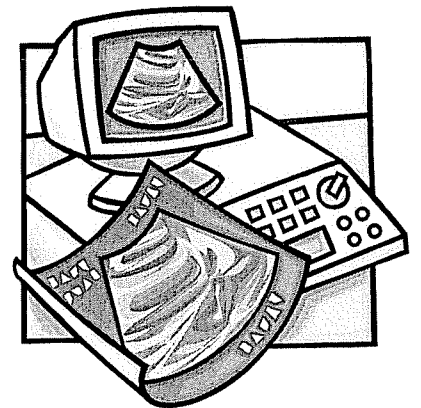
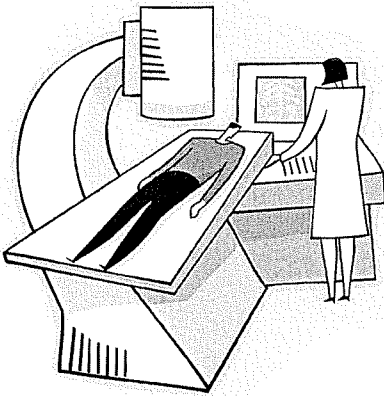
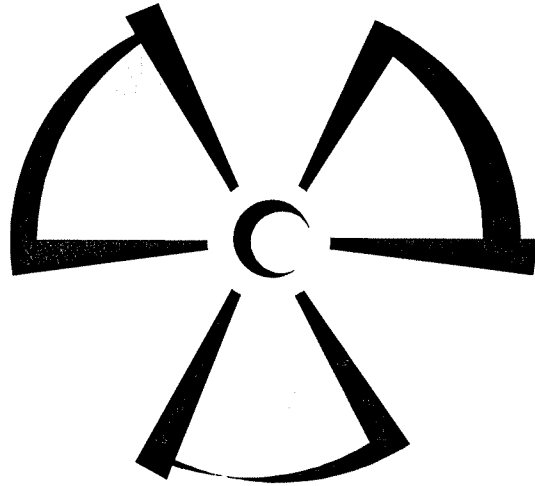


A Handbook of Career Planning in Nuclear Medicine



**Northwestern University
Medical School**

Introduction

This guide is intended to help medical students considering a career in the field of Nuclear Medicine to gain an understanding of the practical issues involved in seeking residency and fellowship training in the field, and to assist them in planning their future clinical or academic careers. Interested students should supplement the information found in this guide with discussions with the Nuclear Medicine faculty and housestaff. Interested students should also select a Nuclear Medicine faculty advisor, take elective clerkships in Nuclear Medicine and Diagnostic Radiology, and are also encouraged to review textbooks and other teaching materials and available online resources, as an introduction to the field.

Choosing a Career in Nuclear Medicine

Nuclear Medicine is a medical specialty not usually well known to medical students, since most medical schools do not provide significant exposure to the field during the didactic portion of the medical school curriculum. This circumstance is particularly true given the recent additions and modifications made to the curricula of most medical schools. Similarly, exposure to Nuclear Medicine during the clinical clerkships is highly variable, and to some degree, a matter of chance. Nevertheless, some exposure to radionuclide imaging and therapy is highly relevant in the training of most physicians, and a few students will become uniquely interested in the field. Nuclear Medicine and Diagnostic Radiology often tend to appeal most to students with strong backgrounds or interests in certain aspects of "high technology," such as computer science, biomedical engineering and physics, although previous training in these fields is not required. While considerable interaction between Nuclear Medicine specialists and patients occurs, direct patient contact in this specialty is typically significantly less than that encountered in most primary care specialties, such as Internal Medicine, Family Practice and Pediatrics. Nuclear Medicine physicians and Radiologists most often serve as consultants to other physicians, with emphasis on interpreting and performing various imaging procedures, and in some cases, administering therapeutic agents. In some instances, part-time positions may be available, which can be a desirable option for those wishing to pursue career and family options simultaneously. One of the greatest appeals of Nuclear Medicine lies in its wide range and variety of clinical activities, which results from its unique capabilities in diagnosis and therapy of a wide range of disorders, involving almost all clinical specialties. It is a rapidly changing and highly dynamic field, in which the daily activities of the clinician or researcher may change dramatically from year to year, and continuing education is very important. Nuclear Medicine physicians receive great gratification from being able to make significant contributions to the care of the patients referred to them, which in some cases are literally life-saving. The discussions which occur in consultation with referring physicians and patients are often stimulating and rewarding.

Students considering a career in Nuclear Medicine or any other field, for that matter, should observe and interact with those physicians already in the field. This evaluation should include not only the types of clinical activities involved in the field, but also observing their work environments, assessing what personality types tend to be attracted to the field, and carefully considering whether this field suits their own interests and abilities. A career in medical imaging is not suitable for all. Those who crave in-depth and longitudinal interaction with patients, or who seek the public recognition associated with more familiar or “high profile” specialties, like surgical subspecialties or Cardiology, should probably not pursue this field. Many of the patients served by Nuclear Medicine physicians may never even have met the physician who interpreted their studies, and in some cases may not even be aware that their Nuclear Medicine specialist is even a physician, let alone one who consulted with and advised their own doctor. On the other hand, for those seeking a fascinating and gratifying career in a rapidly changing field currently experiencing significant growth, having a wide variety of practice options and with projected expanding employment opportunities in the future, Nuclear Medicine is definitely a career worth considering.

Northwestern University Medical School Department of Nuclear Medicine Advisors

The following is a list of the current Nuclear Medicine clinical staff at Northwestern University Medical School and Northwestern Memorial Hospital, along with their responsibilities and special interests and backgrounds. Please note that the two designated primary Nuclear Medicine career advisors are Dr. William Spies (Residency Program Director) and Dr. Stewart Spies (Departmental Medical Director). It is recommended that students interested in pursuing a career in Nuclear Medicine select one of the two principal advisors as soon as they become interested in the field (but by no later than August of their senior year of medical school), to facilitate their selection of appropriate senior elective clerkships. Access to the other clinical faculty members or basic scientists can be individually arranged, if desired. The training backgrounds and areas of interest of the full time Nuclear Medicine physicians at Northwestern Memorial Hospital are indicated in parentheses:

William G. Spies, M.D.	Director, Nuclear Medicine and Nuclear Radiology Residency Programs, Associate Director of Nuclear Medicine, Northwestern Memorial Hospital (clinical Nuclear Medicine, Diagnostic Radiology, cross-sectional imaging, teaching, clinical research)
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Stewart M. Spies, M.D.	Director, Department of Nuclear Medicine, Northwestern Memorial Hospital (clinical Nuclear Medicine, Internal Medicine, teaching, clinical and basic science research)
Padma Rao, M.D.	Attending Nuclear Medicine Physician, Northwestern Memorial Hospital (clinical Nuclear Medicine and Diagnostic Radiology)

Requirements and Pathways for Nuclear Medicine Training

The requirements for Nuclear Medicine training are multiple, and are currently under consideration for change. At present, the American Board of Nuclear Medicine requires at least one year of preliminary training in an ACGME-approved clinically-based training program or equivalent, such as a transitional year or a first year residency position in Internal Medicine, Family Practice or Pediatrics. Residency training in other fields is also often acceptable to the Board as well. Following successful completion of preliminary training, two additional years of Nuclear Medicine residency in an approved program are required. Following successful completion of this training, residents recommended by their Program Directors may sit for the American Board of Nuclear Medicine Certifying Examination, which is given annually in the fall at two or three locations across the country. Interested students should be aware that the Board itself and an association of U.S. Nuclear Medicine Program Directors are currently debating the possibility of extending the Nuclear Medicine component of training to 3 years in the near future.

A second pathway to certification in Nuclear Medicine is available to residents who have successfully completed residency training in Diagnostic Radiology, which is itself a 5 year training program. These residents can complete a one year training program in Nuclear Radiology (essentially a fellowship) that is offered by some institutions, following which they can take an oral examination given by the American Board of Radiology, leading to a certificate of added qualification (CAQ) designated "Special Competence in Nuclear Radiology." Similarly, residents with Board Certification in Internal Medicine may also sit for the ABNM Examination after receiving one year of additional Nuclear Medicine residency training. Finally, some Nuclear Medicine residency programs are beginning to offer additional one year Fellowship programs in Positron Emission Tomography (PET) Imaging, though these latter programs are not currently associated with formalized certification.

Currently there are approximately 65 active ACGME-certified residency programs in Nuclear Medicine in the United States. At Northwestern, both the Nuclear Medicine and Nuclear Radiology programs are offered.

Organization and Content of Nuclear Medicine Residency Programs

The exact organization and structure of Nuclear Medicine programs varies from institution to institution, but there are many common elements shared by these programs. All programs provide a broad exposure to diagnostic and therapeutic procedures using unsealed radioactive sources. Diagnostic studies include a wide variety of clinical imaging techniques, such as imaging of the skeleton for detection of neoplastic involvement, trauma or infection, renal imaging for assessment of renal perfusion, function and detection of obstruction, thyroid imaging, hepatobiliary imaging for assessment of cholecystitis or biliary tract patency, myocardial perfusion imaging for assessment of coronary artery disease and myocardial viability, PET and radiolabeled monoclonal antibody or peptide imaging for the detection, staging and re-staging of cancer, myocardial viability and ventricular function, pulmonary imaging for suspected pulmonary embolism, gallium and radiolabeled leukocyte imaging for detection of infection, and many others. In addition to imaging studies or "scans", diagnostic Nuclear Medicine also encompasses non-imaging and *in vitro* studies, such as thyroid uptake measurement, Schilling tests, red cell mass and plasma volume measurement, breath tests for peptic ulcer disease and others. Therapeutic Nuclear Medicine studies include I-131 therapy for hyperthyroidism and well-differentiated thyroid carcinoma, P-32 therapy for blood dyscrasias or neoplastic involvement of the peritoneal cavity, Sr-89 or Sm-153 therapy for painful bony metastases and monoclonal antibody or peptide hormone therapy for lymphoma or neuroendocrine tumors, respectively. In any given program, not all of these elements may be included. For example, at present not all programs include training in PET imaging (since they do not all yet have available PET scanners), in some institutions radionuclide therapy is performed not by Nuclear Medicine physicians but by Radiation Oncologists, and in some institutions, myocardial perfusion imaging is interpreted only by Cardiologists. Obviously, the more comprehensive the clinical program of an institution is, the more exposure to radionuclide imaging and therapy techniques residents will receive.

In addition to hands-on and didactic training in these areas, there is also formalized didactic and laboratory instruction in the basic sciences of Nuclear Medicine, including Nuclear Physics, Nuclear Medicine Instrumentation and Computer Applications, Radiochemistry, Radiation Safety and Radiobiology. Residents are also required to take part in some research activities during their residency training. Most programs have duty hours well within the new ACGME guidelines, with residents typically working ~ 10 hours per day, 5 or 6 days per week. Call is usually taken as beeper call, and in many programs, is shared with Diagnostic Radiology residents also on call for general radiologic procedures. Policies on moonlighting vary, but in some cases it may be available to residents. Nuclear Medicine residencies are generally small (1-4 residents/program), and do not usually employ "pyramids". Subspecialty rotations may be available in

certain areas, most commonly in Pediatric Nuclear Medicine, as well as rotations at several institutions. With the increasing emphasis given to correlative imaging and image fusion, it is likely that many programs may soon include elective rotations in cross-sectional imaging techniques (CT, MRI or Ultrasound), particularly if Nuclear Medicine residency requirements are increased to 3 years of training. Finally, as mentioned above, some programs are beginning to offer one year fellowships in PET Imaging.

Recommended Elective Clerkships

Since Nuclear Medicine studies involve most other clinical specialties, a broad exposure to many clinical fields during student clerkships provides the best overall preparation for a career in this field. Of particular importance are rotations in Internal Medicine, Surgery, Pediatrics and Diagnostic Radiology. An elective rotation in Nuclear Medicine would also be very helpful in providing an introduction to the field, but is not strictly required. Elective rotations at other institutions are also valuable, especially if taken in institutions the student is considering for residency training. However, students should remember that taking more than two clerkships in the same specialty will not count toward NUMS graduation requirements.

Applying for Residency Positions

While there are some exceptions, most Nuclear Medicine residency programs select applicants outside of the Matching Program. Applications are usually accepted 1-2 year prior to the onset of training. In most cases, programs do not offer intergrated acceptance to preliminary training years, therefore students will need to apply separately to preliminary residency training positions. Standardized application forms are usually accepted, but many institutions (including Northwestern) also have their own dedicated application forms. Interviews are set up informally by mutual agreement between applicants and programs. Students should consult with their advisor(s) for advice in selecting programs to apply to. In general, it is a good idea not to “put all your eggs in one basket,” and to apply to programs with various perceived levels of competitiveness. In general, programs at major academic institutions and tertiary health care institutions tend to be more selective and competitive, particularly if they only have a small number of positions available or if they share their positions between more than one program. Of course, any special geographical or other personal preferences should also be considered when choosing where to apply. Most applications require medical school transcripts, USMLE examination scores and documentation, medical school Dean of Students letter and typically at least 2 additional letters of recommendation. A personal statement explaining the applicant’s reasons for interest in Nuclear Medicine should also be provided. There are no consensus guidelines regarding minimum USMLE test scores or other criteria for acceptance.

The Interview Process

A personal interview is strongly recommended for students interested in specific Nuclear Medicine Residency programs. The interview serves several important functions. First, it allows the Program Director and anyone else who may interview the applicant to get to know them as an individual, and to differentiate between one applicant and another. It also indicates to the Program Director/Residency Selection Committee that the student is a serious applicant for the program. The interview also allows the student the opportunity to observe first hand, not only the institution in which he/she may be training, but also to interact with the Program Director and possibly other faculty and current residents and fellows. If the student is unfamiliar with the area in which the program is located, visiting for an interview also provides an opportunity to explore the community and its resources, such as housing, schools, etc. Students should not expect to be financially compensated for travel expenses related to interviews for residency positions. Dress neatly and conservatively for the interview and plan to arrive on time. Be prepared both to answer questions regarding your background and reasons for interest in the field, as well as other questions about your general interests and future career plans (eg., clinical vs. academic, large vs. small hospital). Questions regarding age, religion, marital status, family plans and physical disabilities are inappropriate, need not be answered, and may indicate inappropriate motives on the part of the interviewer. In addition to being prepared to answer questions about yourself, also prepare some questions of your own, regarding the size and type of the hospital, the organization and philosophies of the program, volume and spectrum of clinical studies performed, number of faculty, departmental equipment, teaching program and research opportunities. If the interviewer does not volunteer this information, also ask about teaching resources (teaching file cases, didactic teaching materials, online resources, etc.), the number of residents, how residents perform on board examinations and recent residents' experiences in the job market. The interview should include a tour of the departmental facilities. If at all possible, you should request to meet with some or all of the residents, who may shed further light (in a more candid way) on other issues, such as workload, the teaching ability, availability and supportiveness of faculty, etc. At the conclusion of the interview, if you feel that you are still interested in the program, it is appropriate to discuss with the interviewer a follow-up plan for notification of your status as an applicant, as well as provide appropriate phone numbers, email addresses and/or pagers at which you may be contacted. At this time, you may also wish to ask other information, such as the location and pricing of housing, procedures for obtaining licensure, and any other matters of concern. Usually, at this point, the interviewer will either inquire about your level of interest in the program, or possibly even offer you a position right on the spot. If this occurs, you should accept only if you are certain that this is your top choice program, or if not, decide upon a mutually agreeable date for coming to a decision. If a position is not offered, it is appropriate for you to ask when a decision can be expected.

Selecting a Program Best Suited to You

A number of factors will influence the student's choice of a residency program. As discussed above, geographical considerations may narrow the choice down to a few possible programs, if closeness to family or friends is of great importance. Most programs are associated with a University medical center, and most are also located in urban areas. The student should pay close attention to the facilities, equipment and scope of clinical coverage provided by programs, to ensure that the educational experience will provide a comprehensive exposure to Nuclear Medicine imaging and therapy, including cutting edge procedures and techniques. Interaction with current and former faculty and residents will help ensure a good "match" of philosophies and personalities. If the resident is distracted by personal conflicts or other sources of dissatisfaction or frustration, then the training experience will be compromised. Finally, students interested in academic careers should pursue programs that indicate active ongoing research and encouragement of resident participation in research. The broader the choices that are acceptable to the student, the greater the likelihood is that the student will obtain a satisfactory position. Again, students should also be realistic in their expectations, and apply to at least some programs that they are very likely to be accepted by. Discussion with faculty advisors can be very helpful in making these assessments.

Ethical and Procedural Considerations

Avoidance of misunderstandings between the program and the student are easily avoided if lines of communication are maintained and kept clear. If you are given a timeframe for accepting a position, honor that request, or if not interested, so indicate. Above all, even though the program may not be using the Matching Program, both the offering and acceptance of a position should be mutually viewed as being binding. It is highly unethical to accept positions at more than one institution, in an attempt to "jockey for position", or to accept a position and later renege on your commitment. If you accept a position, that should be considered as a binding commitment, regardless of what better offers may come down the line later. At the same time, students should regard with suspicion programs that attempt to pressure them into instant decisions, without providing them with time to complete their deliberations. Once acceptance to a program has been extended and accepted, the student should begin the process of preparing for the beginning of training. All necessary paperwork related to licensure and contract agreement should be completed as soon as possible. In many states, including Illinois, residency training may not begin until a valid temporary medical license has been obtained. Your advisor and the Dean of Students should be informed of your appointment. Additional details may be necessary in the event of a move to another area, such as obtaining housing, getting information on community services, employment opportunities for spouses, schools, etc. It is prudent to begin these preparations as far in advance

of the onset of training as possible. Often the Graduate Medical Education Office of the institution you will be attending or the Program Director can provide valuable information and guidance on these issues.

General Resources

Further information regarding Nuclear Medicine training, educational resources and practice can be obtained from several organizations. The American Medical Association FRIEDA Green Book lists all Nuclear Medicine and Nuclear Radiology programs in the United States, along with other ancillary information. This data is also available online at the website www.ama-assn.org/ama/pub/category/2997.html. Nuclear Medicine and Nuclear Radiology residency program information is also listed on the Accreditation Council for Graduate Medical Education, at www.acgme.org and www.acgme.org/adspublic/. Pertinent information can also be obtained at the websites of the American Board of Nuclear Medicine (www.abnm.org) and the Society of Nuclear Medicine (www.snm.org). Additional information regarding Nuclear Medicine and other medical imaging specialties in Radiology, as well as educational resources, may also be obtained from the Radiological Society of North America (www.rsna.org) and the American College of Radiology (www.acr.org).