Difficulties mastered are opportunities won.

—Winston Churchill

The issue of what may constitute optimal training pathways for nuclear medicine and molecular imaging has been of major interest and discussion over the past decade (1–7). The underlying reasons for these efforts are multifactorial but include the evolving landscape for clinical nuclear medicine practice, such as introduction and rapid adoption of multimodality imaging; development of novel instrumentation, radiopharmaceuticals, and theranostics; and the realities of overall poor prospects in the job market for those physicians trained only in nuclear medicine (NM) without certification in diagnostic radiology (DR).

Most recently, the American Board of Nuclear Medicine (ABNM) and the American Board of Radiology (ABR) formed a task force and engaged in discussions that led to a joint proposal with the following principles: (1) that current NM and nuclear radiology (NR) programs be replaced by a single training pathway incorporating a combined 3-year DR curriculum and a 2-year NM curriculum targeted to medical students, resulting in a new primary certificate in NM/DR; and (2) that the new independent discipline of NM/DR be created under the umbrella of the ABR with ultimate dissolution of the ABNM. This proposal was publicly announced to stakeholders on June 3, 2015. Soon thereafter, SNMMI, the SNMMI Technologist Section, the SNMMI Young Professional Council, the American College of Nuclear Medicine (ACNM), and the ABNM–ABR Task Force opened surveys for comments. The results of these surveys were summarized and published (8, 9). SNMMI received the largest number of respondents, with 547 full members (~20% response rate), including 20% of responses coming from SNMMI international members. The results of all 5 surveys, including that of the SNMMI, were similar, with slightly more than half of respondents opposed to the proposal. The main concerns were: (1) the nonnegotiable dissolution of the ABNM (and hence loss of primary specialty status); (2) the notion of a single training pathway, which prohibited nonimaging specialists from entering NM training; and (3) the fact that DR trainees with 4-month NR training would have still been able to practice the full scope of NM, creating 2 parallel but very different pathways for NM clinical practice.

Based on the lack of broad consensus for the proposal, the ABNM announced to its diplomates on November 6, 2015, that the ABNM and ABR had agreed not to move forward with their proposal. Immediately after this announcement, SNMMI formed the Pathways to the Future of Nuclear Medicine Task Force to address the challenges, from fewer NM training programs and job opportunities to the increasing need for dual certification in DR and NM (10). The task force was designed as a 2-phase process. In the first phase, SNMMI invited various organizations within the NM community to brainstorm and come up with solid proposals and/or practical action plans. The invited organizations and their representatives are listed in the Acknowledgments section of this article. This article summarizes the discussions that took place during 3 face-to-face meetings, 2 conference calls, and numerous e-mails. The next phase will be to approach the radiology community (e.g., ABR, American College of Radiology, Radiological Society of North America, Society of Chairs of Academic Radiology Departments, Residency Review Committee for Diagnostic Radiology, Association of Program Directors in Radiology) to discuss the collective results of the NM community’s discussions in order to explore ways in which the consensus proposals might be amenable for closer collaboration between NM and DR for the benefit of value-driven, high-quality clinical NM practice. The goal is to guarantee comprehensive training of NM practitioners, with opportunities for specialists from other disciplines, that ensures that NM remains a vital, innovative component of quality patient care.

The Task Force discussed the challenges and offered a number of training pathways that were believed to accomplish the main objective of the Task Force: value-driven, high-quality clinical NM practice. The guiding principle was that NM would remain as an independent specialty but with genuine interest in and motivation to collaborate with the radiology community for the benefit of the field, its
practitioners, and overall patient care. Table 1 summarizes the potential training pathways for future practitioners in NM. It was recognized that the majority of the workforce, perhaps in the range of 85%–90%, would be trained (and certified) in both DR and NM through a number of viable pathways. However, in view of historical precedents and some continued interest, training pathways are needed to cater to those nonimaging specialists (e.g., cardiologists, endocrinologists, neurologists, etc.) who would benefit from NM training (2 years after certification in a nonimaging field) in their clinical practices. These pathways also allow for training of a relatively small number of highly qualified research-oriented physicians who would be expected to be absorbed into academic practices. Finally, international physicians may want training in the United States with the goal of returning to their countries for clinical practice. The innovative training pathway of blending the fourth year of medical

<table>
<thead>
<tr>
<th>Training pathway</th>
<th>Target physicians</th>
<th>Expected % of future workforce</th>
<th>Strengths, impact on NM field</th>
<th>Weaknesses, barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-y NM residency</td>
<td>MD/PhDs researchers, IMGs</td>
<td>&lt;5%</td>
<td>Committed to NM; researchers important for advancing the field; ABNM certification</td>
<td>Academic; small market</td>
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<tr>
<td>NM embedded in DR (16 mo of NM during 4 y of DR)</td>
<td>DR residents interested in NM; body imaging or neuroradiology trainees who may also be interested in PET</td>
<td>~15%</td>
<td>Important for community NM practice; improvement over current 4-mo basic training during DR residency; likely will be dual certified by ABR/ABNM</td>
<td>May be challenging to embed 16 mo within 4 y; few currently successful programs; will need PR efforts in medical school and early in DR residency programs</td>
</tr>
<tr>
<td>1-y NM fellowship for radiologists</td>
<td>Radiology residents interested in NM; body imaging or neuroradiology trainees who may also be interested in PET; DR programs that cannot offer the embedded pathway; IMGs in ABR alternate pathway</td>
<td>~60%</td>
<td>Traditional pathway for radiologists; important for community NM practice; improvement over current 4-mo basic training during DR residency; may be certified by ABR/ABNM/ABR-NR</td>
<td>Selected by minority of DR residents; may have less NM cultural immersion</td>
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<tr>
<td>Combined NM/DR residency program</td>
<td>Highly motivated NM-oriented individuals recruited from medical school</td>
<td>~15%</td>
<td>Committed to NM; researchers may be interested</td>
<td>Will need PR efforts in medical school</td>
</tr>
<tr>
<td>2-y NM after non-imaging board certification</td>
<td>Cardiology, neurology, endocrinology, internal medicine, etc.</td>
<td>&lt;5%</td>
<td>Historically major contributions to NM; improves NM publicity; certification by ABNM</td>
<td>Mostly academic; small market</td>
</tr>
<tr>
<td>Early start in senior year of medical school with accelerated residency</td>
<td>Medical students</td>
<td>&lt;5%</td>
<td>Early identification with DR/NM; probable reduced debt and/or loan repayment period; needs to be vetted by ACGME</td>
<td>Untested; will need PR efforts in medical school</td>
</tr>
</tbody>
</table>

NM = nuclear medicine; IMG = international medical graduate; ABNM = American Board of Nuclear Medicine; DR = diagnostic radiology; ABR = American Board of Radiology; PR = public relations; ABR-NR = ABR–Nuclear Radiology subspecialty certification; ACGME = Accreditation Council for Graduate Medical Education.
school with acceleration into the residency training is also acquiring some traction in other fields of medicine (e.g., family medicine, pediatrics, orthopedics) and should be considered. The advantages of this pathway are a decrease in the total number of years in training, with practical considerations such as decreased debt and/or repayment time.

It is important to reiterate that the Task Force recognized that the majority of the future high-quality practitioners of NM will likely be dual certified by both the ABR and the ABNM. But given the multidisciplinary nature of NM, which has been strengthened through its innate diversity, there is room and need for a small number of nonradiologists who will benefit from and contribute to the field of NM and molecular imaging.

The Task Force recognized the already substantial alignment between ABR and ABNM for many of these training pathways, with several programs successfully offering, for example, embedded 16-month NM training within the 4-year DR training, 1-year NR fellowship training after DR residency, or combined DR/NM residency training including the 5-year clinician–scientist pathways with dual certification in DR/NM. These major alignments will need to be leveraged, remaining barriers removed, and new bridges built to achieve the desired measure of success, which is adequate numbers of future physicians in the workforce practicing high-quality NM with good job prospects.

The next phase of the Task Force, which will begin immediately, will focus on further alignments with the radiology leadership and community. Bennett Greenspan, MD, MS, the current SNMMI president-elect with extensive experience in physician training issues and who also holds certifications from ABR, ABNM, and the ABR-NR, will chair Phase 2 discussions with the radiology community. In a short time, the path will doubtlessly become clearer, and both radiology and NM communities will work together to ensure high-quality clinical NM practice for the ultimate benefit of our patients.

Acknowledgments

Task force members in Phase 1 included representatives from the SNMMI leadership team (Hossein Jadvar, MD, PhD, MPH, MBA, as the Task}

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Pathways to the Future of Nuclear Medicine discussion participants included, clockwise from back left: Satoshi Minoshima, MD, PhD; George M. Segall, MD, FACNM; Vasken Dilisizian, MD; Hossein Jadvar, MD, PhD, MPH, MBA, FACNM; Bennett S. Greenspan, MD, FACNM, FACR; Patrick Colletti, MD; Jon A. Baldwin, DO; David Brandon, MD; Daniel Lee, MD; Munir Ghesani, MD, FACNM; Leonie L. Gordon, MD, FACNM; Shana Elman, MD; Sally W. Schwarz, MS, RPh, BCNP, FAPhA; and Virginia Pappas, CAE.
Force chair, Bennett Greenspan, MD, as Associate Chair of the Task Force, and Sally Schwarz, RPh, MS, BCNP, SNMMI Board of Directors (Vasken Dilsizian, MD), SNMMI House of Delegates (Le- onie Gordon, MD), SNMMI Academic Council (David Brandon, MD), SNMMI Young Professionals Committee (Erin Grady, MD), SNMMI-Tech- nologist Section leadership (Aaron Scott, CNMT, and Sara Johnson, CNMT, MBA), ABNM (Munir Ghesani, MD), ACNM (Patrick Colletti, MD, Rathan Subramaniam, MD, PhD, MPH), ACNM Nuclear Medicine Resident Organization (Shana Elman, MD), Accreditation Council for Graduate Medical Education–Nuclear Medicine Residency Review Committee (Jon Baldwin, DO), and the Nuclear Medicine Program Directors (Daniel Lee, MD).

References