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Neuroimaging
Program Requirements

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Neuroimaging Program Requirements

The common program requirements are standards required of accredited programs in all UCNS subspecialties. They are shown in **bold** typeface below. Requirements in regular typeface are defined by each subspecialty.

I. Introduction

- A. Neuroimaging is the subspecialty of neurology dedicated to the study of the structure of the nervous system with techniques that provide anatomical renditions, both static and dynamic, of the nervous system and related structures.

Because diseases of the nervous system alter its structure and function, Neuroimaging contributes substantially to the diagnosis, monitoring, and treatment of neurological diseases. Neuroimaging techniques currently employed include, but are not limited to, computed tomography, nuclear magnetic resonance (MRI, MRS, MRA, fMRI), positron emission tomography, single photon emission computed tomography, and catheter angiography.

- B. The training program in Neuroimaging is expected to provide the fellow with expertise in the application of Neuroimaging techniques for the management of disorders of the nervous system. As a subspecialty of neurology, Neuroimaging focuses primarily on the integration of clinical information with information provided by Neuroimaging techniques. Neuroimaging includes the selection of the appropriate technology to image the relevant structure or function of the nervous system and the correlation of the imaging findings with the rest of the clinical data. For this reason, the Neuroimaging fellow should become well acquainted with the histories, physical examinations, and other clinical data of the patients studied.

Emphasis is placed on the correlation of the clinical data with information derived from the various methods used to image and evaluate the nervous system and related structures (*integrated Neuroimaging*) and on the updating of algorithms leading to a cost effective and efficient use of imaging modalities for the diagnosis and treatment of the different disorders of the nervous system.

II. Institutional Support

There are three types of institutions that may comprise a program: 1) the sponsoring institution, which assumes ultimate responsibility for the program and is required of all programs, 2) the primary institution, which is the primary clinical training site and may or may not be the sponsoring institution, and 3) the participating institution, which provides required experience that cannot be obtained at the primary or sponsoring institutions.

A. Sponsoring Institution

1. **The sponsoring institution must be accredited by the Accreditation Council for Graduate Medical Education (ACGME), and meet the current ACGME Institutional Requirements. This responsibility extends to fellow assignments at all participating institutions. The sponsoring institution must be appropriately organized for the conduct of graduate medical education (GME) in a scholarly environment and must be committed to excellence in both medical education and patient care.**
2. **A letter demonstrating the sponsoring institution's responsibility for the program must be submitted. Such a letter must:**
 - a. **confirm sponsorship of the training program,**

- b. state the sponsoring institution's commitment to training and education, and
- c. be signed by the designated institution official of the institution as defined by ACGME.

B. Primary Institution

1. Assignments at the primary institution must be of sufficient duration to ensure a quality educational experience and must provide sufficient opportunity for continuity of care. The primary institution must demonstrate the ability to promote the overall program goals and support educational and peer activities.
2. A letter from the appropriate department chair(s) at the primary institution must be submitted. Such a letter must:
 - a. confirm the relationship of the primary institution to the program,
 - b. state the primary institution's commitment to training and education, and
 - c. list specific activities that will be undertaken, supported, and supervised at the primary institution.

C. Participating Institutions

1. Assignments to participating institutions must be based on a clear educational rationale, must have clearly stated learning objectives and activities, and should provide resources not otherwise available to the program. When multiple participating institutions are used, there should be assurance of the continuity of the educational experience.
2. Assignments at participating institutions must be of sufficient duration to ensure a quality educational experience and should provide sufficient opportunity for continuity of care. All participating institutions must demonstrate the ability to promote the overall program goals and support educational and peer activities.
3. If a participating institution is used, a participating institution letter must be submitted. Such a letter must:
 - a. confirm the relationship of the participating institution to the program,
 - b. state the participating institution's commitment to training and education,
 - c. list specific activities that will be undertaken, supported, and supervised at the participating institution, and
 - d. be signed by the department chair of the participating institution.

III. Facilities and Resources

A. Each program must demonstrate that it possesses the facilities and resources necessary to support a quality educational experience.

1. Equipment that must be available to a Neuroimaging training program include:
 - a. magnetic resonance scanner, preferably with facilities to perform echoplanar imaging,
 - b. computed tomography (CT) scanner, and
 - c. in addition to these required imaging modalities, fellows must be exposed to, and receive appropriate instruction in, the use of CT perfusion, MR perfusion, and other emerging Neuroimaging technologies using these platforms.
2. Facilities must be available for physiological monitoring and for emergency ventilation and cardiac life support. There must be adequate facilities adjacent to, or within, examination rooms for storing supplies needed for the conduct of invasive Neuroimaging procedures, if they are carried out. In this case, there must be appropriately-trained nurses and technologists available to perform these invasive procedures.
3. Adequate space for image display and interpretation of studies must be available. There must be adequate office space and support space for Neuroimaging faculty, staff, and fellows.

4. The program must provide adequate office space, computers, supplies, and administrative support to facilitate the performance of research projects.
5. The program must provide access to core Neuroimaging journals.
6. A teaching file of at least 500 representative Neuroimaging cases, with case histories and images, covering a wide variety of disorders must be available to the fellow, either from the training institution itself or an electronic media.

IV. Faculty

The faculty of accredited programs consists of: 1) the program director, 2) core faculty, and 3) other faculty. Core faculty are physicians who oversee clinical training in the subspecialty. The program director is considered a core faculty member for the purpose of determining the fellow complement. Other faculty are physicians and other professionals determined by the Subspecialty to be necessary in order to deliver the program curriculum. The program director and faculty are responsible for the general administration of the program and for the establishment and maintenance of a stable educational environment. Adequate durations of appointments for the program director and core faculty members are essential for maintaining such an environment. The duration of appointment for the program director must provide for continuity of leadership.

A. Program Director Qualifications

1. **There must be a single program director responsible for the program. The person designated with this authority is accountable for the operation of the program and he or she should be a member of the faculty or medical staff of the primary institution.**
2. **The program director must:**
 - a. **possess requisite specialty expertise as well as documented educational and administrative abilities and experience in his or her field,**
 - b. **be certified in neurology, child neurology, neurosurgery, or radiology by ABMS or RCPSC. Certification in radiology also requires completion of a one-year fellowship in neuroradiology,**
 - c. **possess a current, valid, unrestricted, and unqualified license to practice medicine in the state or province of the program,**
 - d. **be certified, and maintain certification, in Neuroimaging by the UCNS ¹ and,**
 - e. **spend at least 80% of his or her clinical and academic time in Neuroimaging or a neurological-disease related field that focuses on Neuroimaging content.**

B. Program Director Responsibilities

1. **The program director must:**
 - a. **oversee and organize the activities of the educational program in all institutions participating in the program including selecting and supervising the faculty and other program personnel at each participating institution, and monitoring appropriate fellow supervision and evaluation at all participating institutions,**
 - b. **prepare an accurate statistical and narrative description of the program as requested by the UCNS as well as update the program and fellow records annually,**
 - c. **ensure the implementation of fair policies and procedures, as established by the sponsoring institution, to address fellow grievances and due process in compliance with the institutional requirements,**

¹ This requirement will not be imposed until after the expiration of the subspecialty's practice track.

- d. **monitor fellow stress, including mental or emotional conditions inhibiting performance or learning, and drug- or alcohol-related dysfunction, and**
- e. **obtain prior approval of the UCNS for changes in the program that may significantly alter the educational experience of the fellows. Upon review of a proposal for a program change, the UCNS may determine that additional oversight or a site visit is necessary. Examples of changes that must be reported include:**
 - 1) **change in the program director,**
 - 2) **the addition or deletion of sponsoring, primary, or participating institution(s),**
 - 3) **change in the number of approved fellows, and**
 - 4) **change in the format of the educational program**

C. Core Faculty Qualifications

- 1. **Each core faculty member must:**
 - a. **possess requisite specialty expertise as well as documented educational and administrative abilities and experience in his or her field,**
 - b. **be currently certified in neurology, neurosurgery, child neurology, or radiology by ABMS or RCPSC. Certification in radiology also requires completion of a one-year fellowship in neuroradiology,**
 - c. **possess a current, valid, unrestricted, and unqualified license to practice medicine in the state or province of the program, and**
 - d. **be appointed in good standing to the faculty of an institution participating in the program.**
- 2. **The core faculty must include at least one neurologist. The neurologist may also be the program director.**

D. Core Faculty Responsibilities

- 1. **There must be a sufficient number of core faculty members with documented qualifications at each institution participating in the program to instruct and adequately supervise all fellows in the program.**
- 2. **Core Faculty members must:**
 - a. **devote sufficient time to the educational program to fulfill their supervisory and teaching responsibilities,**
 - b. **evaluate the fellows whom they supervise in a timely manner, and**
 - c. **demonstrate a strong interest in the education of fellows, demonstrate competence in both clinical care and teaching abilities, support the goals and objectives of the educational program, and demonstrate commitment to their own continuing medical education by participating in scholarly activities.**

E. Other Faculty and Personnel

- 1. **The program must also include:**
 - a. **Neuroimaging technologists with appropriate training that is ensured by the program director and**
 - b. **appropriate administrative support.**

V. Fellow Appointment

A. Duration of Training

Training in Neuroimaging shall encompass at least 12 months. The training must be distinct from training required for certification in neurology, neurosurgery, or child neurology.

B. Eligibility Criteria

- 1. The fellow must possess a current valid and unrestricted license to practice medicine in the United States or Canada or its territories.**
- 2. The fellow must be a graduate of a residency program in neurology or child neurology accredited by the ACGME or the Royal College of Physicians and Surgeons of Canada (RCPSC).**
- 3. The fellow must be board certified or eligible for certification in neurology or child neurology by ABMS or RCPSC.**

C. Minimum Number of Fellows and Fellow Complement

- 1. The minimum number of fellows to be trained is one.**
- 2. The fellow complement is the number of fellows allowed to be enrolled in the program. There must be at least 1 core faculty member for every 1 fellow.**

VI. Educational Program

A. Role of the Program Director and Faculty

- 1. The program director, with assistance of the faculty, is responsible for developing and implementing the academic and clinical program of fellow education by:**
 - a. preparing a written statement to be distributed to fellows and faculty and reviewed with fellows prior to assignment, which outlines the educational goals and objectives of the program with respect to the knowledge, skills, and other attributes to be demonstrated by fellows for the entire fellowship and on each major assignment and each level of the program,**
 - b. preparing and implementing a comprehensive, well-organized, and effective curriculum, both academic and clinical, which includes the presentation of core specialty knowledge supplemented by the addition of current information,**
 - c. providing fellows with direct experience in progressive responsibility for patient management,**
 - d. monitoring the content and ensuring the quality of the program,**
 - e. using the *Neuroimaging Core Curriculum* to define core competencies with regard to the medical knowledge, patient care skills, interpersonal and communication skills, practice- and systems-based competencies, and standards of professionalism that are to be developed during the period of fellowship training in Neuroimaging, and**
 - f. providing appropriate clinical opportunities and experience as outlined in the program requirements.**

B. Competencies

- 1. A fellowship program must require that its fellows obtain competence in the AGCME Competencies to the level expected of a new practitioner in the subspecialty. Programs must define the specific and unique learning objectives in the area including the knowledge, skills, behaviors, and attitudes required and provide educational experiences as needed in order for their fellows to demonstrate the following:**
 - a. *patient care* that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health,**
 - b. *medical knowledge* about established and evolving biomedical, clinical, and basic sciences, as well as the application of this knowledge to patient care,**
 - c. *practice-based learning and improvement* that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care,**

- d. ***interpersonal and communication skills* that result in effective information exchange and collaboration with patients, their families, and other health professionals,**
 - e. ***professionalism*, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population, and**
 - f. ***systems-based practice*, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.**
2. The purpose of the training program is to prepare the physician for the independent practice of Neuroimaging. This training must be based on supervised Neuroimaging work with increasing responsibility for the selection, performance, and interpretation of Neuroimaging procedures. It must have a foundation of organized instruction in basic neuroscience, particularly as it relates to neuroanatomy, cerebral hemodynamics, and neurochemistry. It must also include instruction in physics, applied to the Neuroimaging procedures used in the program.

C. Didactic Components

1. Neuroimaging programs must include instruction in basic neuroscience, particularly as it relates to neuroanatomy, neuropathology, cerebral hemodynamics, and neurochemistry. It must also include instruction in physics, applied to the Neuroimaging procedures used in the program. Instruction may preferentially emphasize either adult or pediatric Neuroimaging. The content of the didactic component of training is outlined in the *Neuroimaging Core Content*.

D. Clinical Components

1. **Approximately 80% of the fellow's time must be spent in supervised activities related to the care of patients with conditions requiring Neuroimaging procedures. Clinical experiences may include all training relevant to Neuroimaging, including lectures and individual didactic experiences and journal clubs emphasizing clinical matters. Programs with flexible fellowship terms must assure that equivalent time is spent in clinical training.**
2. Each fellow must interpret a minimum of 400-500 MRI and 300-400 CT cases and provide written reports on a minimum of 100 MRI and 100 CT cases. The training must include significant didactic and clinical experience reflecting appropriate representation of the current status and trends in imaging modalities as well as a breadth and balance of care for patients with neurologic conditions. Programs that do not provide experiential training in some modalities (e.g., ultrasound, catheter angiography) must present concepts in didactic form to ensure the fellows acquire working familiarity with the entire field.

E. Scholarly Activities

1. **The responsibility for establishing and maintaining an environment of inquiry and scholarship rests with the faculty. Both faculty and fellows must participate actively in some form of scholarly activity. Scholarship is defined as activities unrelated to the specific care of patients, which includes scholarship pertaining to research, writing review papers, giving research-based lectures and participating in research-oriented journal clubs.**
2. **There must be adequate resources for scholarly activities for faculty and fellows.**
3. Fellows must regularly read the best Neuroimaging journals and Neuroimaging papers that appear in other biomedical journals of a high-impact factor.

4. Fellows must report on clinical series or cases that contribute original ideas or perspectives to the field of Neuroimaging.

F. Duty Hours, Working Environment, and On-Call Activities

Providing fellows with a sound academic and clinical education must be carefully planned and balanced with concerns for patient safety and fellow well-being. Each program must ensure that the learning objectives of the program are not compromised by excessive reliance on fellows to fulfill service obligations. Didactic and clinical education defined by the program requirements must have priority in the allotment of a fellow's time and energy.

1. Supervision of Fellows

- a. **All patient care required by the program requirements must be supervised by qualified faculty. The program director must ensure, direct, and document adequate supervision of fellows at all times. Fellows must be provided with rapid, reliable systems for communicating with supervising faculty.**
 - b. **Faculty schedules must be structured to provide fellows with continuous supervision and consultation.**
 - c. **Faculty and fellows must be educated to recognize the signs of fatigue and adopt and apply policies to prevent and counteract the potential negative effects.**
2. **Duty hours assignments must recognize that the faculty and fellows collectively have responsibility for the safety and welfare of patients. Fellow duty hours and work environment must comply with the current ACGME program requirements.**
 3. **The objective of on-call activities is to provide fellows with continuity of patient care experiences throughout a 24-hour period. *In-house call* is defined as those duty hours beyond the normal work day when fellows are required to be immediately available in the assigned institution. Fellow on-call activities must be consistent with the current ACGME program requirements.**

VII. Evaluation

A. Fellow Evaluation

1. **Fellow evaluation by faculty must:**
 - a. **take place at least semi-annually and areas of weakness and strength must be communicated to the fellow,**
 - b. **records must be maintained documenting fellow experience and performance, and**
 - c. **include the fellow's demonstration of learning objectives and mastery of the core competencies (see VI.B).**
2. **The summary and final evaluation of the fellow must be prepared by the program director and should reflect the input of faculty.**
3. **Regular evaluation of the fellow's knowledge, skills, and overall performance, including the development of professional attitudes and ethical behavior consistent with being a capable neuroimager must occur.**
4. **Programs must have a set of measures in place for their evaluations.**
 - a. **Fellow performance must be monitored and feedback provided on an ongoing basis.**
 - b. **The program director or program director's designee must meet with each fellow quarterly in a formal feedback session to discuss the fellow's standing in relation to specific learning and performance objectives. Plans to correct any deficiencies must be discussed. Each fellow must be an active participant in formulating plans for his or her development. Evaluation data must be in writing and be used to**

- advise the fellow and to make decisions regarding the progression in the fellow's level of responsibility.
- c. Quarterly evaluations must be prepared and filed in the fellow's permanent record. The written record of the evaluation and the review must be signed by the fellow. The fellow must have the opportunity to append a written response to the written record of the evaluation and review.
5. The training program must demonstrate that it has an effective plan for assessing fellow performance throughout the program and for utilizing assessment results to improve fellow performance. This plan must include:
 - a. use of dependable measures to assess the fellow's competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice,
 - b. mechanisms for providing regular and timely performance feedback to fellows,
 - c. a process involving use of assessment results to achieve progressive improvements in fellows' competence and performance.
 6. The final written evaluation for each fellow completing the program must be prepared by the program director and include detailed a review of the fellow's performance in relation to the program's learning and performance objectives during the final period of training and must verify that the fellow has demonstrated sufficient professional ability to practice Neuroimaging competently and independently. The evaluation must be discussed with the fellow.

B. Faculty Evaluation

- 1. The performance of faculty must be evaluated by the program director on a quarterly basis.**
- 2. The evaluations must include a review of their teaching abilities, commitment to the educational program, clinical knowledge, and scholarly activities.**
- 3. These evaluations must include annual written evaluations by fellows.**
4. Training sites must have a quality assurance program regarding Neuroimaging interpretations.

C. Program Evaluation

- 1. The effectiveness of a program must be evaluated in a systematic manner. In particular, the quality of the curriculum and the extent to which the educational goals have been met must be assessed.**
- 2. Confidential written evaluations by fellows must be utilized in this process.**
- 3. Performance by fellows on the UCNS certification exam may also be used to measure the quality of the training program.**
4. The training program must use fellow performance and outcome assessment results in their evaluation of the educational effectiveness of the training program.
5. The training program must have in place a process for using fellow performance assessment results together with other program evaluation results to improve the program.
6. Evaluations of fellows' attainment of the program's learning and performance objectives must be used as the basis for program evaluation. Fellow's performance data must be compared with the program's own criteria, performance criteria set by the UCNS Accreditation Council, and attainment of fellows at other Neuroimaging training programs.
7. Evaluation must occur at least annually.