

# Curriculum: Interventional Neurology/Endovascular Surgical Neurology

## A. Program Demographics

1. **Name of Host Institution:** OBH-Brookdale University Hospital, Brooklyn, NY
2. **Name of the Affiliated Institution:** SUNY Downstate Health Sciences University, Brooklyn, NY
3. **Optional Rotating Site:** Maimonides Medical Center (MMC), Brooklyn, NY

## B. Introduction

1. **History:** The Interventional Neurology (IN)/Endovascular Surgical Neurology (ESN) fellowship program will be initiated at Brookdale University Hospital, Brooklyn, NY in July, 1 2024. We have recruited 2 fellows for the IN-fellowship program.

2. **Duration:** The program shall offer 2-3 years of continuous graduate medical education.

The first preparatory year is dedicated towards development of basic cognitive, clinical and radiographic skills essentials for diagnostic interpretation and clinical decision making. In addition to the pre and intra-procedure medical management of patients with different cerebrovascular diseases requiring intervention, 1<sup>st</sup> year will be dedicated to gain clinical skills in post-operative management of patients in the critical care unit who underwent interventional procedure.

The second advanced year of training is dedicated to Interventional Surgical Neurology interventional procedures when applied in an appropriate cerebrovascular clinical setting using catheter-based technology.

3. **Prerequisite training/Selection Criteria:** To be considered for the Interventional Neurology fellowship program, applicants must have completed a Neurology Residency followed by Vascular Neurology/Neurocritical Care Fellowship OR a Neurosurgery Residency OR a Radiology Residency followed by Diagnostic Neuroradiology Fellowship.

### 4. **Goals and objectives for training:**

#### Goals

- The fellow is able to practice independently in the field of Interventional Neurology/Neuroendovascular Surgery upon graduation.
- The fellow is skilled in the techniques of catheter technology and interpretation of cerebrovascular radiology with excellent diagnostic, clinical and imaging capability.
- The fellow is knowledgeable in the treatment of both hemorrhagic and ischemic strokes.
- The fellow is able to provide excellent pre-procedural, intra-procedural and post-procedural care to the patient including cerebrovascular aspects of critical care management.
- The fellow would demonstrate the competency and understanding of complex pathophysiology of cerebrovascular anatomy and its correlation and application in the clinical setting for the best patient care.
- Training in Interventional Neurology/endovascular surgical neuroradiology would be conducted in an environment conducive to investigative studies of a clinical or basic science nature.

#### Objectives

In this subspecialty, the objective of training is to give residents an organized, comprehensive, supervised, full-time educational experience in diagnostic techniques and imaging of

cerebrovascular diseases and Interventional Neurology. This experience includes the management of patients with neurological disease, the performance of Interventional Neurology/endovascular surgical neuroradiology procedures, and the integration of endovascular surgical neuroradiology therapy into the clinical management of patients.

**The program includes training and experience in the following:**

- Signs and symptoms of disorders amenable to diagnosis and treatment by endovascular surgical neuroradiology techniques.
- The correlation of basic cerebrovascular anatomy and physiology to imaging and diagnosis of vascular disorders of the head and neck circulation and the central nervous system.
- Neurological examinations to evaluate patients with neurological disorders.
- Pathophysiology and natural history of these disorders.
- Indications and contraindications to endovascular surgical neuroradiology procedures.
- Technical skills necessary to perform safe cerebrovascular arteriography including pre-operative, intra-operative and post-operative management skills.
- Technical skills in performing endovascular procedures for treatment cerebrovascular disease.
- Knowledge and understanding of medical and surgical alternatives.
- Pre-operative, intra-operative and post-operative management of endovascular patients
- Neurocritical care management as it applies to the cerebrovascular and endovascular disease processes.
- Fundamentals of imaging physics and radiation biology.
- Interpretation of radiographic studies pertinent to the practice.

**GLOBAL LEARNING OBJECTIVES LINKED TO ACGME CORE COMPETENCIES**

ACGME CORE COMPETENCIES	GLOBAL LEARNING OBJECTIVES
<p><u>A. Patient Care</u> Endovascular/Interventional Neurology fellows are expected to provide patient care that is compassionate, appropriate, and effective for the promotion of health, prevention of illness, treatment of disease, and care at the end of life.</p>	<p>1) IN fellow must be able to gather accurate, essential information from all sources, including medical interviews, physical examinations, medical records, and diagnostic/therapeutic procedures. 2) IN fellow must be able to make informed recommendations about preventative, diagnostic, and therapeutic options and interventions that are based upon sound clinical judgement, scientific evidence, and patient preference. 3) IN fellow must develop, negotiate, and implement effective patient management plans and integrate patient care. 4) IN fellow must be able to perform the diagnostic and therapeutic procedures considered essential to the practice of subspecialty with competency.</p>
<p><u>B. Medical Knowledge</u> Endovascular/Interventional Neurology fellows are expected to demonstrate knowledge of established and evolving biomedical and clinical sciences, and the application of their knowledge to patient care and the education of others.</p>	<p>1) IN fellow must apply an open-minded, analytical approach to acquisition of new knowledge. 2) IN fellow must access and critically evaluate current medical information and scientific evidence, including evidence-based practice guidelines pertaining to the Subspecialty. 3) IN fellow must be able to develop a clinically applicable knowledge of the basic and clinical sciences that underlie the practice of Subspecialty. 4) IN fellow must be able to apply this knowledge to clinical problem solving, clinical decision-making, and critical thinking.</p>
<p><u>C. Practice-Based Learning and Improvement</u> Endovascular/Interventional Neurology fellows are expected to be able to use scientific evidence and methods to investigate, evaluate, and improve patient care practices.</p>	<p>1) Fellows must be able to identify areas for improvement and implement strategies to enhance knowledge, skills, attitudes, and processes of care. 2) IN fellow must be able to analyze and evaluate practice experiences and implement strategies to continually improve the quality of patient practice. 3) IN fellow must be able to develop and maintain a willingness to learn from experience to improve the system or processes of care. 4) IN fellow must be able to use information technology or other available methodologies to access and manage information, support patient</p>

	<p>care decisions, and enhance both patient and physician education.</p> <p>5) IN fellow must be able to gain information and experience from ongoing educational conferences, e.g., multidisciplinary patient conferences and journal clubs.</p>
<p><u>D. Interpersonal and Communication Skills</u> Endovascular/Interventional Neurology fellows are expected to demonstrate interpersonal and communication skills that enable them to establish and maintain professional relationships with patients, families, and other members of the health care team</p>	<p>1) IN fellow must be able to provide effective and professional consultation to other physicians and health care professionals, and sustain therapeutic and ethically sound professional relationships with patients, their families, and colleagues.</p> <p>2) IN fellow must be able to use effective listening, nonverbal, questioning, and narrative skills to communicate with patients and families.</p> <p>3) IN fellow must be able to interact with consultants in a respectful, appropriate manner.</p> <p>4) IN fellow must be able to maintain comprehensive, timely, and legible medical records.</p>
<p><u>E. Professionalism</u> Endovascular/Interventional Neurology fellows are expected to demonstrate behaviors that reflect a commitment to continuous professional development, ethical practice methods, an understanding and sensitivity to diversity, and a responsible attitude toward their patients, their profession, and society.</p>	<p>1) IN fellow must be able to demonstrate respect, compassion, integrity, and altruism in relationships with patients, families, and colleagues.</p> <p>2) IN fellow must be able to demonstrate sensitivity and responsiveness to the gender, age, culture, religion, sexual preference, socioeconomic status, beliefs, behaviors and disabilities of patients and professional colleagues.</p> <p>3) IN fellow must be able to adhere to principles of confidentiality, scientific/academic integrity, and informed consent.</p> <p>4) IN fellow must be able to recognize and identify deficiencies in peer performance.</p>
<p><u>F. Systems-Based Practice</u> Endovascular/Interventional Neurology fellows are expected to demonstrate both an understanding of the contexts and systems in which subspecialty care is provided, and the ability to apply this knowledge to improve and optimize patient care.</p>	<p>1) IN fellow must be able to understand, access, and utilize the resources, providers, and Systems necessary to provide optimal care.</p> <p>2) IN fellow must be able to understand the limitations and opportunities inherent in various practice types and delivery systems, and develop strategies to optimize care for the individual patient.</p> <p>3) IN fellow must be able to apply evidence-based, cost-conscious strategies to prevention, diagnosis, and disease management.</p> <p>4) IN fellow must be able to collaborate with other members of the health care team to assist patients in dealing effectively with complex systems and to improve systemic processes of care.</p>

**5. Program certifications: N/A**

**C. Affiliation and Resource sharing**

1. IN Fellowship at Brookdale University Hospital, Brooklyn, NY is affiliated with SUNY Downstate Health Sciences University, Brooklyn, NY. Therefore, this IN teaching program provides direct valuable resources to the residents, fellows and other faculties at OBH-Brookdale and Downstate

Health Sciences University. This teaching program also provides an opportunity for Brookdale University Hospital, Brooklyn, NY, students, residents and fellows to participate in clinical outcome research in cerebrovascular diseases. Each year, IN fellowship teaching program will help students, residents and fellows at Downstate Medical University to present their clinical research work in the National and the International meetings. The IN-fellowship faculties also do block rotation as an attending to the Cerebrovascular and Neuro-Interventional Surgery teaching services at Brookdale University Hospital.

## **2. Teaching staff:**

### **Program Director**

The program director is Yahia M Lodi, MD., FAHA., FANA., FAAN is the Chief of the Neuroendovascular and Stroke services, Vice chair Department of Neurology at OBH-Brookdale University Hospital. Additionally, Dr. Lodi is a (tenured) full professor in the department of Neurology at Downstate Medical University, College of Medicine. In addition to the responsibilities as program director, Dr. Lodi spends 60% of his clinical time in educating and mentoring IN fellows for the development of cognitive, clinical and technical skills.

### **Other Interventional Neurology/Neuroendovascular Surgical Neurology teaching faculties:**

Besides the program director, the program faculty includes experienced faculty members; Tony Wang, MD, Ph.D is a CAST certified in Neuroendovascular Surgery who holds an appointment in Neurology and board certified in Neurology, Vascular Neurology & Neuroimaging expertise in endovascular surgical neuroradiology techniques who dedicates more than 25% of his time in the field of Neurointerventional Surgery for patient's management. The second teaching faculty is Daniel Zumofen, MD is a Neurosurgeon with subspecialty training in Vascular and Interventional Neurosurgery. The faculty provides didactic teaching and direct supervision of fellow's performance in clinical patient management and in the procedural, interpretive, and consultative aspects of endovascular surgical neuroradiology therapy. The faculty also stimulates scholarly activities and directs fellows in the conduct of such activities.

**Associated Program Director:** Tony Wang, MD, Ph.D is a CAST certified in Neuroendovascular Surgery who holds an appointment in Neurology and board certified in Neurology, Vascular Neurology & Neuroimaging expertise in Interventional Neurology techniques who dedicates 25% of his time in the field of Neurointerventional Surgery for patient's management. He is an Associated Professor and Vice-chair in the department of Neurology at Downstate Health Sciences University and Chief of Interventional Neurology

**Associated Program Director:** Daniel Zumofen, MD is a Neurosurgeon with subspecialty training in Vascular and Interventional Neurosurgery. He is Assistant Professor of Neurology at Downstate Health Sciences University, Brooklyn, NY and Chief of vascular Neurosurgeon at Maimonides Medical Center.

**Vascular Neurology Faculty:** David Rosenbaum, MD., Chair Department of Neurology and distinguished Professor at Downstate Health Sciences University (DHSU). He is also the chairman of Neurology at Downstate Health Science Hospital and Maimonides Medical Center (MMC), Brooklyn. Dr. Rosenbaum is the backbone of the entire academic programs of ACGME Neurology residency program at Brookdale, MMC and DHSU.

**Neurocritical Care Faculty:** David Learner, MD is the director of Neurocritical Care Program at OBH-Brookdale University Hospital. He is Vice-Chair of Neurology department and Co-director of Neurology Residency Program at Brookdale University Hospital.

## **Pulmonary Critical Care Faculty:**

### **Neurosurgery Non-core faculty:**

Dr. Ernest Barthelemy, MD, MPH, MA, FCNS, is the Chief of Neurosurgery and Assistant Professor of Neurology, Orthopedic Surgery and Public Health. Dr. Barthelemy is a board-certified full-time neurosurgeon at OBH-Brookdale University Hospital who provides vital role in the management of patients of acute care neurosurgery and cerebrovascular diseases. Dr. Barthelemy will be crucial part of the fellows training as non-core faculty who will acts a bridge between Interventional Neurology and Neurosurgery.

Dr. William Wirchansky, MD, is the Chief of Neurosurgery at OBH-Brookdale University Hospital. Dr. Wirchansky is a highly experiences board certified neurosurgeon in the management of complex neurosurgical diseases including cerebrovascular diseases and brain tumor. He will provide didactic teaching to the IN fellows regarding surgical options and approaches and how to integrate care of patients with cerebrovascular diseases.

### **Vascular Surgery non-core faculty:**

Paul Haser MD is a board-certified vascular surgeon and Chief of Vascular Surgery at OBH-Brookdale University Hospital play significant role in training IN fellows at Brookdale. He will help fellows for safer approaches to the femoral artery and radial artery access. Fellows will have an opportunity to participate in carotid artery endarterectomy (CEA)for better prospective of understanding the differences between CEA and carotid artery stenting (CAS) procedures.

## **3. Facilities:**

**OBH-Brookdale University Hospital, Brooklyn, NY** is the host facility for the IN-fellowship program. Maimonides Medical Center, Brooklyn, NY-as an optional rotating facility for the IN-fellowship program.

## **D. Educational program - Basic Curriculum**

**1. Clinical and research components:** A period of clinical endovascular surgical neuroradiology training, during which the fellow has the opportunity to carry out all of the following procedures under close supervision: perform clinical pre-procedure evaluations of patients; interpret preliminary diagnostic studies; consult with clinicians on other services; perform diagnostic and therapeutic endovascular surgical neuroradiology procedures; generate procedural reports; and participate in short-term and long-term post procedure follow-up care, including neurointensive care. The continuity of care must be of sufficient duration to ensure that the fellow is familiar with the outcome of all endovascular surgical neuroradiology procedures.

Fellows should serve as consultants under the supervision of staff endovascular surgical neuroradiology practitioners. Direct interactions of fellow with patients must be closely observed to ensure that appropriate standards of care and concern for patient welfare are strictly maintained. Communication, consultation, and coordination of care with the referring clinical staff and clinical services must be maintained and documented with appropriate notes in the medical record.

The program must provide adequate opportunity for fellows to participate in and personally perform and analyze a broad spectrum of endovascular procedures in adults, children, and neonates. Specific training should be provided in the following areas:

Anatomical and physiologic basic knowledge would include:

- Basic knowledge in arterial angiographic anatomy of the brain, spine, spinal cord, and head and neck
- Venous angiographic anatomy of the brain, spine, spinal cord, and head and neck
- Collateral circulation
- Dangerous anastomosis
- Cerebral blood flow

- Autoregulation
- Pharmacology of CNS vasculature
- Technical aspects of endovascular surgical neuroradiology, including:
  - Catheter and delivery systems
  - Embolic agents in cerebral, spinal, and head and neck embolization
  - Flow - controlled embolization
  - Complication of cerebral embolization
  - Flow control between the extracranial and intracranial circulation
  - Electrophysiology
  - Provocative testing (pretherapeutic evaluation)
  - Complications of brain, spine, spinal cord, and head and neck embolization
  - Imaging of vascular system
  - Pharmacological familiarity with:
    - Contrast materials
    - Provocative testing with anesthetics and sedatives
    - Anticoagulants
    - Thrombolytics
- Knowledge and understanding of the coagulation cascade
- The following aspects of brain arteriovenous malformation, spinal cord, arteriovenous fistulas of the brain, spine, spinal cord, head and neck vascular malformations, ischemic stroke, and cerebral aneurysms
  1. Classification
  2. Clinical presentation
  3. Natural history
  4. Epidemiology
  5. Hemodynamic basis
  6. Indications for treatment
  7. Contraindication for treatment
  8. Therapeutic modalities
  9. Combined therapies
  10. Tumors of the head, neck, spine, and central nervous system
  11. Skills for revascularization for occlusive vascular diseases
  12. Arteriopathies
  13. Atherosclerotic lesions
  14. Techniques of revascularization: balloon angioplasty, thrombolytics, and stenting
  15. Embolization for epistaxis or other causes of hemorrhage both traumatic and nontraumatic.
  16. Invasive functional testing
  17. Balloon test occlusions

The program has an investigational component such that the fellows may become familiar with the design, implementation, and interpretation of clinical research studies. Facilities would be made available for research activity.

## **2. Participant's supervisory and patient care responsibilities:**

- For the first year performance of Diagnostic angiograms and diagnostic portion of the interventional cases. For the second year performance of interventional procedures and interpretation of technique and its clinical application.
- Interpretation of diagnostic films and case discussion with the attendings before and after the procedure.
- Participation in the call schedule.
- Daily patient rounds with the faculty for patient care and follow up in the hospital.

- A once weekly resident outpatient clinic supervised by the attending faculty.
- Management aspects including critically ill patients in the field of ESN in pre-operative, intra-operative and post-operative setting.

### **3. Cognitive, clinical and Procedural requirements:**

*In the first year of training:*

Cognitive clinical knowledge in different cerebrovascular diseases and Neurocritical Care

Cognitive clinical knowledge in evaluation of patients who require endovascular procedure with different cerebrovascular diseases in the Emergency Room and Neurocritical Care Unit setting

Appropriate selection of patients, pre, intra and post-operative medical management of patients who are undergoing for endovascular procedure

Development of knowledge and skills in communication with patients and their relatives with respect, care and empathy

#### Diagnostic Procedures:

- Diagnostic catheterization and performance of at least 100 successful cases of supra-aortic catheterization under direct supervision would be required.
- Successful super-selective catheterization of higher order vessels would also be needed for a minimum of 100 cases.
- A detailed case log will be maintained by the fellows in a prospectively collected data base, closely supervised by the faculty, including all complications and technical failures.

*In the second year of training:*

#### Revascularization procedures:

- The fellow would have completed revascularization of at least **50** procedures including but not limited to the thrombolysis for ischemic and embolic stroke, extracranial stenting of anterior and posterior circulation, intracranial stenting of anterior and posterior circulation.

#### Embolization Procedures:

- The fellow would have completed embolization of a minimum of at least **50** procedures including but not limited to the coiling for the aneurysms, embolization for the arteriovenous malformations, balloon test occlusions, embolization for the epistaxis, tumor and trauma related bleeding.

**Minimum Number of procedure required to complete the fellowship under direct supervision is based on the criteria set forth by ACGME;** number cases required based on ACGME and UCNS-Interventional Neurology Fellowship requirements.

1. Diagnostic cerebral angiogram: 100
2. Acute stroke thrombectomy- 50
3. Carotid artery stenting -20
4. Embolization of brain aneurysm, arteriovenous malformation and tumor -50
5. Catheter based delivery of thrombolytic and spasmolytic – 20



If fellow does not acquire the safety and technical skills during his or her two years prior of training with above required numbers of procedure, the additional number of cases and length of time required will be determined by the fellowship training committee with the involvement of institutional graduate medical education committee GMEC.

#### **4. Didactic components:**

**Conferences** - The fellow is required to attend 60% of the conferences.

- Weekly Endovascular/Cerebrovascular Surgery conference (mandatory attendance) – Elective cases for the following week and unplanned, emergency procedures from the past week would be discussed at the conference. Typically, the fellow takes the lead in presenting the case, and the case would be discussed by neuro- endovascular, neurology, neurosurgery and neuroradiology faculty.
- Weekly Neurology/ Neurosurgery/ Neuroradiology Grand Rounds – Neuro- endovascular topics would be covered about 6-8 times in a year.
- Weekly academic session (mandatory)– alternate between:
  - Journal Club
  - Neuro-endovascular mortality and morbidity
  - Neuro-endovascular Basic Science Lecture
  - Neuro-endovascular Clinical Lecture
- Weekly Research meeting between vascular neurology, cerebrovascular surgery, and neuro-endovascular faculty (fellows are encouraged to participate)
- Interdepartmental conferences (fellows are encouraged to participate):
- Vascular Surgery – monthly
- Vascular neurology – weekly
- Neuropathology – weekly

#### **Didactic lectures**

- Neurovascular Anatomy I – Dr. Lodi/Wang
- Neurovascular Anatomy II – Dr. Lodi/Wang/Dr. Zumofen
- Cerebrovascular Physiology I – Dr. Learner/Levin/Dr. Rosenbaum
- Cerebrovascular Physiology II – Learner/Levin/Rosenbaum
- Cerebrovascular pathology I – Dr. Rosenbaum/Learner
- Cerebrovascular pathology II – Dr. Rosenbaum/Learner
- Molecular basis of cerebrovascular ischemia and cerebral edema – Dr. Lodi
- Hemostasis and Coagulation cascade – Dr. Lodi
- Cerebrovascular pharmacology – Dr. Lodi
- Physics of radiological imaging, CT and ultrasound – Dr. Wang
- MRI physics – Dr. Wang
- Intensive Care Management I: Dr. Learner/Dr. Lodi
- Intensive Care Management II: Dr. Learner/Dr. Lodi
- Angiographic imaging techniques, risks and safety- Dr. Lodi/Wang
- Neuro-interventional techniques, devices and materials – Lodi/Wang/Zumofen
- General principles of embolization – Dr. Lodi/ Wang/Zumofen
- Intracranial aneurysms and embolization– Dr. Lodi/ Wang/Zumofen
- Tumor Embolization – Dr. Lodi
- Embolization of Arterio – venous malformations and fistulas – Dr. Lodi/ Wang/Zumofen
- Occlusive cerebrovascular diseases and general principles of angioplasty and stenting – Dr. Lodi/Ranawat/Multani
- Extracranial angioplasty and stenting – Dr. Lodi

- Intracranial angioplasty and stenting – Dr. Lodi
- Endovascular management of acute ischemic stroke – Dr. Lodi/ Wang/Zumofen
- Complications of angiography and principles of endovascular rescue and device retrieval –Dr. Lodi/ Wang/Zumofen

**Suggested Reading**

- Atlas of Functional Neuroanatomy - Hendelman Walter J.
  - Critical Care Neurology and Neurosurgery - Jose I. Suarez (Editor)/Anish Badwaj
  - Diagnostic Neuroradiology - Anne G. Osborn, Julian Maack (Illustrator)
  - Interventional Neuroradiology: Strategies and Practical Techniques - J. J. Connors, Joan C. Wojak
  - Introduction to Cerebral Angiography - Anne G. Osborn, John M. Jacobs
  - Interventional and Endovascular Therapy of the Nervous System - Pearse Morris
  - Practical Neuroangiography - Pearse Morris, Ann Morris
  - Surgical Neuroangiography: Endovascular Treatment of the Spine and Spinal Cord Lesions - P. Lasjaunias, et al
  - Surgical Neuroangiography: Clinical Vascular Anatomy and Variations - Pierre L. Lasjaunias, et al

**5. If the program is longer than twelve months in duration, please describe the progression in responsibilities by PGY level.**

**BLOCK ROTATIONS for Year 1 and Year 2**

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
Interventional (IN) Procedures / NeuroICU/ Vascular	Interventional (IN) Procedures / NeuroICU/ Vascular	Interventional (IN) Procedures / NeuroICU/ Vascular	Interventional (IN) Procedures / NeuroICU/ Vascular	Interventional (IN) Procedures / Neuro ICU Vascular	Interventional (IN) Procedures / Neuro ICU/ Vascular	Interventional (IN) Procedures / Neuro ICU/ Vascular Neurology	Interventional (IN) Procedures / Neuro ICU Vascular	Interventional (IN) Procedures / Neuro ICU/ Vascular	Research/Elective	Interventional (IN) Procedures / Neuro ICU/ Vascular	Interventional (IN) Procedures / Neuro ICU/ Vascular

The Block rotations for Research/Electives give fellows the opportunity to select various interesting projects and rotations each year.

The ESN/Neuro intensive care unit (NICU)/Vascular Neurology block is designed to give maximum clinical and procedural exposure. Performance of Diagnostic angiograms and diagnostic portion of the interventional cases would be done in the first year. Performance of interventional procedures and interpretation of technique and its clinical application would be done in the second year.

**6. Evaluation of fellows**

Fellows will be evaluated monthly after the conclusion of each rotation by the service faculty, assessing the trainee's fund of knowledge, clinical competence, technical skills, professionalism and interpersonal skills. A quarterly meeting

with the program director to discuss the summary of evaluations received and to communicate areas of strength and weaknesses to the trainee. Biannually, a 360 evaluation of fellow by patients and family members chosen in random, by nursing and hospital staff, by students and residents, and by faculty staff will be done. Each fellow will maintain a portfolio containing an updated curriculum vitae, procedure logs, copies of presentations and teaching activities as well as list of conferences and CME activities attended.

A quarterly meeting with the program director will be scheduled per trainee to discuss the summary of monthly evaluations received thus far and to identify strengths and weaknesses. Deficiencies in specific areas will be addressed through individual meeting with trainee and discussion of options for improvement including extra rotation in deficient areas, involvement in projects and didactic sessions in the area of interest, remedial sessions and supervised learning activities as necessary. The trainee will be given three months or a full quarter to meet the required competency. Failure to meet the necessary competency after three months will result in a probationary status of three months or a full quarter. The trainee will be informed of the probationary status. During this time, other options for improvement will be explored with the cooperation of the trainee. Failure to meet the necessary competency after the end of the probationary status may result in early termination of the training status.

## **7. Faculty evaluation**

The Program Director will evaluate the faculty based on the written and personal feedback obtained from the fellows, rotating IN/neurocritical care residents and the IN/neurocriticalcare NPs. Program director will meet with each attending every 6 months. However, the evaluation will be more frequent and immediate if any concern about a specific faculty that was brought to the attention of PD at any point of the academic year by a fellow. The written evaluation of a faculty by a fellow will take precedence during evaluation of a faculty by Program Director.

## **8. Program evaluation**

The program will be evaluated through documentation of the following:

- a. Yearly tally of applicants and accepted applicants.
- b. Cumulative total number of trainees who completed the program.
- c. Written evaluations by the graduating fellows.
- d. Documentation of trainee employment post fellowship, achievements and honors received
- e. Documentation of scholarly work by fellows during training program.

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