

## **Entry Level Educational Requirements for Nuclear Medicine Technologists**

The Society of Nuclear Medicine Technologist Section (SNMSTS) proposes that by the year 2015, education leading to the baccalaureate degree become the standard for entry level nuclear medicine technologists. This recommendation is based on the knowledge and skills considered as essential for technologists who enter the profession by the end of the next decade.

It is recognized that although the implementation of new entry-level requirements will help new technologists meet the needs of a continuously evolving field, some programs will need assistance in transitioning their programs to meet the new requirements. This recommendation should in no way be construed to mean that non-baccalaureate prepared technologists could no longer practice in the field after the implementation date of this proposal.

### ***Evolution of Nuclear Medicine Technology and Clinical Practice Settings***

In the years since 1997, nuclear medicine technology has burgeoned in scope with remarkable advances, including nuclear cardiology instrumentation and processing, positron emission tomography, and fusion imaging technology. Radioimmunotherapy and antibody imaging are expected to grow dramatically and will require in-depth knowledge of molecular sciences.

As these evolutions have emerged at a rapid pace, they have been accompanied by a demanding healthcare environment that has challenged the profession to graduate entry-level nuclear medicine technologists (NMTs) with cutting edge skills and knowledge. Furthermore, because practice settings are shifting from inpatient to outpatient facilities, NMTs work more independently and with less physician supervision than ever before. Many NMTs work with temporary agencies, traveling to a number of locations around the country where they are often expected to work alone. These jobs are not delegated to experienced NMTs only; they are being filled by new graduates every day (Appendix I: SNM Program Director Survey, January 2005).

### ***Evolution of Nuclear Medicine Technologist Education***

The requisite skills and knowledge to be competent as a technologist in 2005 are very different from what was needed 30 years ago, yet the NMT educational model, as well as professional and pre-professional curriculum, have undergone very little change in that time. (Appendix II: JRCNMT Essentials and Guidelines). Nuclear medicine technology programs may be offered at the certificate, associate or baccalaureate level, although many different models of each type are represented in the field. Some certificate programs are open to students right out of high school and some are limited to graduates with a bachelor's degree in the sciences. Many students in associate degree programs already have bachelor's degrees. Even the baccalaureate programs offered 1- and 2-year options in the professional core curriculum. Interpretation of pre-professional coursework varies considerably among the various program types. Because of the diversity of programs and student bodies and because the profession lacks

external benchmarks against which to standardize educational outcomes, it is extremely difficult to correlate relative success of graduates to the type of program from which they graduate.

Data reported as recently as January 2005 (Appendix I) on curriculum enhancements for emerging technologies, including some that are now required by JRCNMT accredited programs, indicate that Computed Tomography (CT), Positron Emission Tomography (PET), and Magnetic Resonance (MR) education are offered on a very limited basis by a handful of existing educational programs. This data suggest that new knowledge and skills are not being secured as part of the entry-level educational process. At best, most technologists are receiving training and education in these modalities through system-specific applications training in continuing education formats.

Molecular imaging and therapy are rapidly emerging as a projected part of clinical operations of the future. These areas of practice will demand the addition of targeted areas of cellular science that are not currently part of the professional applied curriculum. The addition of this component to entry-level and continuing education will require dedicated blocks of time and practicum not currently available within strained educational delivery times.

### ***Leadership Perspective***

For the past several years the leadership of the SNMTS has attempted to address a growing concern regarding the adequacy of academic preparation of graduates from accredited programs in nuclear medicine technology. A number of stakeholders inside and outside the organization have concluded that the current mechanisms for nuclear medicine technology education are diverging from the market need for knowledgeable and skilled professionals in clinical practice (Appendix III: Nuclear Medicine Technology Final Report).

The introduction and adoption of PET-CT came so quickly that it caught the profession unaware. The marketplace replaced the SNMTS as the defining body of the profession. Consequently, a hodgepodge of licensure laws and regulations has emerged that are creating a number of barriers to the practitioners. Further confounding the situation will be the introduction of PET/MRI, Positron Emission Mammography, Nuclear Medicine/Ultrasound, and so forth.

In October 2004, the PET-CT Task Force of the SNMTS met to discuss the educational requirements for students as well as technologists in PET and CT. The task force proposed that all new graduates should be competent in PET-CT to the extent outlined in the PET-CT curriculum (Appendix IV: PET-CT Curriculum) as developed and published conjointly by the SNMTS and the ASRT. This recommendation was formally approved by the Executive Board of the SNMTS and the National Council of Representatives in January 2005.

### ***Education Gateway Task Force***

Leadership with the SNMTS must address the question: **How can we adapt the profession to embrace these modern technological advances and prepare future**

**generations of NMTs for this new world of fusion imaging?** In February 2005, the Education Gateway Task Force, which was composed of SNMTS education committees and task forces, met to address a number of education issues, including that of entry-level technologists. In regard to entry-level education, the task force was to define in a broad sense what technologists would need to do and know when they enter the workforce. Keeping in mind that adoption of new educational standards will take time to implement, the skills and knowledge needed for technologists in the year 2015 should be considered as the targeted goal.

Taking into consideration where the profession was at the present time as compared to where it ought to be now and within 5 and 10 years, most of the current competencies and curriculum should be retained. Technologists will need to be competent in PET-CT and SPECT-CT fusion imaging in the very near future, in PET-MRI within a few years, and in radioimmunotherapy as research and protocols develop. Technologists must be capable of working independently in outpatient clinics and in temporary or traveling positions where they will very likely be the sole technologist. They must be capable of more than technical expertise; they must be able to cope competently with all the peripheral responsibilities of their jobs, especially administrative and regulatory aspects. Considering content amount for pre-professional and professional education, an education at the baccalaureate level is the most applicable for nuclear medicine technology in the workplace of the future.

### ***Desired Knowledge and Skill Base***

Based on the amount and complexity of knowledge and skills that must be acquired before the graduate enters the workplace, a baccalaureate degree is the appropriate level of education. If the new graduate is expected to acquire a very diverse skill set as well as develop the critical thinking skills that come with exposure to a wide variety of subjects, it is virtually impossible to impart that education in 1 or 2 years. Vocational education is no longer sufficient when higher level skills and knowledge are necessary to perform adequately in the market place, both now and in the immediate future. The recently approved curriculum for PET-CT will add significantly to the existing curricula with clinical training alone. Hybrid or fusion imaging equipment with all of its clinical implications is forcing technologists to develop expertise in multiple areas. As patient care moves increasingly to outpatient settings, more technologists are working independently with less nuclear medicine physician oversight and often as the only technologist.

Most existing nuclear medicine programs would have to undergo curriculum revisions, some quite extensively. Just as most college majors allow choices within a curriculum, not all programs must be identical in how they are structured. Consideration should be given to existing programs that have articulation agreements with radiologic technology programs and with community colleges where many nuclear medicine programs currently reside.

Nuclear medicine technology educational programs should be enhanced to reflect the following content:

#### Pre-professional or prerequisites

- A. General education coursework as defined by the institution: e.g., English, literature, history, social sciences, humanities, fine arts
- B. Science as needed for the NMT program and as defined by the institution
  - Human anatomy and physiology (two semester sequence)
  - General chemistry (two semester sequence)
  - General physics (two semester sequence)
  - College algebra
  - Statistics
- C. Medical or health-related courses in preparation for the NMT program (perhaps make these some options rather than recommend all of them)
  - Genetics
  - Immunology
  - Molecular biology
  - Medical terminology
  - Bioethics
  - Pathophysiology
  - Health economics
  - Health management courses
  - Business courses such as accounting

Professional courses in addition to what is currently required

- A. PET and CT: PET-CT curriculum (consider MRI as well)
- B. Health care management: reimbursement (billing, collections, coding), personnel management, operations, performance benchmarking, budgeting, health care systems
- C. Research: evidence-based patient outcomes based on clinical diagnostics and treatment algorithms, research methodology, disease management
- D. Advanced nuclear cardiology: cardiac pathology, expanded ECG, expanded cardiac pharmacology, comparative cardiovascular diagnostics across modalities (Echo, angiography, CT, functional MR), ACLS certification (good adjunct for the nuclear cardiology certification)
- E. Molecular and biochemical medicine: radiotherapeutics
- F. Digital Imaging: PACS, software, hardware, troubleshooting imaging systems.

Many of these courses that were not taken in the original program would be a good basis for bridging programs for practicing NMTs who wish to earn a bachelor's degree.

***Critical Thinking Skills***

In addition to the new and different skill sets driven by the rapid advancement of technology is the need to enhance the graduates' critical thinking skills. This concern has been raised repeatedly among employers and communicated to leadership in the profession. When the SNMTS Continuing Education Committee developed the Master Plan for Continuing Education in February, 2004, there was a consensus that technologists need to be taught to solve problems, communicate well, and think critically.

While honed by experience, critical thinking skills should be developed during the educational process. Critical thinking is essential to skilled reading, writing, and listening, which in turn lead to skilled reasoning and intelligent decision making. Several

studies have evaluated critical thinking abilities of students in various educational settings, and this is one area that consistently demonstrated the superiority of graduates with baccalaureate degrees as compared to associate degrees or undergraduate certificates.

Education is not simply a mastery of factual information but is a process whereby students learn to think their way to conclusions and defend their positions on difficult issues. They learn to consider other points of view, analyzing theories and explanations. They learn to challenge assumptions, solve problems, and transfer ideas to new concepts. In teaching students to think critically, they develop skills, abilities, and values that are essential to their success in everyday life.

Learning to think does not mean that an educational program should be front-loaded with more science or more professional coursework. It is a process that is developed throughout the entire educational experience and in a variety of classes. This skill will become increasingly necessary as more technologists work under the supervision of non-nuclear medicine physicians, and consequently, they will be relied upon to make independent judgments about patient care and nuclear medicine procedures.

### ***Building on Existing Foundations***

In addition to the need for an expanded knowledge base and enhanced critical thinking skills, baccalaureate programs are logical foundations upon which to build a career matrix in nuclear medicine. Many nuclear medicine students come from associate degree programs in radiologic technology, especially as fusion imaging becomes an important diagnostic modality. Logically speaking, students should be awarded more than an associate's degree as they build on prior knowledge and complete far more than 60 or 70 semester hours of credit. It is inappropriate to recognize the significant amount of coursework nuclear medicine students are receiving by awarding only an associate's degree, and it is unfair to the student as well.

The baccalaureate degree is also the foundation for an NMT's future growth, including career moves that require a master's degree. Technologists who remain at the bachelor's level have ample opportunity for professional growth, but at some point, a master's degree may be highly desirable. For example, job opportunities in management, education, industry, or health physics will almost certainly require master's level education. Furthermore, the profession is exploring development of education programs in advanced clinical practice, and that will be offered at the master's level.

### ***Educational Standardization***

The profession of nuclear medicine technology would benefit significantly by standardizing entry-level education requirements. There is no differentiation in practice or credentialing among the graduates based on the type of education they receive. Graduates from any program type are all eligible to take the national certification examinations. They are hired to do the same things in the clinical setting and with no salary differentiation. The result is that prospective students and employers receive conflicting messages from a profession that appears not to value any one type of education over another.

The Council for Higher Education Accreditation, which oversees the JRCNMT, requires organizations that accredit professional programs to document that the education is appropriate for the degree levels. Currently, this requirement is not clearly structured within NMT education.

### ***Professional Status***

No doubt, most who work in healthcare settings would consider themselves “professionals.” And, indeed, the term “professional” is used by everyone who takes pride in what they do. But despite common usage, being a “professional” has many meanings. Sociological definitions of “professionalism” involving checklists of perceived or claimed characteristics such as altruism, self-governance, knowledge, and ethics. In the field of labor law, the term “profession” often refers specifically to fields that require extensive study and mastery of specialized skills, such as law, medicine, clergy, the military, engineering, and so forth. In this sense, “profession” is contrasted with “occupation,” which refers generally to the nature of a person's employment.

Categorization as a profession implies characteristics and privileges not always granted to an occupation. Some of these include autonomy for decision making with accompanying accountability; increased compensation levels commensurate with increased levels of knowledge, skills, and documented technical competency; access to government funding to enhance education, training, research and development; access to government entities for resource needs; and expansion of scope of practice. The federal government defines a “professional” as someone who has a number of the above attributes, including professional education at the baccalaureate level. Currently, the concept of profession and professionalism in regard to NMTs is skewed toward the concept of occupation. An NMT is categorized as a technical occupation by the US Bureau of Labor and Statistics, not as a profession or practitioner occupation.

### ***International Competition***

Professionals who work in the manufacturing, computing, financial, and medical industries are just a few among many who have recognized the value of thinking beyond traditional boundaries. In a global marketplace, standards of education in other countries should be considered if the United States is to maintain a competitive edge. Our neighbors in Canada, Australia, and Great Britain all educate NMTs at the baccalaureate level, and other countries around the world are beginning to follow suit. Other countries have taken the leadership role in raising educational standards, and consequently, recognition of educational credentials from the United States may not be recognized as equivalent to those from other countries.

## **Strategies for Implementation**

### ***Time Frame***

The SNMTS proposes implementation of the new entry-level education standards in several phases over a 10-year time frame. All educational programs should be required to implement the PET-CT education standards as adopted by the SNMTS and the Society of Nuclear Medicine (SNM) in the very near future. By 2010, all existing baccalaureate programs should implement the new standards in their entirety. By 2015, all graduates from nuclear medicine programs will have a baccalaureate degree.

### ***Role of the SNMTS and SNM***

The proposal to advance entry-level education of existing educational programs is challenging from the perspective of individual institutional philosophies, missions, and budgetary constraints. The SNMTS proposes the following rationales and strategies for modification and migration to the baccalaureate level:

1. Affiliation of hospital-based instructional programs with local technical schools and 4-year universities to secure necessary college credit pre-professional coursework. Traditional higher education funding mechanisms are being quickly replaced by corporate and business partnership models to meet local and regional workforce requirements. Additionally, many hospital-based programs recruit from a population of applicants who already possess a baccalaureate degree or another certification in health care, bringing these candidates to educational programs with completion of many of the necessary college pre-requisite courses. *The SNM will work with local institutions to identify resources to facilitate such collaborations.*
2. Affiliation of technical schools and junior colleges offering certificate and associate degree programs with local or regional 4-year colleges as bridging programs to bachelor degree programs. This pipeline model is rapidly evolving in many states with institutional agreements becoming common for the purposes of recruitment and career advancement to meet the need for an increasingly technical workforce. These institutions offer flexible educational formats through distance learning and web-based education. Many institutions partner to share faculty in a time when faculty recruitment dollars are challenged. *The SNM will work to develop pilot models for affiliation that will be available to educational programs and assist with legal and structural modifications.*
3. The US Departments of Education and Labor frequently offer grants that facilitate the development of new educational models for integration of knowledge and skills across disciplines. *The SNM will create an information bureau and grant assistance team to develop grant proposals to assist programs in necessary restructuring and partnering with community resources.*

## **Summary**

Spurred by advances in medicine and health care, clinical training across the board has taken a more scholarly approach, with the role of research and science considered as

valued components in healthcare education. Molecular biology, fusion imaging, and a changing workplace that demands independent thinking and competent technologists implies the need for more stringent standards of professional training in nuclear medicine technology. For these reasons, the SNMTS recommends enhancements to existing educational curriculum to adequately prepare the technologist of 2015 with the necessary skills and knowledge. Furthermore, entry-level education of NMTs should be raised to the baccalaureate level to more appropriately reflect the educational accomplishments of the graduating student.

## Questions and Concerns

**Question:** The radiation therapists attempted to raise their entry-level standards to a bachelor's degree and were unsuccessful. No significant differences were found among the various program types (certificate, associate's, or bachelor's degree). How is this proposal for nuclear medicine technologists any different?

**Response:** The radiation therapy community looked at existing educational programs and attempted to differentiate between them. Their survey data was based on past experiences. This proposal is different in that the nuclear medicine profession is attempting to look into the future and determine the skills and knowledge needed by technologists in 2015. Based on the desired skill and knowledge set, a bachelor's degree is recommended as the most appropriate academic degree.

**Question:** A lot of students in associate degree programs already have a bachelor's degrees and are changing careers. These are some of our best students and we would not want to lose them. If all programs were bachelor's degrees, wouldn't these students with degrees have to start over and go for 4 more years?

**Response:** No, students with existing bachelor's degree transfer most of their pre-professional coursework from their first institution. Therefore the amount of time they would spend in education and training in nuclear medicine would remain nearly equivalent to the time they spend now (approximately 2 years).

**Question:** It is going to be very expensive for students to get a bachelor's degree as compared to an associate degree, and many cannot afford bachelor's level education.

**Response:** It is true that university education is more expensive than at a community college education, but in most public universities, costs are fairly reasonable. Tuition per semester for instate students is typically around \$2100 to \$3000 per semester. All students have access to financial aid, and based on recent surveys of salaries upon graduation, loan repayment should not be burdensome.

**Question/concern:** The ethnic diversity, which is currently extremely low in the field, will become worse without affordable associate degree and certificate programs.

**Response:** As pointed out in the stated concern, ethnic diversity in nuclear medicine needs to be improved, as it does in almost every other health care profession. However, even with all the existing associate's and certificate programs, diversity has not occurred. It does not serve any disadvantaged population well to assume its members can only afford a lower level of education. It could be argued that as minorities have more and more opportunities opened to them, they'll choose the professions that are more attractive in terms of status and pay.

**Question:** If only baccalaureate degree programs were offered for nuclear medicine education, the shortage of technologists would only worsen.

**Response:** Not necessarily. More people may be encouraged to go into the field when the educational level and thus the sense of profession is raised. Many professions that have raised their educational requirements, such as speech therapy, physical therapy, and pharmacy have robust applicant pools.

**Question/concern:** Hospitals that have sent radiographers to go to associate degree or certificate programs in nuclear medicine to be prepared quickly may not want to pay the costs of having their employees attend a university.

**Response:** Alternatively, many hospitals would prefer to reimburse employees for college credits toward a degree, including a bachelor's degree. Many employees find it easier to be reimbursed for college credit rather than continuing education or other types of educational experiences.

**Question/concern:** A number of associate degree and certificate program directors have talked with universities about offering a nuclear medicine technology program and have been rejected.

**Response:** These attempts seem to indicate an existing interest by program directors of associate degree or certificate programs in moving toward a bachelors' degree. The SNMITS, among other stakeholders, must provide more assistance in making such transitions.

**Question/Concern:** Not all baccalaureate degree programs and/or certificate programs have the flexibility to increase the number of hours dedicated to nuclear medicine technology.

**Response:** The same can be said for associate degree programs. Bachelor's programs may actually have more flexibility in that they have more room for elective coursework. Most colleges and universities, including community colleges, must follow guidelines for the total number of hours attained for the degree but offer flexibility as to how many hours are professional and how many are pre-professional.

**Question/concern:** The following fields have advanced levels, Master and or Doctorate degrees, while still having associate degree and/or certificate entry points: nursing, physical therapy, occupational therapy, respiratory therapy, pharmacy, medical lab, etc.

**Response:** Except for nursing and respiratory care, these various levels carry different job titles, different pay levels, and different credentialing examinations. That is not the case in nuclear medicine.

**Question:** If nurses don't require a bachelor's degree to practice but are considered as "professionals", why can't nuclear medicine technologists be categorized as professionals by the government?

**Response:** Nursing is the only health care occupation without a bachelor level or higher education that is classified as "professional" by the government. That classification occurred many years ago and was effected by a very strong nursing lobby. The nuclear medicine technologist community is not nearly as large or powerful as the nursing lobby.