Imagine a day when no outpatients are seen in the nuclear medicine department and only a handful of inpatients are brought in. Imagine a department with only a skeleton staff and standing radiopharmaceutical orders that have dropped dramatically. Now imagine day after day of this schedule, not only at one hospital but at all the surrounding hospitals. That is what nuclear medicine practice in Toronto was like for a period in March and April during the worst of the severe adult respiratory syndrome (SARS) outbreak.

“Business as usual simply shut down,” said Marlon Hershkop, MD, who is program director for the University of Toronto nuclear medicine consortium that includes facilities at Mount Sinai Hospital, the Toronto Hospital, the Hospital for Sick Children, Princess Margaret Hospital, St. Michael’s Hospital, Sunnybrook and Women’s College Health Science Centre, and the PET Centre at the Clarke Institute of Psychiatry. “We performed no elective procedures, and our total volume was down to about 10%.”

For a period of about 3 weeks from March into April, all hospitals in Ontario saw patients only on an inpatient or emergency basis. “We typically do about 2,000 medical imaging procedures a day,” said Hershkop. “At the height of the quarantines and proscriptions about interactions, we were down to less than 300 a day.” Even emergency rooms saw drastic reductions in patients. Many acutely ill patients simply “refused to come in,” said Ronald Laxer, vice president for clinical and academic affairs at the Hospital for Sick Children, in mid-April. “Usually our emergency room visits are running 125 to 150 a day. We’re seeing one-third of that.”

SARS made its first appearance on the Toronto medical scene on March 5, when a 78-year-old grandmother died after returning from a visit to Hong Kong. Her 43-year-old son became seriously ill and was admitted to Scarborough Grace Hospital, where the infection was passed on to doctors, nurses, and other patients before he died on March 13. Soon health care workers at Scarborough Grace became ill.

In the ensuing weeks, as the numbers of infected individuals and deaths rose, several hospitals shut down operations entirely and others closed emergency departments and instituted additional measures to inhibit transmission. Thousands of individuals, many of them medical workers, were placed on home quarantine. Others were quarantined in medical facilities, sometimes under duress. As fears mounted, masks and gloves became mandatory in hospitals and could be seen on many people going about daily activities in the streets and shops of Toronto.

Nuclear medicine was not called on to provide imaging services for SARS patients. “The suggestion really was not made,” said Hershkop, pointing out the almost insurmountable difficulties in transporting infected patients through the hospital and the risk of putting more hospital personnel under quarantine constraints.

One immediate effect of SARS on the Toronto imaging community was a ban on going from institution to institution. Physicians accustomed to seeing patients at several hospitals or to working certain hours of each week in a different imaging department found themselves cut off from patients and colleagues. “Thank goodness for PACS [picture archiving and communication systems],” said Hershkop. The potentially beneficial effects of having more free time for teaching or graduate education could not be realized during this period, because hospitals encouraged workers at all levels to stay at home unless they were needed for specific shifts.

By late April, some hospitals had begun to resume elective procedures on a restricted basis, and volume in the network that Hershkop directs was back up to 50%. “What really worries us at this point is the backlog, especially for oncology patients who really need the services of nuclear medicine both for diagnosis and assessment of treatment,” he said. “Some patients, for example those needing cardiac imaging, may have shunted over to clinicians in private practice, but we don’t really get the impression that has happened. Most people have simply stayed away from medical settings, and, at some point, they will return.”

The process of returning to normalcy is relative. Most hospitals in early May still did not encourage visitors, and separate entrances were established for staff members. Visitors and patients received questionnaires about symptoms and recent travel, squirts of antibacterial spray, and, in some hospitals, paper gowns and masks.
Hershkop believes that most of the lessons learned from the SARS experience were at the hospital and public health levels. “The general consensus is that the hospitals were initially a little slack in terms of infection control—mainly because they had never dealt with anything like this before,” he said. “For the rest of us, it’s been a potent reminder that we should give serious consideration to wearing a mask and gloves in the imaging department when we deal with patients who have respiratory symptoms.” At Newsline press time, the international toll for SARS stood at almost 9000 people infected and more than 690 dead. In Toronto 147 individuals were definitively diagnosed with SARS and 24 died.

Tolls on Schedules and Morale

For physicians and other health care workers, dealing with SARS and the potential spread of infection presented organizational, financial, and emotional difficulties.

“It’s extremely difficult for our members,” said Pat Collyer, president of the local labor union that represents laboratory, nuclear medicine, and radiology technologists at the Scarborough Hospital. “The directives from the Ministry of Health change almost daily.” Speaking on April 25, she noted that although patient loads were down, proscriptions preventing medical personnel from moving from one hospital to another had played havoc with scheduling. Most individuals took this “in their stride,” although the new schedules had constraining effects on their personal lives.

The emotional toll extended to changes in the usual social routines of the hospital. Collyer noted, “When taking our breaks, we must not sit together but must maintain at least 1 meter distance apart from one another in the cafeteria.” Other health care workers under home quarantine deliberately isolated themselves from family members to avoid spreading the infection. Collyer also expressed concerns about staffing shortages (already tight in radiology and nuclear medicine) when normal scheduling resumes.

A perennial complaint about the Canadian health care system has been the length of time some patients must wait before gaining access to high-tech medicine, including sophisticated imaging techniques and complex surgeries. Most observers fear that this hiatus in “medicine as usual” will exacerbate these problems. “A number of cancer surgeries have been delayed,” Robert Bell, MD, chief operating officer at Princess Margaret Hospital, an Ontario cancer treatment center, told the press. “We know that before SARS broke out, our waiting times were prolonged, so we’re sensitive to the fact that we can’t let cancer patients wait too long.”

“We’re short hundreds of nurses in the Toronto area because they’re quarantined,” said Barb Wahl, president of the Ontario Nurses Association. “We’re already stretched to capacity and along comes this. We aren’t prepared or able to deal with this kind of thing.”

Lessons for U.S. Hospitals

Even with the numbers of new cases of SARS subsiding in Toronto and no signs of the predicted epidemic outbreak in the United States, officials from the World Health Organization and the Centers for Disease Control (CDC) warned that the disease is likely to recur, possibly in a more severe form. In major cities, emergency medical alert systems set up to deal with Homeland Security issues are now looking at precautionary measures for handling a possible epidemic. More than 5,000 emergency rooms in the United States have identified special isolation areas and are giving attention to redirecting emergency room flow for patients reporting with severe respiratory symptoms. The demand for masks, especially the N95 masks that block 95% of solid and liquid particles, is high. At the 3M Corporation in Minnesota, for example, factories are running on 24-hour schedules 7 days a week to meet back orders for the masks.

Many hospitals are re-emphasizing the basics of handwashing. Some imaging departments are addressing issues of patient contamination of devices and advising staff to wear double gloves and face masks when imaging patients with respiratory infections. “SARS has the potential to be a significant problem here if it were to get out of control, considering what happened in Toronto,” said Stephen Sokalski, DO, director of infectious diseases at Advocate Christ Hospital in Chicago. “That could happen here.”

In New York City, Health Commissioner Thomas Frieden announced that the city was prepared to “invoke its legal authority” to isolate and quarantine SARS patients. He also announced that the city had activated its “syndromic surveillance system,” which follows abnormal statistical clusters of symptoms from 911 calls, emergency room visits, and drug store purchases.

Writing in the May issue of the Journal of the American Medical Association (2003:289; epub online at www.jama.org), a number of clinicians from Toronto hospitals reported on clinical features and short-term outcomes of 144 SARS patients in the area. They found that the majority of cases (77%) came from hospital exposure. On an encouraging note, they found that although SARS is associated with significant morbidity and mortality, especially in already compromised patients, the majority (93.5%) of patients in the study had survived at 21-day follow-up. This, the authors stated, has important implications for infection control:

Hospitals and clinicians’ offices must be prepared to institute appropriate respiratory precautions when assessing patients with undifferentiated respiratory conditions and their family members in order to prevent the introduction of SARS in the hospital setting. Individuals such as health care workers or household contacts of cases who are exposed to SARS patients, especially those with early symptoms, need to be placed in isolation and have appropriate follow-up. These 2 recommendations may form the basis of containing the disease as it enters new communities.

In an editorial accompanying the report, Dr. Henry Masur of the National Institutes of Health (NIH) pointed out the importance of the sometimes forgotten rule that only a healthy facili-
The Centers for Medicare and Medicaid Services (CMS) announced on April 16 that coverage for PET would be expanded to the diagnosis and staging of thyroid cancer and evaluation of “potential cardiac diseases.” The decision on thyroid cancer was based on extensive evidentiary review of the medical literature, a technology assessment, and recommendations from the CMS Medicare Coverage Advisory Committee, before which SNM representatives testified. CMS also reviewed scientific findings and statements on the utility of \(^{13}\text{N}-\text{ammonia}\) PET in evaluating possible cardiac disease and agreed that it should be covered. PET is currently covered by Medicare for diagnosis, staging, and restaging of lung, esophageal, colorectal, head and neck, and breast cancers and lymphoma. It is also covered in assessing myocardial viability and in presurgical evaluation of refractory seizures.

“These approvals mark a significant step forward in expansion of PET services available to our patients, particularly in those suffering from cardiovascular disease,” notes Peter S. Conti, MD, PhD, of the University of Southern California. “The SNM has played a crucial role in gaining consensus among key interested parties, including other professional societies and industry, in order to obtain this progress on expansion of these indications.”

CMS decided against extending Medicare coverage for soft-tissue sarcoma. After a review of submitted data, the Centers concluded that “PET did not improve patient outcomes in this group of beneficiaries.” In a move that disappointed nuclear medicine diagnosticians and researchers, CMS also restated its current denial of coverage for PET in Alzheimer’s disease, stating that “clinical benefit to patients has not been demonstrated.” Medicare continues to cover clinical evaluation of cognitive impairment under the guidelines of the American Academy of Neurology, which do not include PET. “The available scientific evidence indicates that this work-up remains the most appropriate at present for the diagnosis and management of the disease,” said a CMS statement.

The potential for PET in Alzheimer’s disease was acknowledged, however, when CMS agreed to design a demonstration study to evaluate the appropriate role of PET in patients with suspected dementia. The agency will work with the National Institutes of Health to convene a multidisciplinary expert meeting with geriatric specialists, neurologists, radiologists, PET experts, and patient advocates to fully explore the value of PET in Alzheimer’s disease.

Conti said that “although multidisciplinary consensus is the aim of such a demonstration study, it ultimately will serve only to delay approval for what is already established in the literature and in current clinical practice—that PET provides useful and timely diagnostic information in the work-up and evaluation of suspected Alzheimer’s dementia patients, regardless of the current status of treatment options.”

Decisions on coverage result from CMS investigation of formal requests for National Coverage Analysis. Currently active requests for coverage affect diagnosis and/or staging of brain, testicular, small cell lung, cervical, and pancreatic cancers. Seven additional requests for analysis were submitted in February and March for PET in ovarian and advanced prostate cancers, gastrointestinal stromal tumors, multiple myeloma, pediatric tumors, \(^{18}\text{F}\) bone scans, and Merkel cell tumors. Although coverage decisions on some of these requests could come as early as September 2003, nuclear medicine professionals have grown accustomed to long delays in the Medicare approval process. Limited PET applications for breast cancer, for example, were approved after more than 2 years of rejections, reevaluations, requests for additional supporting data, technological assessments, and laborious clearance requirements.

“It makes little sense at this point to continue to approve individual cancer imaging applications for FDG PET, given its wide potential and current use in tumor imaging,” said Conti. “Physicians know what works and what doesn’t with FDG PET, and less micromanagement by CMS in this regard would be better for everyone.” He noted that the U.S. Food and Drug Administration approved FDG as safe and effective for general cancer imaging in 2000.

For more information on these approvals and the complete approval memorandum, visit www.cms.hhs.gov.
SNM Member Brings Public Policy Perspective to New Institute

On April 14 Health and Human Services Secretary Tommy G. Thompson announced the appointment of Barbara J. McNeil, MD, PhD, Harvard Medical School, as one of two new members of the National Advisory Council for Biomedical Imaging and Bioengineering, the principal advisory body of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at the National Institutes of Health (NIH). The council provides recommendations on the conduct and support of biomedical imaging and bioengineering research and research training. Also appointed was Norbert J. Pelc, ScD, from the radiology department of Stanford University School of Medicine.

McNeil is widely known for her innovative work in public health policy, for which she has been recognized with numerous awards and honors. She is also board certified in nuclear medicine and is active in the field, with interests in ongoing research, education, clinical practice, and the effects of evolving health care policy. Called “perhaps the most influential woman in American medicine today,” she is the Ridley Watts Professor of Health Care Policy and the founding head of the Department of Health Care Policy at Harvard Medical School. She is also a professor in radiology at the Harvard Medical School and in the Division of Nuclear Medicine at Brigham and Women’s Hospital. She holds numerous appointments at Harvard and in organizations at the state and national levels and in advisory capacities to government regulatory bodies.

Her research activities focus on quality-of-care issues in the areas of measures for chronic cardiac diseases, incentives and practices for assuring quality, and assessment of guidelines in improving outcomes of care. She recently completed a 10-year study involving nearly 50 academic institutions in the United States on the benefits of a variety of radiology approaches to the initial and subsequent management of patients with cancer.

McNeil received her MD degree from Harvard Medical School and her PhD degree in biological chemistry from Harvard University. After serving an internship in pediatrics at Massachusetts General, she was a nuclear medicine resident in the radiology department at Peter Bent Brigham Hospital and Children’s Hospital Medical Center. Among many other concurrent appointments, she served from 1978 to 1995 as deputy director for residency training in the Joint Program in Nuclear Medicine of the Harvard Affiliated Hospitals. She has been a member of the prestigious National Academies of Sciences Institute of Medicine for more than 20 years.

Her work with national advisory boards, such as those of the Blue Cross Medical Advisory Panel, Technology Evaluation Center; the National Council on Radiation Protection and Measurements; the National Advisory Council for the Agency for Health Care Policy, Research, and Evaluation; the National Research Council; the Joint Commission on Accreditation of Healthcare Organizations; and the Medicare Coverage Advisory Commission have placed her in the forefront of activities relating to the introduction of new imaging technologies into clinical practice. As a longtime SNM member, she is currently on the Society’s Academic Council and the Efficacy Subcommittee. She is the author of hundreds of journal articles and numerous books and contributed chapters.

Newsline recently had the opportunity to talk with McNeil about her appointment to the NIBIB advisory board, the evolution of her interest in nuclear medicine, and specific challenges for nuclear medicine in the future.

**Newsline:** What role do you see NIBIB playing in selling the benefits of new imaging technologies and integrating the roles of imaging and bioengineering across the spectrum of NIH activities?

**McNeil:** The role of NIBIB could become extremely important if its budget becomes large enough to support the development of prototypical new devices for imaging. I am pleased to be a member of its Advisory Council. By including biological and physical sciences in its...
from the shoulder of physicians. If true, then physicians would 
assume that because information is difficult to obtain, we 
can merely lobby for reimbursement. We are coming to a “zero 
sum game” in health care, and, in fact, we may already be there. 
We need to figure out how to work within constraints, con-
sidering not only imaging costs but also total costs for 
patient evaluation and therapy.

**Newsline:** Where do you see nuclear medicine in 10 or 
20 years? What health care policy issues are associated with 
the increasingly molecular focus of the specialty?

**McNeil:** I think that we will be seeing efforts to develop 
and use radionuclides to increase specificity of diagnoses, 
whether through PET alone or through PET and CT. We will 
also be seeing PET and functional MRI used as routine tools 
in physiology research as well as in psychology research. I was 
intrigued by a preliminary study that followed up the famous 
work of Tversky and Kahneman [on decision-making mod-
els] on risk-seeking behavior as visualized by PET.

**Newsline:** What proactive steps should nuclear medicine 
departments be taking to look to the future and go out to 
meet changes in attitudes about reimbursement and develop-
ment of more complex technologies?

**McNeil:** We obviously need to continue to develop new 
imaging devices and new agents to improve, depending 
upon the condition, the sensitivity and specificity of our 
diagnostic armamentarium. Many great researchers are work-
ing in this arena already, and they will likely need and want 
to continue their work with basic scientists (chemists and biol-
gists) and clinicians from other fields. Simultaneously, how-
ever, the nuclear medicine community needs to increase its 
role in evidence-based medicine across a spectrum of diseases 
and technologies. It also needs to figure out cost-effective and 
timely ways to obtain good information on effectiveness. 
The field of technology assessment has been around for nearly 
25 years in nuclear medicine, and we still don’t have the right 
recipe for getting timely and accurate information. In some 
ways we are letting the “perfect get in the way of the good,” 
while in other ways we aren’t trying hard enough.

Simultaneous with these activities we need to identify 
situations in which small numbers of patients make the usual 
approaches to technology assessment difficult. Then we 
need to figure out how to solve these problems. We cannot 
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**Newsline:** At the beginning of the 20th century, hopeful 
futurists believed that roentgen-ray specialists would be the 
“gatekeepers” to all of medicine, magically screening all 
patients and instantly identifying a wide range of diseases and 
symptoms. We seem to be at another period of enthusiasm and 
hopes for wide applications of imaging. If so, what public pol-
icy issues will be most apparent in the near future?

**McNeil:** The role of imaging will increase in importance 
over the next decade and, in many ways, we will fulfill the same 
role that a very skilled general diagnostician did in the past. In 
other ways, as the specificity of our imaging tools increases, 
we will be more like skilled specialists. Thus, we will become 
increasingly critical at all stages of a patient’s travels through 
the medical system.

**Newsline:** What are the biggest health care policy issues 
currently facing nuclear medicine, specifically issues involv-
ing PET and PET/CT?

**McNeil:** The biggest issue for both of these technologies 
involves finding their proper place in the work-up of patients 
so that quality is improved and costs don’t go through the roof. 
These tasks will require excellent data and excellent practi-

cioners.

**Newsline:** How did you become interested in the public 
policy aspects of medicine?

**McNeil:** When I began my work in nuclear medicine, 
Jim Adelstein, head of the Joint Program in Nuclear Medicine 
[at Harvard Affiliated Hospitals] suggested that I should think 
about applying the relatively new tools of decision analysis 
and cost-effectiveness analysis to medicine, in particular radi-
ology and nuclear medicine. I did so using data from a coop-
erative study on imaging in renovascular hypertension. Sub-
sequent studies in technology assessment and cost-containment 
activities in hospitals led to my appointment to the Prospec-
tive Payment Assessment Commission, the predecessor of the 
Medicare Coverage Advisory Commission. This activity put 
me into the national policy arena in a major way and ultimately 
led to the creation of the Department of Health Care Policy 
at Harvard Medical School with me as its head. Other national 
activities, such as participation in the Advisory Council for 
Healthcare Research and Quality, helped reinforce my activi-

ties nationally.

**Newsline:** Was the creation of a separate health care pol-
cy institute a hard sell or one for which the time had clearly 
come?

**McNeil:** Most physicians realized in the mid 1980s that 
the tasks of improving quality and decreasing costs would rest 
on the shoulders of physicians. If true, then physicians would 
have to work closely with social scientists (e.g., economists, 
medical sociologists) to help improve the system. At that time, 
there were few, if any, truly interdisciplinary departments in 
schools of medicine in which social scientists and physicians 
worked side by side in research and education. The logic of a 
department of health policy made sense. Since Harvard Medical 
School started its department, many other institutions 
across the country have followed suit.

**Newsline:** Where do you see nuclear medicine in 10 or 
20 years? What health care policy issues are associated with 
the increasingly molecular focus of the specialty?

**McNeil:** I think that we will be seeing efforts to develop 
and use radionuclides to increase specificity of diagnoses, 
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cioners.
Radionuclides and Radiopharmaceuticals for 2003

The SNM Commission on Radiopharmaceuticals, in an effort to assemble a comprehensive listing of radioisotopes and radiopharmaceuticals available to nuclear medicine practitioners and researchers in 2003, has prepared the tables on this and the following pages of Newsline. These lists detail commercially available radiopharmaceuticals in the United States and also indicate those radionuclides that can be provided in 2003 in North America and their producers. Worldwide reactors and the radioisotopes they produce are also listed.

The list of radionuclides was reviewed and amended by the following individuals who generously gave of their time: Marc Berridge, Roy Brown, Barbara Croft, Cathy Cutler, Michael Gelfand, Judy Hughes, Joseph Hung, Henry Kramer, Carol Marcus, Leonard Mausner, Louis Morgan, John Panta-leo, Barry Siegel, Jeffry Siegel, Suresh Srivastava, Chris Wagner, and Michael Welch. This list is published here with the understanding that the organizations have said that they can or will provide these radionuclides in 2003. It is almost certain that some of these radionuclides cannot be provided without some period of delay to allow for production. In addition, the Commission on Radiopharmaceuticals has accepted the product lists of these organizations without on-site inspections. If any producers or radionuclides have been omitted, we will publish addenda as needed.

As the nuclear medicine community continues to be concerned about radioisotope availability, the presence of these products is heartening.

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

### TABLE 1
Commercially Available Radiopharmaceuticals, 2003

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Description</th>
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<tbody>
<tr>
<td>14C-urea</td>
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<tr>
<td>57Co-cyanocobalamin</td>
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<tr>
<td>51Cr-sodium chromate</td>
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<tr>
<td>18F-sodium fluoride</td>
<td></td>
</tr>
<tr>
<td>18F-fluorodeoxyglucose (FDG)*</td>
<td></td>
</tr>
<tr>
<td>67Ga-gallium citrate</td>
<td></td>
</tr>
<tr>
<td>111In-capromab pendetide (PMSA)†</td>
<td></td>
</tr>
<tr>
<td>111In-ibritumomab tiuxetan (CD20)†</td>
<td></td>
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<tr>
<td>111In-indium chloride</td>
<td></td>
</tr>
<tr>
<td>111In-indium oxyquinoline (oxine)*</td>
<td></td>
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<tr>
<td>111In-pentetate (DTPA)*</td>
<td></td>
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<tr>
<td>111In-pentetreotide (SR5)†</td>
<td></td>
</tr>
<tr>
<td>123I-iobenguane</td>
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<tr>
<td>123I-iodhippurate sodium</td>
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<tr>
<td>123I-sodium iodide</td>
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<tr>
<td>125I-iodinated albumin</td>
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<tr>
<td>125I-sodium iothalamate</td>
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<tr>
<td>131I-iobenguane</td>
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<tr>
<td>131I-iodinated albumin</td>
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<tr>
<td>131I-iodhippurate sodium</td>
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<tr>
<td>131I-sodium iodide</td>
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<tr>
<td>131I-6-β-iodomethyl-19-norcholesterol††</td>
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<tr>
<td>32P-chromic phosphate (suspension)</td>
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<td>32P-sodium phosphate</td>
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<tr>
<td>82Rb-rubidium chloride</td>
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<td>153Sm-samarium lexidronam</td>
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<tr>
<td>89Sr-strontium chloride</td>
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<tr>
<td>99mTc-apcitide (GPIIa/IIib)†</td>
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<tr>
<td>99mTc-acromumab (CEA)†</td>
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<tr>
<td>99mTc-bicisate dichloride (ECD)*</td>
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<td>99mTc-disofenin</td>
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<tr>
<td>99mTc-exametazime (HMPAO)*</td>
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<tr>
<td>99mTc-glucenate</td>
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<tr>
<td>99mTc-lidofenin</td>
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<tr>
<td>99mTc-macroaggregated albumin (MAA)*</td>
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<tr>
<td>99mTc-mebrofenin</td>
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<tr>
<td>99mTc-medronate (MDP)*</td>
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<td>99mTc-meriatide (MAG3)*</td>
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<td>99mTc-oxidronate (HDP)*</td>
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<td>99mTc-pentetate (DTPA)*</td>
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<tr>
<td>99mTc-secastami</td>
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<tr>
<td>99mTc-succimer (DMSA)*</td>
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<tr>
<td>99mTc-sulfur colloid</td>
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<tr>
<td>99mTc-tetrofosmin</td>
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<tr>
<td>201Tl-thallous chloride</td>
<td></td>
</tr>
<tr>
<td>133Xe-xenon gas</td>
<td></td>
</tr>
<tr>
<td>90Y-ibritumomab tiuxetan (CD20)†</td>
<td></td>
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</tbody>
</table>

*Common chemical abbreviation.
†Antigen or receptor with which interaction occurs.
††IND with the University of Michigan required.
§Red cells labeled with commercially available kit.
<table>
<thead>
<tr>
<th>Country</th>
<th>Reactor</th>
<th>Owner</th>
<th>Operator (if not same as owner)</th>
<th>Thermal power (kW)</th>
<th>Reactor type</th>
<th>Location</th>
<th>Isotopes</th>
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<tbody>
<tr>
<td>Argentina</td>
<td>Atucha 1</td>
<td>CNEA</td>
<td></td>
<td>335,000 (kWe dual use)*</td>
<td>Pressurized heavy water</td>
<td>Cordoba</td>
<td>60Co</td>
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<tr>
<td></td>
<td>Embalse 1</td>
<td>CNEA</td>
<td></td>
<td>600,000 (kWe dual use)*</td>
<td>Pressurized heavy water</td>
<td>Lima</td>
<td>60Co</td>
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<td>HIFAR</td>
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<td>Lucas Heights Science and Technology Centre</td>
<td>10,000</td>
<td>Heavy</td>
<td>Sydney</td>
<td>99Mo, 192Ir, 131I, 153Sm</td>
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<td>BR-2</td>
<td>SCK/CEN</td>
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<td>Tank</td>
<td>Mol</td>
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<td>IPEN-CNEN/Sao Paulo</td>
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<td>Pool</td>
<td>Sao Paulo</td>
<td>131I, 153Sm, 99Mo, 192Ir, 198Au, 82Br</td>
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<td>Bulgaria</td>
<td>IRT Sofia</td>
<td>INRNE</td>
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<td>Pool</td>
<td>Sofia</td>
<td>198Au, 162Ta, 82Br, 60Co</td>
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<td>Canada</td>
<td>NRU</td>
<td>Atomic Energy of Canada Ltd.</td>
<td>Chalk River Laboratories</td>
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<td>Heavy water</td>
<td>Chalk River</td>
<td>99Mo, 125I, 60Co, 14C</td>
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<td></td>
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<td>Saskatchewan Research Council</td>
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<td>20</td>
<td>Slow-poke</td>
<td>Edmonton</td>
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<td></td>
<td>MAPLE 1 &amp; 2</td>
<td>MDS Nordion</td>
<td>(waiting licensing)</td>
<td>10,000 each</td>
<td>Tank in pool</td>
<td>Chalk River</td>
<td>99Mo, 125I, 131I, 133Xe</td>
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<td>AECL</td>
<td></td>
<td>769,000 (kWe dual use)*</td>
<td>CANDU (commercial power reactor)</td>
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<td>La Reina</td>
<td>Comision Chilena De Energia Nuclear</td>
<td>La Reina Nuclear Centre-CChen</td>
<td>5,000</td>
<td>Pool</td>
<td>Santiago</td>
<td>99mTc, 131I</td>
</tr>
<tr>
<td>China</td>
<td>HFETR</td>
<td>Nuclear Power Institute of China</td>
<td></td>
<td>125,000</td>
<td>Tank</td>
<td>Chengdu (Sichuan)</td>
<td>60Co, 99mTc, 192Ir</td>
</tr>
<tr>
<td></td>
<td>MJTR</td>
<td>Nuclear Power Institute of China</td>
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<td>5,000</td>
<td>Pool</td>
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<td>99mTc, 153Sm, 131I</td>
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<td>Czech Republic</td>
<td>LWR-15 Rez</td>
<td>Nuclear Research Institute REZ PLC</td>
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<td>Rez (Prague)</td>
<td>152Sm, 166Ho, 186Re, 192Ir, 203Hg</td>
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<td>Denmark</td>
<td>DR-3</td>
<td>Risoe National Laboratory</td>
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<td>10,000</td>
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<td>Riso</td>
<td>24Na, 64Cu, 82Br</td>
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<td>VTT-Chemical Technology</td>
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<td>Otaniemi</td>
<td>82Br, 140La</td>
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<td>France</td>
<td>Orphee</td>
<td>CEN-SACLAY</td>
<td>Orphee Reactor Service</td>
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<td>Pool</td>
<td>Saclay</td>
<td>Various</td>
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<td>Osiris</td>
<td>CEA/CEN-SACLAY</td>
<td>DENIS/DSRN, Service d'Exploitation Du Reacteur Osiris</td>
<td>70,000</td>
<td>Pool</td>
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<td>Johannes Gutenberg Universiteit Mainz</td>
<td>Institut Fuer Kernchemie Manz</td>
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<td>Mainz</td>
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<td>FRJ-2 Dido</td>
<td>Forschungszentrum Juelich GMBH</td>
<td></td>
<td>23,000</td>
<td>DIDO</td>
<td>Juelich</td>
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<td>Hungary</td>
<td>Budapest Research Reactor</td>
<td>Atomic Energy Research Institute</td>
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<td>10,000</td>
<td>Tank</td>
<td>Budapest</td>
<td>131I, 125I, 153Sm, 32P</td>
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<tr>
<td>India</td>
<td>Cirus</td>
<td>Bhabha Atomic Research Centre (BARC)</td>
<td>BARC, Reactor Operations Division</td>
<td>40,000</td>
<td>Heavy water</td>
<td>Trombay</td>
<td>99Mo, 51Cr, 35S, 203Hg, 131I, 60Co, 192Ir, 197Hg, 85Sr, 204Tl, 32P, 45Ca</td>
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Note: * Dual use reactors.
<table>
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<th>Country</th>
<th>Reactor</th>
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<th>Operator (if not same as owner)</th>
<th>Thermal power (kW)</th>
<th>Reactor type</th>
<th>Location</th>
<th>Isotopes</th>
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<td>Dhruva</td>
<td>BARC</td>
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<td>100,000</td>
<td>Heavy water</td>
<td>Trombay</td>
<td>$^{131}$I, $^{51}$Cr, $^{99}$Mo, $^{129}$I, $^{192}$Ir, $^{125}$I, $^{94}$H, $^{14}$C</td>
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<td>Pusat Pengembangan Teknologi Reaktor Riset</td>
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<td>Pool</td>
<td>Jakarta</td>
<td>$^{99}$Mo, $^{131}$I, $^{192}$Ir, $^{32}$P</td>
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<td>Triga RC-1</td>
<td>ENEA, Ente per le Nuove Tecnologie, l'Energia e l' Ambiente</td>
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<td>Rome</td>
<td>Medical, $^{166}$Ho</td>
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<td>Laboratorio Energia Nucleare Applicata</td>
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<td>250</td>
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<td>Pavia</td>
<td>Tracers, $^{64}$Cu</td>
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<td>Tokai Research Establishment</td>
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<td>Pool</td>
<td>Tokai-mura</td>
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<td>Rikkyo</td>
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<td>Oarai Research Establishment</td>
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<td>Tank</td>
<td>Oarai</td>
<td>$^{192}$Ir, $^{169}$Yb, $^{188}$Re, $^{171}$mLu</td>
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<td>Tokai Research Establishment</td>
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<td>Pool</td>
<td>Tokai</td>
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<td>Pool</td>
<td>Yuseong</td>
<td>$^{60}$Co, $^{192}$Ir, $^{99}$mTc, $^{99}$Mo, $^{198}$Au, $^{33}$P, $^{59}$Fe, $^{94}$H, $^{14}$C</td>
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<td>Wolsong 1 &amp; 2</td>
<td>KAERI</td>
<td></td>
<td>629–650,000 (kWe dual use)*</td>
<td>CANDU (power)</td>
<td>Wolsong</td>
<td>$^{60}$Co</td>
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<td>Malaysian Inst. for Nuc. Tech. Research (MINT)</td>
<td>Atomic Energy Licensing Board</td>
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<td>TRIGA II</td>
<td>Bangi</td>
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<td>HFR</td>
<td>European Commission</td>
<td>Joint Research Centre</td>
<td>45,000</td>
<td>Tank in pool</td>
<td>Petten</td>
<td>$^{99}$Mo, $^{99}$mTc, $^{192}$Ir, $^{89}$Sr, others</td>
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<td>Kjeller</td>
<td>$^{153}$Sm, $^{82}$Br, $^{60}$Co</td>
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<td>Parr-1</td>
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<td>Pool</td>
<td>Islamabad</td>
<td>$^{131}$I</td>
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<td>Lima</td>
<td>$^{131}$I, $^{99}$Mo, $^{32}$P</td>
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<td>Maria</td>
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<td>30,000</td>
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<td>Swierk</td>
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<td>Pool</td>
<td>Lisbon</td>
<td>Short-lived, $^{198}$Au, radioactive sources</td>
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<td>Institute for Nuclear Power Research, Pitesti</td>
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<td>14,000</td>
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<td>Pitesti</td>
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<td>Dimitrovgrad (SRIAR)</td>
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<td>Moscow (Kurchatov)</td>
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<td>Petersburg Nuclear Physics Institute</td>
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<td>Thermal power (kW)</td>
<td>Reactor type</td>
<td>Location</td>
<td>Isotopes</td>
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<td>Basel</td>
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<td>Nuclear Sci. &amp; Tech, Development Centre</td>
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<td>Tsing Hua</td>
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<td>2,000</td>
<td>TRIGA III</td>
<td>Ongkharak</td>
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<td>Imperial College of Science, Tech &amp; Medicine</td>
<td>Reactor Centre</td>
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<td>Pool</td>
<td>Ascot</td>
<td>$^{51}$Cr, $^{62}$Br, $^{60}$Co, $^{24}$Na, $^{46}$Sc, $^{110}$Ag, $^{122}$Sb, $^{54}$Mn</td>
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<td>HFIR</td>
<td>USDOE</td>
<td>ORNL - Research Reactors Division</td>
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<td>Sacramento, CA</td>
<td>Iodine isotopes plus several others for nuclear medicine</td>
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<td></td>
<td>McClellan</td>
<td>University of California at Davis</td>
<td>McClellan Nuclear Radiation Center</td>
<td>2,000 (up to 1,000 MW in pulsed mode)</td>
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<td>Research Reactor Center</td>
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<td>Radiation Center, Oregon State University</td>
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<td>Institute of Nuclear Physics</td>
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<td>Tank</td>
<td>Tashkent</td>
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<td>Pool</td>
<td>Dalat</td>
<td>$^{99m}$Tc, $^{32}$P, $^{131}$I, RIA kits</td>
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*Dual-use in this context means the reactor is used for both commercial electric power generation and radioisotope production.
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<th>Source</th>
<th>Radioisotopes</th>
<th>Source</th>
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<td>TX</td>
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<td>$^{241}\text{Am}$</td>
<td>Aur, DOE</td>
<td>$^{95}\text{Nb}$</td>
<td>PE</td>
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<tr>
<td>$^{41}\text{Ar}$</td>
<td>TX, OR</td>
<td>$^{63}\text{Ni}$</td>
<td>Aur, DOE, Nor, PE</td>
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<td>$^{73}\text{As}$</td>
<td>DOE</td>
<td>$^{191}\text{Os}$</td>
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<td>$^{198}\text{Au}$</td>
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<td>$^{32}\text{P}$</td>
<td>MURR, Nor, PE, TCI</td>
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<td>$^{103}\text{Pd}$</td>
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<td>$^{195}\text{mPt}$</td>
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<td>DOE, PE</td>
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Alp = AlphaMed (Acton, MA); Am = Amersham Health (Princeton, NJ); Aur = Auriga Medical (Burlington, MA); BMS = Bristol Myers Squibb (Princeton, NJ); CAL-D = University of California–Davis; DOE = U.S. Department of Energy (Washington, DC); Drax = Draximage Inc. (Quebec, Canada); Mal = Mallinckrodt Corporation (St. Louis, MO); MURR = University of Missouri Research Reactor (Columbia, MO); Nor = MDS Nordion Corporation (Ottawa, ON, Canada); OR = Oregon State University (Corvallis, OR); OSU = Ohio State University (Columbus, OH); PE = PerkinElmer Corporation (Boston, MA); TCI = Technical Commercialization International (Albuquerque, NM); TX = Texas A&M University (College Station, TX); WSU = Washington State University (Pullman, WA); WU = Washington University (St. Louis, MO).
Welcome to Leadership Update. This is the first in a series of columns from the SNM Headquarters designed to keep you informed about the activities of the SNM and our work on your behalf to promote the nuclear medicine profession. This month I have the privilege of announcing the results of the election for 2003–2004 officers of the SNM and SNMTS.

SNM
Vice-President-Elect
Peter Conti, MD, PhD

SNM Technologist Section
President-Elect
Nanci A. Burchell, CNMT

Secretary/Historian
Ann Marie Alessi, CNMT

Delegate
Denise A. Merlino, CNMT

Executive Board
Danny A. Basso, CNMT
William L. Hubble, CNMT
LisaAnn Trembath, CNMT

Nominating Committee
Marcia R. West, CNMT
Deborah A. Erb, CNMT
Mary Beth Farrell, CNMT
Myrellen L. Merry, CNMT

Finance Committee
Peggy A. Squires, CNMT

Mid-Winter Meeting
The Mid-Winter Meeting held in Fort Lauderdale, FL, in January marked the first meeting of the House of Delegates (HOD), under the new, streamlined structure. Co-chairs Dr. Edward Silberstein and Dr. Robert Carretta ran a successful meeting that included a 1.5-hour “environmental scan” on the state of our profession to provide background information for the Board of Directors (BOD) meeting in April. This information was also used in drafting the Society’s new strategic plan. The environmental scan is an excellent example of how the reorganized HOD, as a cross section of the nuclear medicine profession, can provide valuable input and advise the Society leadership and BOD on issues that are important to the membership. The more flexible HOD is now capable of moving rapidly to address changes in the profession—such as developments in molecular imaging.

Collaborations with Other Organizations
The Society is very interested in developing partnerships with other organizations in the nuclear medicine field. Collaboration with the American Society of Nuclear Cardiologists resulted in the “Nuclear Cardiology for the Technologist” seminar last month, the PET myocardial glucose metabolism and perfusion imaging guidelines, and discussions with the National Institutes of Health on a nuclear cardiology program. (Continued on page 60N)
SNM President’s Report

As my year as president of the Society of Nuclear Medicine draws to a close, I want to share some of the progress made by the Society and its many volunteer leaders and members during the past 12 months.

During this year the Society’s governance was updated, and the House of Delegates (HOD) transitioned to a broader advisory role. From the outset, the House and its leadership have provided input from a unique perspective that is representative of the grassroots membership. I sincerely compliment Dr. Edward Silberstein and Dr. Robert Carretta for their efforts that have made the restructured HOD a well-functioning body.

At its June meeting, the HOD will be asked to approve a bylaws change that will permit the formation of “Centers of Excellence” within the SNM. This new membership-based organization will work closely with the Society’s leadership and be eligible for financial input through the Society’s budgetary process. The initial impetus for this new organizational structure came from the need to address the explosive growth of PET and PET/CT. The Society has taken on this challenge and opportunity by creating the PET Center of Excellence.

The PET Center of Excellence will be in the forefront of the Society’s efforts in PET and PET/CT education. It will incorporate the PET Learning Center (now with additional sessions conducted in other areas of the country, including California) established by immediate Past-President Alan Maurer, MD, and further expand the Society’s educational efforts with additional programs in PET and PET/CT. The PET Center of Excellence will also take on government relations and advocacy roles in concert with the American College of Nuclear Physicians/SNM Government Relations Committee. We are now working to bring the PET Center of Excellence up to full speed by soliciting members and scheduling elections for this year. The PET Center of Excellence will be jointly governed by its membership and SNM leadership. Other centers will follow, and some councils may wish to become centers of excellence and increase their activities and roles within the Society.

We are now looking forward to our 50th Annual Meeting in a few weeks in New Orleans, a wonderful place to celebrate our golden anniversary. The world’s best nuclear medicine science will be showcased; more than 1,400 papers and posters have been accepted from more than 34 countries. There will be three plenary sessions featuring talks by the Society Historian, Henry N. Wagner, Jr., MD, and the first director of the National Institute of Biomedical Imaging and Bioengineering, Roderic I. Pettigrew, MD, PhD, and we will have New Orleans-style musical offerings before and after each plenary. The highly rated Modern Imaging Technology program organized by Dr. Michael Welch will be held again this year, immediately before the Annual Meeting. The New Orleans meeting will be the start of the Society’s 50th anniversary year, culminating in the 51st Annual Meeting in Philadelphia in June 2004. Look for anniversary year events as they are announced through Newsline and on our Web site at www.snm.org.

The new SNM and Educational Research Fund (ERF) joint development program will be kicked off at the New Orleans meeting and will be a feature of the anniversary year celebration. This joint effort positions the ERF as a philanthropic fundraising organization in support of SNM’s education and research program.

The Mid-Winter Meeting in January marked the end of a 3-year successful trial, where we added enhanced educational offerings to the meeting’s usual schedule of governance and committee work.

We continue to reach out to other nuclear medicine organizations in North America whose members are involved in nuclear medicine practice, such as the American College of Radiology and the American Society of Nuclear Cardiology. We have found important areas of common ground where we can work together for the betterment of nuclear medicine. Similarly we are reaching out to other national and regional nuclear medicine organizations with educational efforts. We share their input through our International Advisory Group.

We continue to work together with industry on workforce, reimbursement, and regulatory matters though our Industry Leaders Working Group and other joint committees. This spring our advocacy efforts took us to Capitol Hill to discuss nuclear medicine issues with key Congressional staff.

In another effort to look to the future, the HOD and Board of Directors reviewed our Strategic Plan to identify the areas in which the Society will increase its efforts during next few years and the directions in which it will move.

Finally, I would like to thank Ms Virginia Pappas, who has been invaluable to me in her first full year as executive director, and I also thank her talented department directors and staff. My thanks also go to the Board of Directors and particularly the other members of the Executive Committee, Drs. Henry Royal, Mathew Thakur, Alan Maurer, and Leonie Gordon and Ms Frances Keech and Ms Lyn Mehlberg, who have worked with me during many hours of meetings and conference calls. And finally, I want to thank my wife, Janelle, for her support during this demanding year. Although it has been a challenge working two jobs instead of one, my year as SNM president has been extremely rewarding.

Michael J. Gelfand, MD
President, SNM
It’s been a long year, but we’ve come a long way thanks to an incredible team of committee chairs, committee members, task force members and leaders, and the elected members of the SNM Technologist Section Executive Board and National Council. Their diligent work and invaluable counsel over the last year has helped us move some very difficult issues to workable conclusions.

Fusion Imaging
Who is best qualified to operate fusion scanners? In August last year the American Society of Radiologic Technologists (ASRT) and the SNM Technologist Section brought together a group of stakeholders to look at the emerging fusion imaging field and debate how we can ensure an available, qualified pool of technologists to run these new scanners. The group tackled this contentious issue with honesty and vigor, developing a consensus statement and the framework of a working plan for the future.

Later in the year, we filled in that framework by developing a collaboration between the SNMTS, the ASRT, the American Registry of Radiologic Technologists (ARRT), and the Nuclear Medicine Technology Certification Board (NMTCB). We now have a draft of curricula customized for technologists with various backgrounds and detailing the supplemental knowledge required to operate fusion instruments based on the certifications that an individual technologist brings to the educational process. The curricula are now being reviewed, and the ARRT and NMTCB are working together to develop certification requirements for PET/CT.

This issue has been very difficult for the nuclear medicine technologist (NMT) community, challenging a number of age-old paradigms. The course taken by the leadership of the SNMTS has tried to balance patient access with the need for NMTs to be recognized as the best qualified and legitimate operators of these machines. I know a number of technologists disagreed with our approach, and I fully understand their viewpoints, but an isolationist policy can be very risky. “Going it alone” can only work if you are in a position of strength.

With only 22 states having NMT licensure versus 38 states licensing RTs and with only 18,000 NMTs compared to 210,000 RTs, the wise decision for us was to work with other groups.

Strategic Plan
The National Council and other key individuals sat down at the Mid-Winter Meeting to develop a new strategic plan for the SNMTS. The next step will be to flesh out the action items and objectives that constitute our plan for the future.

Licensure
The 107th Congress marks the third time the Consumers Assurance in Radiologic Excellence (CARE) Act has been presented to Congress. To date, the bill’s House sponsor, Representative Heather Wilson, has 25 cosponsors for HR 1024. On the Senate side we are hopeful that a sponsor will be found to present the bill to the Senate before the next recess. Harish Vaidya and the leadership of the SNMTS have been involved in revisions to the bill and in developing the procedures that will accompany it.

The Government Relations Committee headed by LisaAnn Trembath has been diligently working on standardizing state licensing legislation. Val Cronin, CNMT, from New York State, is working to assist our legislative network of technologists to help push this process forward. The lack of standard licensure, or no licensure at all in some states, has made the problem of defining standards for PET/CT operators even more complex.

Publications
In October last year we brought together a group of professionals to the hinterlands of Virginia to review the publications of and for the Technologist Section. The group developed an action plan to increase the number of peer-reviewed journal articles from technologists, to reassess the focus of the Journal of Nuclear Medicine Technology, and to seek out areas for development of new publications.

As the reins of leadership are passed to the next generation, the Technologist Section has many issues to work on in the next few months including advanced practice, entry-level educational standards, and PET/CT education. I look forward to assisting the new leadership in developing policies and action plans around these and other issues. I also want to express my incredible gratitude to the committee chairs, committee members, executive board members, staff at the SNM office, and leadership of the Society, especially SNM President Michael Gelfand, MD, for all the help and work over the last year as we made progress on issues of importance to the Technologist Section.
Nuclear Medicine Confronts Uncertainty with Bayes’ Theorem

Although the stethoscope has greatly facilitated physical diagnosis, it is being put aside by devices which obviate the basic skills of history taking, observation, and examination. Perhaps it is time to stop worrying about patenting our ideas, avoiding lawsuits with unnecessary tests, and advertising to gain more patients. It is time to return to the practice of medicine as a profession rather than a business, and to provide better care to the patient.

Donald Blaufax

In the late 1960s, a frequent topic of lectures at SNM national meetings was the relative utility of cameras and scanners. By the 1970s, serious debate centered around the question, “Do computers have a role in nuclear medicine?” Some individuals questioned whether computers would ever play a role in nuclear medicine practice or research. To this day, I can’t remember their arguments.

Although a few nuclear medicine departments pioneered the use of medical minicomputers in imaging as early as 1969, the large-scale potential of the technology was only beginning to be realized at the 1982 meeting with the introduction of computer-assisted diagnosis in coronary artery disease (both of which are routinely abbreviated as CAD, leading to occasional confusion in the scientific literature).

By 1982, not only were ventricular wall motion and regional myocardial perfusion measured, but also ventricular volumes, the rates of ventricular emptying and filling, stroke volume, and systolic and diastolic time intervals were quantified in combined valvular as well as coronary artery disease. This information was being used to address the ventricular response to antiarrhythmic, vasodilator, and ionotropic drugs in individual patient care. Unfortunately, these procedures are not widely used today.

Nuclear cardiology had been in a latent phase of growth between 1970 and 1975. Important parallel events, however, occurred during this period. More studies were being performed with scintillation cameras. Commercial radiopharmacies were beginning to make 99mTc tracers widely available to cardiologists and nuclear medicine specialists. Considerable skepticism greeted initial efforts at what was called “nuclear angiocardiography,” monitoring with scintillation cameras or nonimaging “probes” of the passage of a bolus of a radioactive tracer (such as 99mTc-albumin) through the heart. One pediatric cardiologist concluded at that time that “these studies are a step in the wrong direction.” Although echocardiography later took precedence, nuclear angiocardiography paved the way for radioactive tracers in coronary heart disease.

Nuclear cardiology was able to help solve many problems in patients with coronary disease. It is not coincidental that the growth of coronary artery bypass surgery paralleled that of nuclear cardiology. Just as lung scanning was invented to facilitate rapid diagnoses in patients with massive pulmonary embolism who were candidates for surgery using newly developed extracorporeal pump oxygenators, nuclear cardiology helped select patients for coronary artery bypass surgery. 43K was the first radionuclide used to measure regional myocardial perfusion, but 201TI proved to be much better.

Computers compensate for the relatively small amount of memory each human has and our inability to personally handle vast amounts of information. In 1982 I wrote, “The time has come to rid ourselves of the image of the computer as an inhuman monster waiting in the wings to replace the physician and to begin to look upon the computer as a descendant of the slide rule, as a slave not a master.” Computers brought to nuclear cardiology the ability to gather, process, and draw conclusions from vast amounts of data. The new technology promised to yield three-dimensional displays of the heart and chest that could be combined with CT, MRI, and atlas images using software.

But the new information being provided on nuclear cardiology presented a challenge. How could the large amounts of data from history, physical examination, laboratory tests, and increasingly complex imaging be interpreted and effectively translated into better patient care? Computer-assisted diagnosis was just around the corner. And one of the problems in interpreting data would be solved by the re-evaluation of an interesting insight by an 18th-century English minister.

Bayes’ Theorem

The theorem that carries his name was devised by Rev-
erend Thomas Bayes and first published in 1763. Bayes was a nonconformist Presbyterian minister whose most famous work was found among his papers after his death and published in the Philosophical Transactions of the Royal Society of London in 1764. Known as Bayes’ theorem, this mathematical expression and supporting rationale are used to assess the probability of a particular event happening based on the fact that some other event has already happened. It is a decision-making tool used in science to understand the extent to which past actions and situations affect current observations. In 1959, Ledley and Lusted suggested its use in medicine, where, as a reasoning tool, it is often called “inverse probability.” One example from nuclear medicine will suffice: If we know that the accumulation of FDG in a lesion must be the result of a neoplasm or an infection, the application of Bayes’ theorem assists in determining the probabilities that the lesion is the result of either one.

The diagnosis depends on the combined likelihood of a disease, such as cancer, being present. This likelihood is determined on the basis of family history, symptoms, physical signs, laboratory data, and imaging. These likelihood ratios can be combined, provided the manifestations are sufficiently independent. Bayes’ theorem is useful when abnormalities are found that could be the result of one or more of many possible causes.

Bayes’ theorem is expressed mathematically as:

$$P(A_j|B) = \frac{P(B|A_j) P(A_j)}{\sum P(B|A_i) P(A_i)}$$

The equation states that given a manifestation of disease (B) in a patient, the probability that it was the result of cause A_j is equal to the probability that A_j should produce the manifestation B times the probability that A_j is likely to be present in the specific populations from which the patient comes, divided by the probability of that manifestation occurring in healthy people or people with different diseases. The probability of a manifestation occurring in a specific disease is called its “sensitivity” for detecting that disease. One minus the probability that the manifestation occurs in all diseases is called its “specificity.”

Bayes’ theorem was not only helpful in automation but also as an aid to the logical thinking of physicians, as they became involved in answering questions that define the practice of medicine: What is wrong? What is going to happen? What should be done about it? How did it happen? The results of the nuclear medicine study needed to be combined with other a priori data after the imaging studies have been interpreted independently. Then the imaging study could be interpreted looking at all the data available about the clinical problems being addressed. A final diagnosis should be reported together with probability statements.

Such a report consists of several parts: (1) the question(s) being asked of the study; (2) a brief description of the performance of the procedure; (3) the objective findings; and (4) the interpretation, which states the disease(s) likely to be present and the probability of each. The following are the basic principles of the diagnostic process:

- The diagnosis is a “category” in which the patient’s illness is placed because it is useful to do so, some “thing” within the patient that must be removed or treated with drugs.
- The diagnostic process is probabilistic, and diagnoses must always be presented with probability statements.

Probabilistic statements can be combined if they are obtained from data that are sufficiently independent. The best way to combine probabilities of serial data is to convert the percentage probability statements from each result into “likelihood ratios.” The likelihood ratios can be multiplied easily to give the final likelihood of the disease(s).

Implicit in this approach is the “ontological” theory of disease, that is, that disease is defined by histopathological manifestations. Histopathology remains an important foundation of the practice of medicine today, but nuclear imaging of regional physiology and chemistry is an equal partner. Physiological and biochemical quantitative imaging are now helping define many diseases, such as depression, for which there are no histopathological criteria.

Exercise electrocardiography took the lead in applying probability theory to routine cardiology. For example, Rifkin and Hood pioneered the use of Bayes’ theorem in electrocardiography. The clinical information provided the a priori probability and to this was added the degree of ST segment depression in the electrocardiogram. In 1982, nuclear medicine physicians at Johns Hopkins used the program of Diamond and Forrester to help select the type of nuclear medicine study that should be performed and to interpret the results. Unfortunately, this approach has not become widespread.

Most people tend to approach complicated problems by oversimplification. Many physicians order a large number of tests hoping to find a highly specific abnormality. I call this the “holy grail” or “eureka” approach to medical diagnosis. Computers make it possible to remember and analyze all data, considering each bit according to its value and importance.

In 1968, I wrote:

> Every question that the physician asks in obtaining a medical history, every maneuver that he performs in the physical examination, and every subsequent laboratory procedure (or nuclear medicine procedure) that he orders should be selected because of the likelihood that the new fact will alter the estimate of the probability that the patient has a particular disease or diseases.

*Henry N. Wagner, Jr., MD
SNM Historian*
**PUBLIC AFFAIRS UPDATE**

**NRC Part 35 Amendments:** On April 21, the Nuclear Regulatory Commission (NRC) published a direct final rule amending certain regulations regarding the medical use of byproduct material (*Fed Reg.* 2003;68:19321–19326). Among the aims of the multipart amendment are, according to the NRC, “to clarify the definitions of authorized users [AUs], authorized medical physicists [AMPs], authorized nuclear pharmacists [ANPs], and radiation safety officers [RSOs]; clarify the notification requirements if the patient is in a medical emergency or dies; clarify the record keeping requirements for calibration of brachytherapy sources; ...clarify that prior to October 24, 2004, individuals who meet the training and experience requirements in Subpart J may undertake responsibilities specified in certain sections in Subparts B and D-H; and eliminate a restriction that training for ophthalmic use of strontium-90 can only be conducted in medical institutions.” These clarifications were made necessary by inconsistencies in the new Part 35 final rule.

The Subpart J training and experience amendments resulted from inconsistencies in the status of AUs, AMPs, ANPs, and RSOs under a proposed 2-year transition period to the requirements of the new Part 35. The direct final rule amendment makes it clear that persons who qualified under the old Part 35 can continue as preceptors under the new Part 35 until October 24, 2004. In the interim the teaching and experience requirements of the new Part 35 will be amended and are expected to continue these provisions.

As a direct final rule, this amendment becomes effective on July 7, 2003, unless significant adverse comment is received. Comments on the direct final rule were due May 21.

**State Licensing Updates:** SNMTS members in several states have reported movement on licensing efforts within their respective legislatures this spring. In April, Paul Christian, CNMT, was invited by the Utah State Department of Occupational Licensing to give a presentation on PET/CT technology and participate in a discussion on qualifications for operating such scanners. At the conclusion of the discussion, the Utah Radiology Technologist Licensing Board determined that a licensed nuclear medicine technologist with training in PET was fully qualified to operate the equipment and perform combined PET/CT exams. The Board noted that nuclear medicine technologists are already covered by their current certification, are licensed by the state of Utah as radiology technologists, and are already trained and prepared in safe practices with ionizing radiation. The state does not currently have special licensing for radiation technologists who work with CT.

Lynn Fulk, CNMT, reported that on April 25, the Indiana Radiation Control Advisory Commission voted to support several suggested changes to the radiation technologist licensure rule to clarify that nuclear medicine technologists do not have to be certified by the American Registry of Radiologic Technologists (ARRT) to operate the CT portions of PET/CT studies in that state. To be licensed to do so, an individual (a) must be a certified nuclear medicine technologist or have ARRT(N) certification; (b) must participate in vendor applications; (c) must have 100 hours of experience/training in the CT suite; and (d) must have completed 50 cases under the supervision of an approved CT technologist or physician. The Commission also agreed to move forward on the issue of state licensure for nuclear medicine technologists.

William Uffelman  
Director of Public Affairs  
General Counsel, SNM
LETTER TO THE NEWSLINE EDITOR

TO THE NEWSLINE EDITOR:


I started my work in nuclear medicine in the mid-1950s in central Europe, where the field was not yet known as nuclear medicine. Political winds blew me out into the larger world, and I ended here in the United States. After completing nuclear medicine residency training and passing the specialty board, I settled in Houston, TX, where, for more than 30 years, I have worked with excellent physicians.

I have enjoyed nuclear medicine—a fascinating combination of internal medicine, physiology, physics, and work with patients. But during those years I have seen with sadness the “rise and fall” of nuclear medicine. Recent articles from the United Kingdom indicate similar trends. Our teaching institution is seriously contemplating closing its nuclear medicine residency training program. We can only speculate on the various causes of the present decline, but I would like to share some specific points with you.

One of the most important factors is our failure to teach nuclear medicine to medical students. Here, in the cradle of nuclear medicine, medical students have no formal teaching, lectures, or examinations in the discipline. By comparison, just a few years ago my nephew, in medical school in central Europe, attended lectures in nuclear medicine, studied from a textbook (not a bad idea even for our residents), and passed a specific examination (not as part of radiology or another discipline) in the subject. This may be one of the reasons that Europeans now supply The Journal of Nuclear Medicine with a significant number of articles, as Dr. Graham pointed out in his commentary.

As a result of absent formal training, our medical, surgical, and other residents and staff physicians in the hospital have only a superficial grasp of nuclear medicine. They often do not know which examinations would be most helpful in managing their patients. We have failed to teach future referring physicians, those who supply us with our “daily bread.” Instead, we have trained radiology residents and cardiology fellows for a few months, only to see them take positions as nuclear medicine specialists despite the fact that their training in the field is much shorter than that of those who go through a true nuclear medicine residency. There is, of course, no similar reciprocity for nuclear medicine physicians in either radiology or cardiology. Years ago, we allowed radiologists to join the strictly nuclear medicine associations in order “to increase the membership base.” Today, some nuclear medicine physicians in those organizations feel almost like guests—I do. Many medical students who are interested in nuclear medicine will choose radiology first.

We tried to offer nuclear medicine lectures at one of our local medical schools in Houston but found no interest in including it in the curriculum. Only one department agreed and limited the didactic experience to a 1-hour lecture on nuclear medicine each year. I feel that we in nuclear medicine and especially the leaders in our profession have missed a great opportunity by neglecting to make teaching medical students a topic of ongoing concern.

Nicholas Kutka, MD, PhD
Houston VA Medical Center
Houston, Texas

SNM'S ANNUAL MEETING ANNIVERSARY:
50 YEARS OF APPLYING NUCLEAR SCIENCE TO CLINICAL MEDICINE

New Orleans, Louisiana
Ernest N. Morial Convention Center
June 21-25, 2003

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**NEWSLINE**

**Radiation Monitoring and Nuclear Medicine Patients**

In recent months, the media have carried several reports of patients who underwent nuclear medicine procedures and subsequently triggered radiation monitoring equipment at public transportation checkpoints. Some patients have encountered confusion and suspicion from security personnel, and full body searches and significant delays have been reported.

The SNM is working with security authorities to develop procedures, including the provision of identifying information for patients, that will reduce the chances of such responses. In a notice published on the Society's Web site (www.snm.org) in April, physicians were advised to provide patients who will be traveling on public transportation (such as airplanes, trains, and rapid transit) or visiting secure facilities with a letter that contains the following information:

- Patient name;
- Name of nuclear medicine procedure;
- Date of nuclear medicine procedure;
- Radionuclide;
- Its half-life;
- Administered activity; and
- 24-hour contact information for verification.

The letter should provide specific and detailed contact information. Outside of normal working hours, the contact person should have access to an appropriate source of information, such as a hospital or radiology information system, so that the letter can be independently confirmed.

If one of your patients is stopped by security personnel after triggering radiation devices and has complaints about the response or actions of security personnel, please notify the SNM by sending details about the date of the encounter, location, nature of the complaint, and the name of the security agency or police department to wuffelman@snm.org.

**K-Level Research Training Offered At NIBIB**

The National Institute for Biomedical Imaging and Bioengineering (NIBIB) announced on April 8 that it would join other branches of the National Institutes of Health (NIH) in offering research training opportunities at the career (K) level. Opportunities include Mentored Research Scientist Development awards (K01; for career development in a new area of research); Mentored Clinical Scientist Development awards (K08; for development of the independent clinical research scientist); and Mentored Patient-Oriented Research Career Development Awards (K23; for development of the independent research scientist in the clinical arena). All awards cover 3- to 5-year periods.

A detailed announcement, including funding mechanisms, levels of support, and NIH-wide program announcement references, was released in the NIH Guide on April 8 (http://grants.nih.gov/grants/guide/). For additional details, contact Dr. Meredith Temple-O'Connor (templem@mail.nih.gov) at NIBIB.

**PET Use, Numbers of Facilities Grow**

According to a study released by the Medical Informatics Division of market research and consulting firm IMV (Des Plaines, IL) and reported on auntminnie.com in April, more than 95,000 PET procedures were performed in the United States during the fourth quarter of 2002, up 70% over the corresponding quarter of 2001.

The report indicated that oncology procedures made up the largest proportion of PET studies, followed by neurology and cardiology procedures. IMV estimated that more than 1,000 U.S. facilities were performing PET procedures in 2002, double the number in 2000.

Mobile PET services accounted for as much as 70% of locations, although fixed PET or PET/CT sites performed a greater percentage of all PET studies (68%).

**ASCO Releases New Policy on Cancer Trial Review**

The American Society of Clinical Oncology (ASCO) on April 29 released new recommendations designed to improve the cancer clinical trial review system. In a press release, ASCO called the new policy “unique in its recommendation that oversight and review of cancer clinical trials be centralized, reducing some of the burden on local Institutional Review Boards (IRBs) caused by duplication in the system, improving patient safety, and streamlining clinical cancer research review.”

ASCO also released a revised conflict-of-interest policy requiring clinical cancer researchers seeking to publish or present trial outcomes to disclose virtually all financial ties to trial sponsors and restricting the financial interests of principal investigators and other clinical trial leaders. The new policies will appear in the June 15 issue of The Journal of Clinical Oncology and will apply immediately to those engaged in ASCO activities, including presenters at the organization’s annual meeting, authors who submit manuscripts to The Journal of Clinical Oncology; and individuals serving in ASCO governance. The policies are expected to be influential in determining similar guidelines under development by other professional groups with members who regularly conduct or participate in clinical trials.

“These policies are designed to improve the cancer research system in America, and preserve public trust in clinical trials,” said ASCO President, Paul A. Bunn, Jr., MD. “The system as it stands is the finest in the world. These policies are an attempt to raise the standards even further.”

The new policies were developed by a 20-member task force of academic and community oncologists, cancer survivors,
Elevated Thyroglobulin Levels/Negative Scans: Indications for $^{131}$I

In a study published in the April issue of *Clinical Endocrinology* (2003;58:421–427), Koh et al., from the University of Ulsan College of Medicine (Seoul, Korea), reported on a study to evaluate the effect of therapeutic doses of $^{131}$I in patients with elevated thyroglobulin levels but negative diagnostic $^{131}$I whole-body scans. The study group included patients who had undergone total or near-total thyroidectomy and remnant ablation with radioiodine as treatment for papillary thyroid carcinoma and who showed elevated thyroglobulin levels. Of the 60 patients, 28 were treated with therapeutic doses of $^{131}$I, and 32 were not treated.

The authors compared serum thyroglobulin levels at less than 3 months before initiation of therapy or diagnostic scan in the two groups with levels at 6–12 months after administration. They found that percentage decreases in thyroglobulin levels in the treated group were significantly higher than those in the untreated group. In the follow-up period, serum thyroglobulin levels in four of the treated patients converted to negative (<1.0 ng/mL). Such negative conversion was not seen in any of the untreated participants.

The authors concluded that the administration of therapeutic doses of $^{131}$I has a therapeutic effect, at least for palliation in short-term observation, considering the serum thyroglobulin level as an index of tumour burden, and that it can disclose previously undiagnosed lesions in some patients with differentiated thyroid cancer who show elevated thyroglobulin level but negative diagnostic $^{131}$I whole-body scan.

*Pediatrics*

Safety Data on $^{90}$Y-Ibritumomab Tiuxetan RIT

Data continues to accrue on the safety and efficacy of radioimmunotherapy (RIT) with $^{90}$Y-labeled anti-CD20 antibody ($^{90}$Y-ibritumomab tiuxetan; Zevalin, IDEC Pharmaceuticals Corporation). In a study published in the April issue of the *Journal of Clinical Oncology* (2003;21:1263–1270), Witzig et al., from the Mayo Clinic and Foundation, Rochester, MN, reported safety data from 349 patients with relapsed or refractory, low-grade, follicular, or transformed B-cell non-Hodgkin’s lymphoma (NHL) in five studies of outpatient treatment with the therapeutic regimen.

Patients received rituximab 250 mg/m$^2$ on days 1 and 8, and either 0.4 mCi/kg (15 MBq/kg) or 0.3 mCi/kg (11 MBq/kg) $^{90}$Y-ibritumomab tiuxetan on day 8 (maximum dose, 32 mCi). These patients were followed for adverse effects, including toxicity, for up to 4 years. In this period, no significant organ toxicity was noted. Toxicity was primarily hematologic, with nadir counts occurring at 7–9 weeks and lasting 1–4 weeks. After the 0.4-mCi/kg dose, grade 4 neutropenia, thrombocytopenia, and anemia occurred in 30%, 10%, and 3% of patients, respectively, and, after the 0.3-mCi/kg dose, these grade 4 toxicities occurred in 35%, 14%, and 8% of patients, respectively. The risk of hematologic toxicity increased with degree of baseline bone marrow involvement with NHL.

During the follow-up, 7% of patients were hospitalized with infection, and 2% had grade 3 or 4 bleeding events. Myelodysplasia or acute myelogenous leukemia was reported in five patients (1%) 8–34 months after treatment. The authors concluded that single-dose $^{90}$Y-
ibritumomab tiuxetan RIT has an acceptable safety profile in relapsed NHL patients with <25% lymphoma marrow involvement, adequate marrow reserve, platelets >100,000 cells/mL, and neutrophils greater than 1,500 cells/mL."

**Journal of Clinical Oncology**

**FDG PET Predicts Treatment Response in NSCLC**

Researchers from the University of Alabama at Birmingham reported in the April 2003 issue of *Journal of Thoracic and Cardiovascular Surgery* (2003;125:938–944) on a study of the comparative abilities of FDG PET and CT in predicting the response of patients with non-small cell lung cancer (NSCLC) to preoperative chemotherapy before surgical resection.

Cerfolio et al. studied 34 patients with NSCLC who had undergone initial FDG PET scan staging with tissue biopsy, neoadjuvant chemotherapy, repeat FDG PET scanning, and repeat biopsies. Of these patients, 11 had N2 disease, and 7 had N1 disease. Seven patients received radiation in addition to chemotherapy. Twenty-five patients underwent resection. The authors found that FDG PET scanning was more specific and had higher positive and negative predictive values than CT for residual tumor at the primary site and for paratracheal nodes. FDG PET scanning also had a higher positive predictive value than CT for the other N2 lymph nodes.

The authors concluded that despite the lack of a significant difference in detection in N1 nodes, repeat FDG PET scanning is more specific and has higher positive and negative predictive values than CT for detecting residual tumor in the lung and paratracheal nodes in patients with NSCLC who have received preoperative chemotherapy.

In another study, an international team of researchers reported in the April issue of *Journal of Clinical Oncology* (2003;21:1285–1292) on a comparative study of PET and CT in predicting survival after radical radiotherapy or chemoradiotherapy for NSCLC. Responses to therapy as assessed by PET and CT were categorized as complete, partial, or no response; progressive disease; or nonassessable. Responses were correlated with subsequent survival. Median survival after follow-up PET was 24 months. PET and CT were the same in only 40% of patients. PET assessed significantly more patients as complete responders (n = 34) than CT, (n = 10) and fewer patients as nonresponders (PET, n = 12; CT, n = 20) or as nonassessable (PET, n = 0; CT, n = 6).

After multifactor analysis, only PET response was significantly associated with survival duration (P < 0.0001). The authors concluded that in NSCLC “a single, early, post-treatment PET scan is a better predictor of survival than CT response, stage, or pretreatment performance status.”

**Journal of Thoracic and Cardiovascular Surgery**

**Radionlabeling of Endothelial Progenitor Cells in Myocardium**

In a study e-published ahead of print for the journal *Circulation* (2003;April 14), Aicher et al., from the Universities of Frankfurt and Kiel (Germany), reported on radionlabeling of transplanted endothelial progenitor cells (EPCs) in an effort to monitor their tissue distribution in animal models.

Human EPCs were labeled with 111In-oxine and injected in athymic nude rats 24 hours after myocardial infarction or after sham operations. Scintigraphic images were acquired at 1, 24, 48, and 96 hours after EPC injection. Specific radioactivity was measured in different tissues after the animals were killed. At 24–96 hours after the injection of EPC, approximately 70% of the radioactivity was localized in the spleen and liver, with only 1% identified in the heart of sham-operated animals. After myocardial
infarction, however, this heart-to-muscle radioactivity ratio increased significantly. Injection of EPCs into the left ventricular cavity increased this ratio profoundly, from 2.69 ± 1.54 in sham-operated animals to 4.70 ± 1.55 in rats with myocardial infarction. Immunostaining confirmed that the EPCs targeted the infarct border zone.

The authors concluded that “radiolabeling might eventually provide a useful tool for monitoring the fate of transplanted progenitor cells and for clinical cell therapy.”

**MPS Defects with Normal Angiography**

Schindler et al., from the Albert-Ludwig-Universität Freiburg (Germany), reported in May in *Heart* (2003;89: 517–526) on a study designed to investigate the reasons behind scintigraphic regional myocardial perfusion defects during exercise in some patients with normal coronary angiography.

The study included 38 patients divided into two groups according to the presence or absence of exercise-induced scintigraphic myocardial perfusion defects. A cold pressor test was performed in all patients during routine coronary angiography, followed by dynamic PET to establish coronary blood flow-mediated vasoreactivity of the epicardial coronary artery and the myocardial territories supplied by the left anterior descending, left circumflex, and right coronary arteries. Twenty-eight participants showed regional myocardial perfusion defects, and imaging was normal in 10 individuals.

The fusion images revealed 49 regional myocardial perfusion defects. In patients with exercise-induced regional myocardial perfusion defects, the responses of epicardial luminal area and regional myocardial blood flow (rMBF) to cold pressor testing were reduced compared with those of patients with normal perfusion imaging. In patients with regional abnormal scintigraphic perfusion, the corresponding rMBF response to cold pressor testing was more severely impaired than the mean myocardial blood flow in the remaining two vascular territories, but the difference was not significant. There was a highly significant correlation between the endothelium-dependent responses of rMBF to cold pressor testing and the severity of exercise-induced scintigraphic regional myocardial perfusion defects.

The authors concluded: “exercise-induced scintigraphic regional myocardial perfusion defects in patients with angina but normal coronary angiography may be related to abnormal endothelium-dependent vasoreactivity of the corresponding myocardial territory.”

**PET, CT, and Cervical Cancer**

Lin et al. from the China Medical College Hospital (Taichung, Taiwan) reported in the April issue of *Gynecologic Oncology* (2003;89:73–76) on the efficacy of FDG PET in detecting paraaortic lymph node metastasis in patients with locally advanced cervical cancer in whom CT findings were negative.

Standardized staging was used to classify paraaortic lymph node metastasis as present or absent after FDG PET imaging in 50 women who met these criteria. Fourteen metastases were found on retroperitoneal surgical exploration. FDG PET was false-negative in two patients and false-positive in two others. PET imaging had a sensitivity of 85.7%, a specificity of 94.4%, and an accuracy of 92%, leading the authors to conclude that “FDG PET can accurately detect paraaortic lymph nodal metastasis in patients with advanced cervical cancer” in the absence of positive CT findings.

**Antidementia Drug and PET**

Supplementary information on the use of PET in imaging a novel antidementia drug was e-published ahead of print on April 3 in *The Journal of Pharmacology and Experimental Therapeutics* by Noda et al. from the Medical and Pharmacologic Research Center Foundation (Hakui, Japan).

Originally reported earlier this year in *The Journal of Nuclear Medicine* (2003;44:105–108), the study assessed the effect of N-(4-acetyl-1-piperazinyl)-p-fluorobenzamide monohydrate (FK960) on regional cerebral blood flow (rCBF) and regional cerebral metabolic rates for glucose (rCMRglc) in older rhesus macaques. Seven macaques (ages 21.6 ± 7 years) were administered doses of 0, 0.01, 0.1, or 1 mg/kg FK960 for 7 consecutive days, in randomized order. PET was used to scan each animal four times, at least 3 weeks after treatment with saline or after three doses of FK960. In the group treated with 1 mg/kg FK960, significant increases in rCBF were noted in the left temporal and left frontal cortices and in rCMRglc in the right hippocampus and adjacent cortex. No change was observed at doses of 0.01 or 0.1 mg/kg.

The authors concluded that these results suggest that “FK960 restored the rCBF and rCMRglc deficits in brain areas responsible for cognitive functioning in aged rhesus macaques.”

**PET and Sentinel Lymph Node Biopsy for Oral Carcinoma**

Hyde et al., from St. George’s Hospital (London, UK) reported in the June issue of *Oral Oncology* (2003;39: 350–360) on a study designed to evaluate the utility of FDG PET and sentinel lymph node (SLN) imaging and biopsy in assessing locoregional lymphatics in patients with oral squamous cell carcinoma.

The study included 19 patients with biopsy-proven disease who had no palpable or radiological evidence of neck metastases. All patients underwent both whole-body and regional FDG PET imaging. SLN imaging was performed
Lymphatic Mapping and SLN in Thin Primary Melanomas

Working with a very large patient database, Bleicher et al., from St. John’s Health Center (Santa Monica, CA), studied the efficacy of lymphatic mapping and sentinel lymphadenectomy (LM/SL) in staging regional nodes in thin (<1.5 mm) primary melanomas. Reporting in the April issue of the Journal of Clinical Oncology (2003;21:1326–1331), the group summarized results in 512 patients who underwent LM/SL with dye alone or with dye and a radiopharmaceutical for thin primary melanomas.

Patients with tumor-positive sentinel nodes (n = 25) underwent complete dissections. This group tended to be somewhat younger than the larger group with negative sentinel nodes. Among those with 1.01- to 1.05-mm primary lesions, 7.1% were sentinel node-positive. Among 272 patients with lesions ≤1.00 mm, 2.9% had positive sentinel nodes; 1.7% with lesions ≤0.75 mm had sentinel node metastases. All 13 deaths were in sentinel node-negative patients. Median follow-up durations in sentinel node-positive and -negative patients were 25 and 45 months, respectively.

The authors concluded that “the high nodal positivity rate associated with primary melanomas 1.01–1.50 mm thick suggests that LM/SL is indicated in this group.” They noted that younger age may correlate with nodal metastases in patients with lesions ≤1.00 mm. For lesions ≤0.75 mm, however, LM/SL is rarely indicated.

Oral Oncology

SPECT and MMSE in Evaluating Alzheimer’s

Lamp et al., from Tel Aviv University (Israel), reported in the April International Journal of Geriatric Psychiatry (2003;18:288–291) on a study designed to assess the utility of a coordinated use of the Mini-Mental State Examination (MMSE) and HMPAO brain SPECT in evaluating neurodegenerative processes in patients with Alzheimer’s disease (AD).

In the study, 51 patients diagnosed with AD took the MMSE and underwent HMPAO brain SPECT. SPECT abnormalities were categorized as mild, moderate, or severe, and statistical analyses were performed to determine the extent of correlation between imaging and neuropsychological testing results.

The authors found marginal inverse correlations in the two sets of results on the right and left side and the left temporal region. The MMSE subgroup component of orientation was highly significantly inversely associated with SPECT imaging of right and left frontal regions, and the MMSE subgroup of immediate memory was significantly correlated to left and right temporal regions.

MicroPET and Prostate Cancer

In the April issue of Prostate (2003;55:39–47), Yang et al., from the University of California at Los Angeles School of Medicine, reported on a study using small animal PET to image human prostate cancer cell xenografts in immunodeficient mice.

Human prostate LNCaP tumor cells, stably transduced ex vivo with the mutant herpes simplex virus type 1 thymidine kinase (HSV-sr39tk) PET reporter gene and green fluorescent protein (GFP), were implanted into severe combined immunodeficient mice. Beginning at 2 weeks after injections, mice were scanned with 18F-labeled penciclovir.

Imaging results were correlated with tumor size, percentage of injected dose, prostate-specific antigen (PSA) levels, autoradiography, and histology. MicroPET was found to be able to detect subcutaneous tumors as small as 3 mm in diameter. Uptake in PET images correlated with tumor volumes and serum PSA levels.

In assessing the efficacy of other tracers, the authors concluded that 11C-acetate provided better imaging results than 18F in LNCaP cells. They concluded that it is feasible to “monitor prostate cancer xenografts in a mouse model using microPET” with a PET reporter gene/reporter probe system. This approach may facilitate repetitive imaging of prostate tumor metastases.

Radiolabeled Antimicrobial Peptides in Infection

The promise of radiotracers in imaging infection continues to be explored in research around the world. In a study published in the April issue of The Lancet Infectious Diseases (2003;3:223–229), Lupetti et al. from the Leiden University Medical Center (The Netherlands),
reported on scintigraphic imaging of bacterial and fungal infections using $^{99m}$Tc-labeled antimicrobial peptides, which bind preferentially to bacteria and fungi over mammalian cells.

In small animal studies, they found that accumulation of the radiolabeled peptides at sites of experimental infection correlated well with the number of viable bacteria/yeasts present. They concluded that “nonmicrobicidal amounts of $^{99m}$Tc-antimicrobial peptides are promising candidates for the scintigraphic imaging of bacterial/fungal infections and for monitoring the efficacy of antimicrobial therapy in patients.”

*Lancet Infectious Diseases*
ity can provide optimal care. He noted that hospitals “must provide equipment and environmental controls that maximize the safety of their health care staff.”


The Role of Imaging

The role of imaging in SARS remains unclear. According to the study in JAMA, a significant portion of patients (25%) have negative findings on plain radiography. In the May issue of the American Journal of Roentgenology (2003;180:1247–1249), Nicolaou et al. from Vancouver General Hospital offered a preliminary case report on CT and plain film imaging of SARS. The patient was a previously healthy 55-year-old man admitted with fever, headache, dyspnea, and a slightly productive cough. Portable computed radiography (CR) showed diffuse bilateral ground-glass opacification with poorly defined nodules and mild air-space consolidation in the retrocardiac region of the right lower lobe, as well as mild cardiomegaly. A second CR, 12 hours after admission, showed diffuse air-space consolidation. The patient subsequently underwent CT, which showed extensive bilateral areas of ground-glass attenuation and dependent areas of consolidation in both lower lobes. The authors concluded that, “the imaging features of SARS are nonspecific and can range from consolidation in a lobar or nonlobar distribution to extensive ground-glass opacities and air-space consolidation characteristics of acute respiratory distress syndrome.”

At press time, neither Newsline nor the editorial offices of The Journal of Nuclear Medicine had received reports of efforts to use nuclear medicine techniques to image SARS. This is not surprising, given the difficult logistics of maintaining isolation precautions for SARS patients. However, NIH reported in early May its intention to establish a SARS unit at or near its clinical center in Bethesda, MD. This would provide the opportunity for additional imaging studies, including the possibility of white-blood-cell studies with radionuclides.

Leadership Update

Education was another top issue at the BOD meeting. Under a previous educational strategic plan, the Society’s Education Department was tasked with designing educational offerings in PET and basic science, resulting in the PET Learning Center program and the Modern Imaging Workshop that we will be presenting for the second time at this year’s Annual Meeting. The educational strategic plan has been successfully completed and a new plan is being developed.

Industry Leaders Working Group

The SNM Nuclear Medicine Industry Leaders Working Group was formed about a year ago as a way to collaborate with representatives from industry on issues of importance to nuclear medicine. Two top priorities for this group are the shortage of nuclear medicine technologists and the FDA approval process. A Workforce Task Force has been formed to work on the shortage issue. They have several projects ongoing, including initiatives on technologist retention and targeted recruitment. An FDA/Nuclear Medicine Coalition is also being formed, designed as a broad-based, inclusive organization that will bring together the expertise and interests of nuclear medicine professionals and industry leaders to positively affect the FDA approval process. Their first meeting was scheduled for late May in Washington, DC.

Virginia Pappas, CAE
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