. The result we all seek is an increase in philanthropy for the benefit of nuclear medicine.

For our field, the promise is as great as the need. Current student fellowships and summer research grants are barely adequate in size and number. The Society should be able to offer clinical fellowships. Where is the money to respond to the need for education as the field expands, such as in radiotherapy? To endow a fellowship in imaging instrumentation or radiopharmacy?

The success to date of the ERF has rested on many shoulders and on a few major donors, for which we are grateful. This year, the Jane and Abass Alavi family has again made major contributions in support of student awards and scholarships. This summer, through the efforts of SNM President-elect Mathew Thakur, PhD, a commitment of $100,000 was made by Carlo Croce, MD, director of the Kimmell Cancer Center in Philadelphia, PA, to develop an international grant program. The Society has appointed a task force of international representatives to review applications for these grants.

In all, the ERF is excited about the alliance, the new development office, and the future of nuclear medicine. In our 30th year and the Society's 50th year we look back to a proud history and forward to a very bright future.

Kenneth McKusick, MD
President, SNM ERF

From the SNM Committee on Education

At a planning meeting held in late 2002, the Committee on Education reviewed ongoing educational programs and developed a strategic plan for SNM educational activities. The group identified 5 major areas of focus for the next 1–3 years: (1) PET education; (2) basic science/emerging technologies; (3) international education initiatives; (4) resident and student education; and (5) patient education. In a follow-up conference call in May 2003, we assessed initial progress on these goals. In addition, we affirmed our commitment to reviewing existing educational materials and distance learning activities and to forming strategic relationships to enhance the distribution and reach of SNM educational work. Throughout 2003 we worked to make substantial advances in each of these areas.

The PET Learning Center in at SNM headquarters in Reston, VA, continued to grow and expand its outreach in 2003, with a total of 12 weekend session for physicians and technologists in Reston plus 2 sessions offered at alternative sites. The PET Learning Center has been tremendously successful, with most sessions booked well in advance. We will continue to build on these efforts, with 22 sessions already scheduled for 2004 and the debut of 1-day sessions on specific aspects of PET imaging and technique. The first of these, "Cardiac PET: Expanding Nuclear Cardiology," was held on January 24 at the Sheraton Wild Horse Pass Resort and Spa (near Phoenix, AZ). The next 1-day session, to cover neurological aspects of PET, will be offered on April 17 in the Washington, DC area.

The year 2003 also marked the launch of the SNM PET Center of Excellence, headed by Peter Conti, MD. Working together, we hope to expand the reach of the PET Learning Center through targeted publications and the encouragement of expanded continuing medical education. We will also develop a definitive advanced PET/CT curriculum that can be used by nuclear medicine physicians and trainees and by individuals in other imaging specialties.

In New Orleans in 2003, as at every SNM annual meeting, the Education Committee was active in several arenas. We presented the 2nd Modern Imaging Technology Workshop on instrumentation and molecular imaging on June 20 and 21, just prior to the beginning of the meeting. Discussions included advances in molecular approaches to movement disorders, Alzheimer's disease, proteomics, and imaging of the heart and lung. The well-attended annual Nuclear Medicine Board Review was held on June 21 and 22. The review was captured and produced in 2 formats for distance learning: a pay-per-view Web cast and a CD-ROM. The CD-ROM features 12 one-hour lectures by distinguished clinicians and scientists, covering gastrointestinal system and abdominal imaging (I and II), FDG PET, brain and central nervous system review, cardiac imaging, endocrine imaging, tumor/abscess imaging, NRC regulations, bone/gallium scintigraphy, pulmonary imaging, lymphoscintigraphy and sentinel lymph node imaging, and bone densitometry.

As part of a stellar schedule of educational and scientific presentations at the meeting, the Education Committee partnered with 6 SNM chapters to provide programs on radioimmunotherapy in non-Hodgkin's lymphoma. The committee provided curriculum, slides, educational grants, and partial travel support for these programs on a topic of great interest in nuclear medicine and oncology.

The committee will be active at the SNM 51st Annual Meeting this June in Philadelphia, PA. One highlight will be a 2-day PET and PET/CT categorical course.

We continue to explore ways in which the Internet, and, especially, the revamped SNM Web site, can be used to advance the mission and goals of the Education Committee. In 2003, we expanded and enhanced our online teaching files through the SNM Case-of-the-Week Web site feature (www.snm.org/cotw). A variety of continuing education (CE) credits are now available online, including exams derived from CE articles in *The Journal of Nuclear Medicine* and the *Journal of Nuclear Medicine Technology*. Webcast presentations of educational events (such as the Nuclear Medicine Board Review sessions) include streaming video and audio and are supplemented with text, graphics, and extended educational opportunities.

Alan Maurer, MD
Chair, SNM Education Committee

DOE Isotope Program Updates

The Department of Energy (DOE) strategy is to maintain critical user facilities in a safe, secure, environmentally compliant, and cost-effective manner to support national priorities. Within this context, the Isotope Program will avail itself of the department's unique facilities for the production of radioisotopes. Investments will also continue to be made. For example, the DOE is expanding its accelerator capacity by investing in the Isotope Production Facility (IPF), a new production capability at the Los Alamos Neutron Science Center. The IPF is in its final stages of commissioning and should be producing isotopes in 2004.

The Isotope Program is working to fully address its customers' requirements and to forecast future trends. This is being done through frequent interactions between customers and program staff, data obtained from customer and grantee site visits, attendance at society conferences (e.g., the annual meeting of the SNM), and coordination of isotope activities with stakeholders in the isotope community, including other federal agencies. For example, to ensure the future supply of medical research isotopes for National Institutes of Health grantees and researchers, the staffs of the DOE Isotope Program and the National Cancer Institute have been seeking ways to best plan, select, and fund production of medical research isotopes. Information from both agencies has been analyzed, and a policy will be forthcoming. Another valuable source of information has been the Nuclear Energy Protocol for Research Isotopes (NEPRI; www.ne.doe.gov/infosheets/NEPRI.pdf). The NEPRI, which was implemented in fiscal year 2003, has been significantly revised, based on input from the isotope research community. These revisions will greatly improve the submitting and processing of isotope preorder forms. The NEPRI process gives DOE insights on which isotopes to produce and enables DOE to prioritize production of isotopes that will provide the greatest benefit to medical research.

The principal elements of the Isotope Program's strategy are: efficient use of existing facilities and staff, backup supply agreements, upgrades of present facilities, purchase of needed equipment, and investment in new facilities as warranted by demand. The challenges to the program will continue as new scientific and medical research produces increased demand for new isotope products.

John Pantaleo
DOE Office of Isotopes for Medicine and Science

National Institute of Biomedical Imaging and Bioengineering Growing Rapidly

The bioimaging and bioengineering communities have enthusiastically embraced the programs and activities of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) over the past 3 years. Requests for applications issued by the institute in fiscal year (FY) 2003 yielded an astounding response: more than 1,100 applications were received. Remarkably, about 50% of respondents were self-identified as new applicants to the National Institutes of Health (NIH). This robust response makes apparent the importance of NIBIB's programs and the research it supports.

The year 2003 was active for NIBIB staff as well, with more than 744 extramural research and training applications funded in the amount of $257 million. We were delighted to now have a solid base of grantees poised to rapidly advance the Institute's mission. In partnership with our research community, NIBIB is ready to meet new challenges.

The FY 2004 presidential budget request for the Institute is $282 million. Upon approval, NIBIB plans to participate in several designated initiatives, including: Informatics Training for Global Health; Cellular and Molecular Imaging of the Cardiovascular, Pulmonary, and Hematopoietic Systems; Development of High-Resolution Probes for Cellular Imaging; and Robotics for Rehabilitation Therapy. In addition, NIBIB is slated to participate in the NIH Roadmap activities, which focus on 3 main themes: new pathways of discovery, research teams for the future, and the re-engineering of the clinical research enterprise.

An important milestone for NIBIB in the coming year will be the startup of an intramural research program dedicated to multidisciplinary research and training in emerging biomedical technologies.

The Institute's research portfolio now tops 800 grants, and advances reported by NIBIB-supported researchers are extraordinary. Among these are:

- A team of researchers led by Dr. Watt Webb of Cornell University has developed a remarkable laser-

based technology that allows visualization of the cells and molecules in living tissue without the use of potentially noxious stains. This technology will enable researchers to focus on the tissue surface as well as the layers buried beneath.

- Professor Alan Verkman, a NIBIB-supported investigator from the University of California at San Francisco, has developed a robotic screening procedure that examines small molecules in the search for potent and selective inhibitors and activators of the cystic fibrosis transmembrane conductance regulator (CFTR) protein. The inhibitors and activators will be useful tools in understanding the biochemical mechanisms that underlie CFTR protein function, which may suggest new approaches to managing cystic fibrosis.
- Dr. Jonathan Wolpaw and his team at the Wadsworth Center have developed a brain–computer interface that uses readily available hardware and an adaptive algorithm to process and translate brain activity, enabling individuals with neuromuscular diseases to use "thoughts" to control a cursor on a computer screen or a prosthetic device.

For more information on NIBIB and its activities, visit the Web site at www.nibib.nih.gov.

Donna J. Dean, PhD
Former Deputy Director, NIBIB

ABNM Focuses on PET, Updates Certification Exam Process

The American Board of Nuclear Medicine (ABNM) began 2003 with a new strategic plan and ended the year by offering its first computer-based certification and recertification examinations. The ABNM certified 4,778 diplomates in nuclear medicine and recertified 135 diplomates, as the first-time limited certificates issued in 1992 came up for renewal. The ABNM mission statement, revised in January 2003, states: "The American Board of Nuclear Medicine is the primary certifying organization for nuclear medicine in the United States. The Board serves the public health through assurance of high-quality patient care by establishing standards of training and certification of initial and continuing competence for physicians rendering nuclear medicine services."

Recognizing the emergence of PET imaging as a growing and integral part of nuclear medicine practice, the ABNM has worked with the Accreditation Council for Graduate Medical Education's Residency Review Committee for Nuclear Medicine and the nuclear medicine program directors organization as these groups have developed criteria for PET training. A revised "Components of Professional Competence for the Nuclear Medicine Physician" was published in the June issue of *The Journal of Nuclear Medicine* (2003;44:988–990).

The revised content manual for the ABNM examination, available on the ABNM Web site (www.abnm.org), now includes basic science, technical, and clinical knowledge aspects of PET. The clinically based recertification examination is also available to diplomates who are without time-limited certificates but who want a way to officially document their competency in PET imaging. We have worked with the SNM to see that the refresher course that is directed at residents planning to take the certification examination is also available for continuing medical education credit to practicing physicians preparing for the recertification examination. This course will next be offered at the June 2004 SNM annual meeting in Philadelphia.

The first computer-based certification and recertification examinations were successfully given in 2003 at more than 200 sites across the country, using the facilities of the Pearson testing organization. The overall cost of taking the examinations was reduced, because travel to a central test site and associated overnight hotel costs were eliminated. In addition, the examination could more realistically test interpretive knowledge, with images displayed on monitors representative of standard image interpretation conditions. The ability to display cine images is now available.

As the voice representing nuclear medicine physicians on the American Board of Medical Specialties, we have been developing the mandated general clinical competencies for residency training and components of competence for recertifying board-certified physicians. This topic was discussed previously in the September Newsline (*J Nucl Med.* 2003;33[9]:12N) and on the ABNM Web site. All of these efforts are directed at maintaining ABNM certification as the recognized guarantor of the highest quality of nuclear medicine practice.

As noted in Newsline in January (*J Nucl Med.* 2004; 45[1]:24N), William H. Blahd, MD, longtime leader of the ABNM, is stepping down as executive director. During 2003, the Board completed an administrative review directed at assuring a smooth transition and maintenance of a strong office to carry out the ABNM mission as we participate in these most exciting times for our specialty.

Lawrence Holder, MD
Chair, ABNM