From the Exhibitors' Hall: SNMMI Annual Meeting 2013

It is interesting to compare the 2013 SNMMI Exhibitors Hall in Vancouver, British Columbia, with the 2012 hall in Miami, FL. Last year, 5% of exhibitors were developers of small animal imaging systems; 8% offered services and logistics (including data gathering and clinical trial management); 10% were registered as software development companies; 12% were listed as societies, associations, and publication entities; 25% offered biomarker development and radiotracer laboratory services; and 40% were companies dealing with refurbished cameras, laboratory instruments, hospitals, and/or supplies. Almost the same distribution of percentages of exhibitors came to this year's meeting in Vancouver. A total of 165 exhibitors came to Vancouver, the same number as in Miami, with 33 new exhibitors and 33 from last year not returning. Although a 20% turnover might suggest the environment is in flux, it more likely represents a healthy response to the changing environment of medical care and adjustments to the field. Of the new exhibitors, 13 were companies supplying biomarkers, precursors, and radiopharmaceuticals, and 10 were suppliers of instruments, refurbished cameras, and general nuclear medicine accessories. The highest percentage of newcomers included companies delivering services and supplies. The mainstays of nuclear medicine and molecular imaging—new imaging instrumentation, data gathering technologies, analytic software, and educational associations—remained stable at the meeting.

New Imaging Cameras

Small changes aside, the "Big Three" companies (GE, Philips, and Siemens) are the anchors of the SNMMI Exhibitors Hall and continue to show their newest models of SPECT and PET systems for clinical use. The competition is strongest among their PET/CT models installed in oncology departments and independent imaging suites. The newest development is the advent of the PET/MR camera, which, at first glance, seems the next logical step after PET/CT. Operating 511-keV photon-counting electronics in strong magnetic fields, however, is complex and challenging. A comparison of PET/MR development among major manufacturers is interesting. Siemens, which had its PET/MR unit on display at the SNMMI meeting, indicates that 30 of its PET/MR units are installed, with about the same number on order. Philips has 10 units installed and had a small tabletop mockup of their combined scanner on display. Philips continues to physically separate its PET and MR units by several feet as in their PET/CT design. GE operates 4 PET/MR engineering units, and in Vancouver (as in Miami) an appointment was necessary to view slides describing the development and status of their newest combined scanner.

George Zubal, PhD

These 3 manufacturers' PET/MR units share some similarities: all offer 3-Tesla magnets and all are developing segmentation algorithms for delineating lung, soft tissue (fat), and bone to apply PET attenuation correction based on the accompanying MR scan. In other respects, their units differ. Only Philips and GE scanners are capable of time-of-flight PET imaging. PET detectors for Siemens, Philips, and GE are lutetium oxyorthosilicate–, lutetium-yttrium oxyorthosilicate–, and silicon photomultiplier–based, respectively. GE offers the intriguing capability of retrofitting certain existing MR scanners with PET inserts to upgrade to PET/MR in the field.

Although the competition between various capabilities of these PET/MR scanners is quite strong and advantages and disadvantages are enthusiastically discussed, potential buyers of PET/MR scanners have several recurring questions: When it comes to current standard-of-care clinical imaging, does PET/MR offer strong incentives for use over PET/CT? Is eliminating the CT radiation dose a strong reason to migrate to PET/MR scanners, especially for pediatric imaging? Will the high cost of PET/MR scanners limit clinical implementation? Many believe that despite these concerns, PET/MR will quickly make its way into routine clinical use. In an era of evolving medical care regulations, financial as well as engineering developments are likely to affect the speed with which these scanners appear in every hospital. Investigations proving clinical diagnostic advantages will be required before general acceptance.

Analytic Software

New and innovative software analysis methods represent advances in display and diagnostic software that may soon emerge for broader use in the medical community. Although the Big Three offer a fairly complete library of analytic software for evaluating their own camera images, several dedicated clinical software companies either support installations on the camera manufacturers' platforms or offer alternative packages. Two examples (Fig. 1) show the development of smart algorithms that can help identify tumors in PET whole-body scans. These represent automated lesion detection methods in which the characteristics

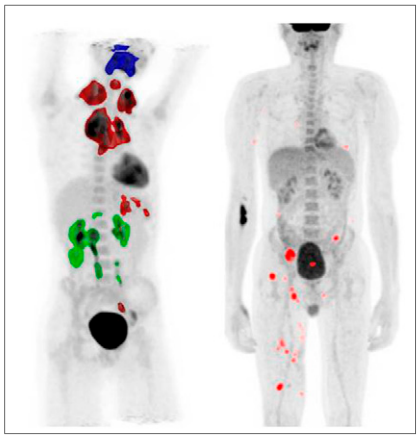

FIGURE 1. Displays demonstrating hotspot recognition algorithms that help to identify tumors in oncologic whole-body scans. These image evaluation tools can be used in highlighting questionable lesions and thereby minimizing reading and reporting times. Left: Courtesy of Hermes Medical Solutions. Right: Courtesy of Mediso Imaging Systems.

of hotspots lead to segmentation for highlighting suspicious foci (tumors) as an aid in diagnosis. Associated CT and MR scans can be used to help with classification methods. Further groupings can be attempted for separation into bone versus soft tissue lesions, and quantitative probability calculations (including standardized uptake values) help the clinician to characterize these areas. The Figure 1 examples are fully automated, and such "smart" image evaluation tools may aid in interpretation and decrease visual read times.

Since the introduction of DaTscan and Amyvid for Parkinson and Alzheimer disease imaging, innovative brain analysis methods have continued to grow. MIM Software developed one of the early β-amyloid evaluation packages and has been associated with training modules provided for Amyvid. Segami also provides brain analysis software and has particularly attractive display modes for their functional brain evaluations. Figure 2 (left) shows one of their colorized brain surfaces, using well-established display methods employed by many developers in SPECT perfusion, PET metabolism, and, more recently, β-amyloid visualizations. Figure 2 (right) shows a more interesting, deeper view into the internal structures of the brain, with the lentiform and caudate nuclei segmented separately and semiquantitative intensities shown in color. This method of internal structure display becomes more interesting as DaTscan continues to be used more extensively for clinical imaging.

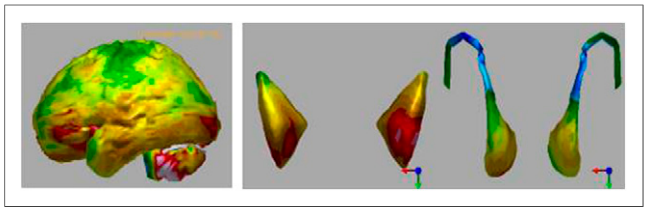

FIGURE 2. An example of colorized functional overlays on anatomic structures. Of particular interest is the application of these methods for internal structures like the caudate and putamen, with potential application in diagnosis of Parkinson disease and other dementias. Left: High (red) and low (green) brain function on the surface of the left hemisphere and cerebellum. Right: Deeper view into the internal structures of the brain, with the lentiform and caudate nuclei segmented separately and semiquantitative perfusion intensities shown in color. Courtesy of Segami Corporation.

As new brain imaging agents show promise in studying age-related dementias, research and clinical trial analysis methods continue to improve. PMOD Technologies Ltd. offers brain analysis tools that can be applied to dynamic scans for input data into a variety of kinetic modeling methods (Fig. 3). The ability to combine MR imaging for anatomic delineation with PET scans continues to be developed and is used in clinical trial evaluations. Improved resolution for visualizing and measuring substructures in the brain provides more accurate and specific information about neuroreceptors and other targets. Noteworthy in Figure 3 is the very high level of detail shown in regions that delineate gray- from white-matter tissue on the transverse PET image (obtained from MR anatomy). Better radiotracer uptake measurements lead directly to better kinetic modeling of new candidate molecules, particularly in dementia studies, where gray matter is often the target tissue.

Dosimetry Software

At the 2013 SNMMI Annual Meeting, Michael Stabin, PhD, delivered the Hal Anger Lecture, titled "A Pivotal Time for Radiation Dosimetry and Radiobiology." His excellent overview of dosimetry calculations reminds us that, in addition to diagnostics, SNMMI also includes those who prescribe the use of isotopes for therapy. Extensive therapy planning dosimetry calculations are primarily associated with external beam treatments, and more needs to be done to better understand and predict the dosimetry associated with radiopharmaceutical therapies carried out in nuclear medicine departments. A software package in support of such planning calculations is shown in Figure 4,

FIGURE 3. High-resolution internal structure delineations. Dynamic functional information captured within these internal structures is used for kinetic modeling to better characterize new drug characteristics or to evaluate disease status and progression. Courtesy of PMOD Technologies Ltd.

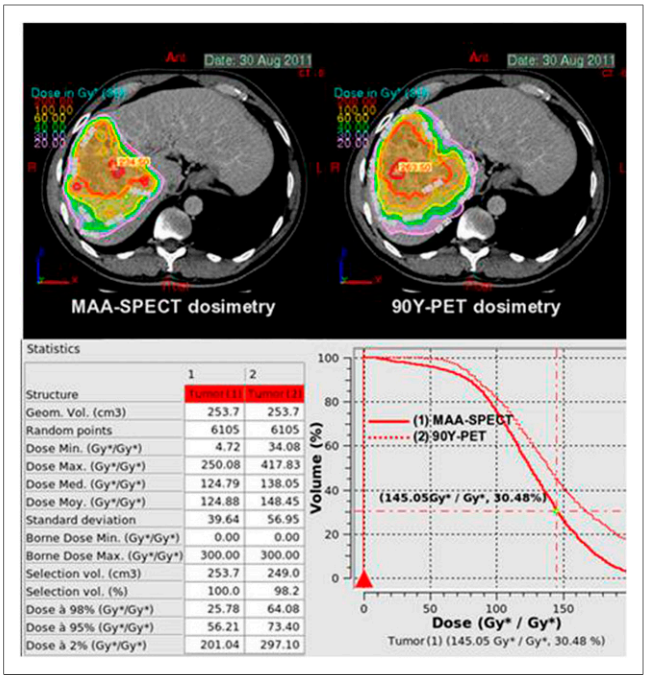

FIGURE 4. Example of dosimetry calculations demonstrating good correlation between MAA SPECT and ^{90}Y PET dosimetry estimates for treatment planning in hepatocellular carcinoma, with dosimetry color values and isodose contours overlaid onto the CT scan. Courtesy of DOSIsoft.

from the French company DOSIsoft. The internal dosimetry is based on macroaggregated albumin (MAA) SPECT compared with PET imaging of ^{90}Y microsphere distribution for treatment of hepatocellular carcinoma. By itself this is interesting, in that it demonstrates the good correlation between an easier-to-use imaging agent (MAA) and the actual therapy isotope (^{90}Y). However, the dosimetry software shown is a reminder that our European colleagues have paid more attention to such individualized treatment planning, whereas U.S. approaches have more often relied on fixed doses for all patients in a disease group. In more carefully assessing bone marrow doses and renal toxicity, therapy planning software packages can play a role in improving individualized care. As Dr. Stabin explained, such individualized dosimetry should come into more common use as standards of practice, and we look forward to updated regulations that encourage its use.

Display (diagnostic) software innovations are incorporating computer vision methods that can aid the physician in more quickly recognizing lesions or important anatomic structures in reconstructed functional scans. The ability to extract substructures from SPECT and PET images permits a focused attention on these internal structures and/or delineation of tissue types, improving interpretation of nuclear medicine scans. Nuclear cardiology has played an important role in the early development of such anatomically based quantitative analysis methods, and, more recently, these techniques have been applied in oncologic and brain imaging. Cardiac analysis software has matured and enjoys established (reimbursed) status in our imaging clinics. Oncologic and brain analysis software seems to be next in line. Internal dosimetry software should serve as a tool for introducing higher levels of therapy planning within our discipline.

Global Distribution of Molecular Imaging Exhibitors

The United States bring the largest number of exhibitors to the 2013 SNMMI Annual Meeting but represents only 70% of exhibitors. The remaining 30% of companies come to the meeting from around the world. The largest European companies operate subsidiaries with North American addresses, with headquarters outside the United States. Of those companies at the meeting coming from addresses outside the United States, 21% in 2013 were based in Canada. It is interesting that most of these Canadian companies supply equipment and methods for radiopharmaceutical manufacturing. Advanced Cyclotron Systems, CPDC, JML Biopharm, Jubilant DraxImage, Medical Radiotracers, Trace Sciences, and TRIUMF all play important roles in supplying radiotracers and isotopes. Germany contributed 15% of non-U.S. exhibitors coming to the annual meeting. Companies like ABX, ITM Isotopen, QC1, and Synthra focus on supplying precursors, reagents, radionuclides, and biomarkers. As is also the case for Canada, Germany supplies services for refurbished cameras, general clinical and hot lab products, and software. One German company, Crystal Photonics GmBH, manufactures a one-of-a-kind handheld nuclear medicine camera that can be used in surgery or small organ imaging applications. France represented 12% of non-U.S.–based companies, China 10%, and Belgium 8%. Companies also came from Australia, Austria, Hungary, Italy, India, Japan, Korea, Netherlands, Russia, Spain, Switzerland, and Taiwan.

The Exhibitors Hall this year echoed many of the developments discussed in posters and oral presentations in the scientific sessions. It should be remembered that the companies exhibiting at the meeting are faced with the challenge not only of demonstrating solid scientific worth and utility; their wares and methods must also find applicability in clinical use, must abide by federal regulations, and (sometimes most difficult) must convince insurers that the medical services supplied or facilitated by their products should be covered for payment. This high level of scrutiny makes the Exhibitors Hall a particularly intriguing window through which to observe our medical field. We look forward to next year's view in St. Louis.

George Zubal, PhD
Molecular NeuroImaging LLC, and
Yale School of Medicine
New Haven, CT