

## **Clinical Neurophysiology Training Program Massachusetts General Hospital Curriculum**

### **Overall Educational Goals**

The intent of this fellowship program is to provide a strong foundation in the technical, interpretive clinical aspects of electroencephalography and evoked potentials and in clinical epileptology. Fellows attain competencies in clinical neurophysiology, patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. Graduates of the program are expected to be able to direct an epilepsy program and an EEG/EP laboratory.

### **Program Overview**

The fellowship program offers training to adult and pediatric neurologists. The fellowship program relies on case-based learning to achieve its educational objectives. Clinical experience is complemented by a series of didactic lectures, an array of clinical and scientific weekly conferences, and a journal club. Fellows also gain teaching experience in their interactions with Neurology residents, medical students, and allied health professionals.

The first year of fellowship is a fully accredited Clinical Neurophysiology Training Program (The Mass General Clinical Neurophysiology Training Program) that qualifies participants to take the American Board of Psychiatry and Neurology Added Certificate in Clinical Neurophysiology examination. Training in clinical neurophysiology is supported by a busy EEG and Evoked Potentials Laboratory, a 5 bed Epilepsy Monitoring Unit, a busy Long-Term Bedside and ICU Monitoring Program, an 8-bed Sleep Laboratory, an Intraoperative Monitoring Program, and an Electromyography Laboratory housed in the Neuromuscular Center.

An optional second year of training focused on clinical Epilepsy is available. The Epilepsy Fellowship is newly accredited by the ACGME as of AY2015. The goal of this fellowship year is to provide fellows with additional training in the management of complex epilepsy, increased experience and responsibility for teaching, and additional time for dedicated research.

The Epilepsy Service at the Massachusetts General Hospital is staffed by Drs. Andrew Cole, Daniel Hoch, Keith Chiappa, Elizabeth Thiele, John Stakes, Stephen Parker, Lauren Moo, Mirela Simon, Syd Cash, Ronan Kilbride, Ronald Thibert and Ken Sassower.

The clinical service includes an inpatient consultation service, an active outpatient epilepsy clinic, an epilepsy monitoring unit, an epilepsy surgery program co-directed by Dr. Emad Eskandar, a Pediatric Epilepsy Program directed by Dr. Thiele, and an active epilepsy research program including both clinical and basic science research approaches to the problem of chronic epilepsy. In addition to offering advice on the medical management of seizure disorders, and evaluation for the surgical management of such problems, the Epilepsy

Service also provides the opportunity for patients to enroll in investigational treatment protocols.

### **Accreditation**

The Mass General Epilepsy/Clinical Neurophysiology Fellowship is ACGME accredited (Mass General Clinical Neurophysiology Training Program). At this time accreditation is offered by the ACGME for one year of fellowship, and fellows are expected to gain exposure to a variety of neurophysiological disciplines. Arrangements can be tailored to meet individual objectives. To meet accreditation requirements, 20% of the fellows' time during the first year will be spent in a "non-major" discipline. Clinical Neurophysiology fellows at Mass General generally spend that time in the Sleep lab. The 20% commitment may be satisfied by a combination of didactic and clinical experience. Intraoperative monitoring experience is also available under the direction of Dr. Simon, and may be accepted by the ACGME as satisfaction of the 20% requirement. Currently, because of the participation of the EMG lab in an accredited Neuromuscular fellowship program, dedicated experience in EMG may be available to Clinical Neurophysiology fellows by special arrangement.

### **Topics**

The following topics are addressed during the fellowship in the course of didactic teaching conferences, regularly scheduled conferences, one-on-one teaching in the course of reviewing clinical tests and encounters, fellow presentations, and self-directed learning:

#### **EEG:**

- Cellular basis of EEG activity
- Cortical generators and EEG vol-tage fields
- Engineering principles
- Recording techniques
- Display of EEG
- Analog
- Digital
- Filtering
- Montage selection
- Compressed spectral analysis
- EEG recording formats
- Routine EEG
- Ambulatory EEG
- Continuous EEG
- EEG with video
- Event-directed EEG
- Electrocorticography
- Invasive EEG
- Analytic approaches to EEG
- Visual analysis of EEG
- Source localization

Computerized analysis  
Quantitative analysis  
Neonatal EEG  
Benign EEG variants and patterns of unknown significance  
Activation methods  
Artifacts  
Abnormal EEG findings  
Focal  
Generalized  
Continuous  
Intermittent  
Non-epileptiform  
Epileptiform  
Epileptic  
EEG findings in disease  
Encephalopathies  
Dementias  
Coma  
Structural brain diseases  
Psychiatric diseases  
Systemic diseases

**EPILEPSY MONITORING:**

Indications for video-EEG monitoring  
Technology  
Computerized event detection  
Analysis  
Visual  
Computerized  
Electro-clinical correlation  
Artifacts  
Abnormal findings  
Background disturbances  
Interictal epileptiform discharges  
Ictal events

**EPILEPSY:**

Approach to the patient with episodic neurological disturbance  
History  
Examination  
Clinical neurophysiology  
Imaging  
Neuropsychological assessment  
Psychiatric assessment

Classification of seizures and epilepsies  
Approach to the first seizure  
Longterm follow-up of patients with epilepsy  
Refractory epilepsy  
Special diagnostic approaches  
Medical management  
Surgical assessment and management  
Device-based treatments  
Pharmacology  
Epilepsy in systemic diseases  
Genetics of epilepsy  
Epilepsy in special populations  
Children  
Elderly  
Women of reproductive age  
Complications of treatment

**LONG-TERM BEDSIDE MONITORING:**

Approach to the patient with altered mental status  
Selection of monitoring technologies  
Optimization of monitoring protocols  
Recognition of common artifacts encountered in the bedside environment  
Identification of EEG patterns of significance in critically ill patients  
Principles of treatment of status epilepticus and recurrent seizures  
Integration of monitoring data with imaging and biochemical data  
Principles of brain death determination  
Ethical principles in critically ill patients

**INTRAOPERATIVE MONITORING:**

Neurophysiological Tests used in IOM  
Tailoring the Monitoring Technique on an Individual Basis (single versus combination of neurophysiological tests)  
EP/EEG Machine-technological aspects; recording, saving and reviewing data; editing new programs and customized montages;  
Indications/methodology/troubleshooting/interpretation for:  
Electrocorticography  
Functional Cortical Mapping  
EEG Monitoring  
Somatosensory Evoked Potentials Monitoring  
Motor Evoked Potentials Monitoring  
Brainstem Auditory Evoked Potentials Monitoring  
Other Cranial Nerves Monitoring  
Free and Triggered EMG Monitoring  
Particularities of Monitoring/Mapping of Nervous System during certain types of

## Surgical Procedures

Epilepsy Surgery

Supratentorial Tumor Resection

CEA

Intramedullary Spinal Cord Tumor Resection

Decompressive Surgery of the Spine

Scoliosis Surgery

TAA Repair

Surgery of the Brachial Plexus

Resection of Tumors of the Peripheral Nervous System

Posterior Fossa Surgery- Acoustic Neuromas, Microvascular Decompressive

Surgery (of V, VII nerves)

Communication with surgical and anesthesia teams

Anesthetic Regimens and their Impact on the Neurophysiology of the Central and

Peripheral Nervous System

## **EMG:**

Fellows will gain familiarity with the neurophysiological findings in the following diseases:

Inflammatory myopathies

Motor neuron disorders/ALS

Movement disorders/dystonias

Muscular dystrophies

Myasthenia gravis/Lambert Eaton syndrome

Myelopathies

Myotonic disorders and channelopathies

Neuropathies: mononeuropathies

Neuropathies: polyneuropathies

Inflammatory

Inherited

Metabolic

Toxic

Plexopathies

Radiculopathies

Spinal stenosis

## **ROTATIONS**

Rotations include core and elective experiences. Core rotations include EEG, Epilepsy Monitoring Unit (EMU), and Long Term Bedside Monitoring (LTM) services. Each of these rotations is organized around clinical cases evaluated by the fellow. Teaching is provided by the supervising faculty member throughout the course of the rotation, and is complemented by didactic lectures delivered throughout the year, and by dedicated conferences focused on Epilepsy, EEG, and LTM. Elective rotations include Sleep,

Intraoperative Monitoring (IOM), and EMG. In these rotations fellows review and interpret studies in conjunction with faculty members, and participate in each service's conferences and didactic lectures.

### **Competency-Based Curriculum for Each Rotation:**

#### **EEG ROTATION**

##### **Activities:**

Trainees will be responsible for interpreting EEG studies performed in the clinical neurophysiology laboratory, and entering a preliminary report into the computer-based reporting system. They will review all studies with a faculty member who will ultimately finalize and sign the report. In the case of urgent findings, fellows will communicate directly with the patient care team to advise them of the findings and assist with planning an appropriate response as requested. In some cases, fellows may suggest conversion of the routine EEG into an LTM study to better monitor response. Fellows will also be responsible, in a progressive fashion throughout the year, for triaging EEG requests, troubleshooting technical problems, and addressing clinical issues that might arise in the lab (e.g. the occurrence of a clinical seizure).

Learning objectives are supported by clinical experience with test interpretation, one to one faculty teaching at sign-out, a weekly review of problematic EEGs at our Clinical Neurophysiology Conference, dedicated lectures on EEG at our weekly Clinical Neurophysiology Didactic Conference, review of pertinent EEGs at our weekly Epilepsy Clinic Conference and journal clubs focused on the EEG literature.

##### **OBJECTIVES:**

Patient Care. Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. By the end of the rotation, the fellow will be able to:

1. Interpret EEG and EP studies and understand their significance as they pertain to patient management.
2. Recognize normal variants and artifacts and distinguish them from cerebral activity.
3. Set up a patient and operate an EEG machine.
4. Make adjustments on the EEG instrument, including gain, filters, and paper speed and relate their effect on appearance and interpretation of EEG studies.
5. Troubleshoot technical and clinical problems in EEG recording.
6. Interpret and understand long term monitoring (LTM) studies.
7. Evaluate and formulate diagnostic and management strategies for patients with suspected seizures or epilepsy.
8. Participate in testing for evoked potentials and polysomnograms and understand their role in clinical diagnosis and management.
9. Participate in invasive EEG tests such as intracarotid amytal testing, and

intraoperative monitoring, including electrocorticography and electrocortical stimulation.

**Medical Knowledge.** Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. By the end of the EEG rotation, the fellow will be able to:

1. Interpret, differentiate, and explain EEG findings in a broad range of medical, psychiatric and neurological disease states.

**Practice-based Learning and Improvement.** Fellows must demonstrate the ability to investigate and evaluate their EEG skills, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. By the end of the rotation, the fellow will be able to:

1. Recognize limitations in their own EEG knowledge base and interpretive skills, and understand and address the need for lifelong learning.
2. Obtain and critically appraise current literature, carry out investigational protocols, and explain to patients and others how research studies are conducted in clinical neurophysiology to assist in the quality care of patients
3. Evaluate caseload and practice experience in a systematic manner, including case-based learning, use of practice guidelines, review of patient records, elicitation of patient feedback, use of principles of quality improvement in practice, and use of a system to examine errors in practice and to initiate improvements.

**Interpersonal and Communication Skills.** Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. By the end of the rotation, fellows will be able to:

1. Listen and communicate effectively with patients using verbal, nonverbal, and written skills as appropriate
2. Transmit EEG results to referring physicians and patients in a clear and meaningful fashion
3. Serve as an effective consultant to other medical specialists, mental health professionals, and community agencies
4. Communicate effectively with technologists to optimize EEG studies according to the clinical situation

**Professionalism.** Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. By the end of the rotation, fellows will be able to:

1. Demonstrate responsibility for their patients' care, including responding to communication from patients and professionals in a timely manner

2. Use medical records for appropriate documentation of the course of illness, testing, and treatment

Systems-based Practice. Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. By the end of the rotation, fellows will be able to:

1. Access community, national, and allied health professional resources that may enhance the quality of life of patients examined in the clinical neurophysiology laboratory
2. Use appropriate consultation and referral mechanisms for the optimal clinical management of patients with complicated medical illness
3. Understand ethical and legal implications of tests and adhere to highest standards
4. Demonstrate an understanding of risk management

## **LONG TERM MONITORING ROTATION**

### **Activities:**

Fellows will be responsible for overseeing all longterm bedside monitoring studies conducted in the hospital. Many, but not all of these studies, take place in critical care units. Fellows will review data several times a day as required, review pertinent findings with a faculty member, and advise the care team about the findings and evolution of the EEG. They may provide management suggestions as required. Fellows will generate preliminary reports of LTM studies, which will be reviewed and finalized by a faculty member. Fellows will assist technologists in solving technical problems, and will oversee triage of monitoring requests.

Learning objectives are supported by clinical experience with test interpretation, one to one faculty teaching at sign-out, a weekly review of problematic LTMs at our Clinical Neurophysiology Conference, dedicated lectures on LTM at our weekly Clinical Neurophysiology Didactic Conference, and journal clubs focused on the LTM literature.

### **OBJECTIVES:**

Patient Care. Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. By the end of the rotation, the fellow will be able to:

1. Interpret LTM studies and understand their significance as they pertain to patient management.
2. Recognize normal variants and artifacts and distinguish them from cerebral activity.
3. Set up a patient and operate a video-LTM machine.
4. Make adjustments on the EEG instrument, including gain, filters, and paper speed and relate their effect on appearance and interpretation of EEG studies.

5. Troubleshoot technical and clinical problems in EEG recording.
6. Interpret and understand long term monitoring (LTM) studies.
7. Evaluate and formulate diagnostic and management strategies for patients with suspected seizures or altered mental status.

Medical Knowledge. Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. By the end of the LTM rotation, the fellow will be able to:

1. Interpret, differentiate, and explain EEG findings in a broad range of medical, psychiatric and neurological disease states.
2. Apply findings from neurophysiological studies to formulate recommendations for ongoing diagnostic studies and treatments.
3. Be familiar with end of life issues and ethical concerns in the care of critically ill patients, including the role of EEG data in guiding decision making

Practice-based Learning and Improvement. Fellows must demonstrate the ability to investigate and evaluate their LTM skills, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. By the end of the rotation, the fellow will be able to:

1. Recognize limitations in their own LTM and clinical skills, and understand and address the need for lifelong learning.
2. Obtain and critically appraise current literature, carry out investigational protocols, and explain to patients and others how research studies are conducted in clinical neurophysiology.
3. Evaluate caseload and practice experience in a systematic manner, including case-based learning, use of practice guidelines, review of patient records, elicitation of feedback, use of principles of quality improvement in practice, and use of a system to examine errors in practice and to initiate improvements.

Interpersonal and Communication Skills. Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. By the end of the rotation, fellows will be able to:

1. Listen and communicate effectively with referring physicians, patients and/or their families using verbal, nonverbal, and written skills as appropriate
2. Transmit LTM results to treating physicians and to families and caregivers in a clear and meaningful fashion
3. Serve as an effective consultant to other medical specialists

Professionalism. Fellows must demonstrate a commitment to carrying out professional

responsibilities and an adherence to ethical principles. By the end of the rotation, fellows will be able to:

1. Demonstrate responsibility for their patients' care, including responding to communication from patients and professionals in a timely manner
2. Interact with colleagues in a stressful critical care environment in a collaborative and collegial manner
3. Use medical records for appropriate documentation of the course of illness, testing, and treatment

Systems-based Practice. Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. By the end of the rotation, fellows will be able to:

1. Use appropriate consultation and referral mechanisms for the optimal clinical management of patients with complicated medical illness
2. Understand ethical and legal implications of tests and adhere to highest standards
3. Demonstrate an understanding of risk management

## **EMU ROTATION**

### **Activities:**

Fellows will be responsible for overseeing all EMU studies conducted in the hospital. These studies take place on the adult neurology ward and on the pediatric floors in dedicated rooms. Fellows will review data several times a day as required, review pertinent findings with a faculty member, and advise the care team about the findings and evolution of the EEG. They may provide management suggestions as required. Fellows will generate preliminary reports of EMU studies, which will be reviewed and finalized by a faculty member. Fellows will assist technologists in solving technical problems. Fellows are responsible for integrating monitoring findings with other clinical data to determine the necessary length of EMU studies, and to adequately interpret them. Fellows will present EMU cases to the MGH Epilepsy Conference, including clinical, imaging, psychological, and EMU data, and will lead the clinical discussion of the findings and their implications for ongoing care. Fellows will communicate those findings and suggestions to patients and to referring physicians.

Learning objectives are supported by clinical experience with test interpretation, one to one faculty teaching at sign-out, a weekly review of EMU recordings at our MGH Epilepsy Conference, a weekly review of problematic EMU recordings at our Clinical Neurophysiology Conference, dedicated lectures on EMU monitoring at our weekly Clinical Neurophysiology Didactic Conference, review of pertinent EMU recordings at our weekly Epilepsy Clinic Conference, and journal clubs focused on the Epilepsy

literature.

**OBJECTIVES:**

Patient Care. Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. By the end of the rotation, the fellow will be able to:

1. Understand the indications for video-EEG monitoring
2. Plan an appropriate video-EEG recording session based on the clinical question and characteristics of the specific patient
3. Set up and operate the video-EEG recording equipment
4. Understand the impact of technical controls on the appearance and interpretation of video-EEG recordings
5. Troubleshoot technical and clinical problems in video-EEG recording
6. Interpret video-EEG studies.

Medical Knowledge. Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. By the end of the EMU rotation, the fellow will be able to:

1. Understand, interpret and report invasive video-EEG studies, including participating in the selection of the most appropriate recording approach, e.g. depth, grid, strip, PEG, or foramen ovale electrodes.
2. Integrate video-EEG findings into a clinical care plan for individual patients.

Practice-based Learning and Improvement. Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. By the end of the rotation, the fellow will be able to:

1. Recognize limitations in their own knowledge base and clinical skills, and understand and address the need for lifelong learning.
2. Obtain and critically appraise current literature, carry out investigational protocols, and explain to patients and others how research studies are conducted in clinical neurophysiology to assist in the quality care of patients
3. Evaluate caseload and practice experience in a systematic manner, including case-based learning, use of practice guidelines, review of patient records, elicitation of patient feedback, use of principles of quality improvement in practice, and use of a system to examine errors in practice and to initiate improvements.

Interpersonal and Communication Skills. Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. By the end of the

rotation, fellows will be able to:

1. Communicate effectively with the clinical care team, including physicians and nurses, to manage patients in the Epilepsy Monitoring Unit.
2. Communicate results effectively with patients and their caregivers
3. Communicate results and clinical implications to referring physicians
4. Communicate effectively to facilitate interdisciplinary conferences

Professionalism. Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. By the end of the rotation, fellows will be able to:

1. Demonstrate responsibility for their patients' care, including responding to communication from patients and professionals in a timely manner
2. Use medical records for appropriate documentation of the course of illness, testing, and treatment

Systems-based Practice. Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. By the end of the rotation, fellows will be able to:

1. Access community, national, and allied health professional resources that may enhance the quality of life of patients with epilepsy
2. Use appropriate consultation and referral mechanisms for the optimal clinical management of patients with chronic neurological illness
3. Understand ethical and legal implications of tests and adhere to highest standards
4. Demonstrate an understanding of risk management

## **SLEEP ROTATION:**

### **Activities:**

The sleep rotation is designed to expose fellows to polysomnography and sleep medicine in fulfillment of the ACGME-required 20% minor requirement. Fellows will review sleep studies ½ day each week with a member of the sleep medicine faculty, and assist in generating a report. Some fellows may choose to devote a 1 month elective block to obtaining additional focused experience in sleep medicine. These individuals will read studies daily, and may attend sleep clinic. Fellows will obtain additional exposure to sleep medicine in the form of didactic lectures offered during our year-long Clinical Neurophysiology Lecture series.

Learning objectives are supported by clinical experience with test interpretation, one to one faculty teaching at sign-out, dedicated lectures on Sleep and polysomnography at our weekly Clinical Neurophysiology Didactic Conference, and review of pertinent Sleep studies at our weekly Epilepsy Clinic Conference. Fellows may also attend a weekly

sleep conference.

## **OBJECTIVES**

Patient Care. Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. By the end of the rotation, the fellow will be able to:

1. Understand the indications for polysomnographic studies
2. Plan an appropriate polysomnographic study based on the clinical question and characteristics of the specific patient.
3. Set up and operate the polysomnography equipment
4. Understand the impact of technical controls on the appearance and interpretation of the polysomnogram
5. Troubleshoot technical and clinical problems in polysomnography

Medical Knowledge. Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. By the end of the Sleep rotation, the fellow will be able to:

1. Understand and interpret polysomnographic studies
2. Be able to evaluate patients with sleep-related disorders using clinical skills and integration of polysomnographic data, and to develop a care plan for such individuals.

Practice-based Learning and Improvement. Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. By the end of the rotation, the fellow will be able to:

1. Be familiar with the current literature, investigational protocols, and research studies in sleep medicine and polysomnography.

Interpersonal and Communication Skills. Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. By the end of the rotation, fellows will be able to:

1. Communicate effectively with referring providers to provide timely interpretation of polysomnographic tests and their implications for clinical decision making.

Professionalism. Fellows must demonstrate a commitment to carrying out professional

responsibilities and an adherence to ethical principles. By the end of the rotation, fellows will be able to:

1. Demonstrate responsibility for their patients' care, including responding to communication from patients and professionals in a timely manner
2. Use medical records for appropriate documentation of the course of illness, testing, and treatment

Systems-based Practice. Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. By the end of the rotation, fellows will be able to:

1. Access community, national, and allied health professional resources that may enhance the quality of life of patients with chronic neurological illnesses
2. Use appropriate consultation and referral mechanisms for the optimal clinical management of patients with complicated medical illness
3. Understand ethical and legal implications of tests and adhere to highest standards
4. Demonstrate an understanding of risk management

## **INTRAOPERATIVE MONITORING ROTATION**

### **Activities:**

The IOM rotation is designed to expose fellows to IOM in fulfillment of the ACGME required 20% minor requirement. Fellows who choose this discipline for their minor will work with members of the IOM faculty ½ day/week to conduct IOM studies, and assist in generating a report. Some fellows may choose to devote a 1 month elective block to obtaining additional focused experience in IOM. These individuals will read studies daily. Fellows will obtain additional exposure to IOM in the form of didactic lectures offered during our year-long Clinical Neurophysiology Lecture series, and in reviewing IOM studies presented at our weekly Clinical Neurophysiology conference.

Learning objectives are supported by clinical experience with test interpretation, one to one faculty teaching at sign-out, review of problematic IOM studies at our weekly Clinical Neurophysiology Conference, dedicated lectures on IOM at our weekly Clinical Neurophysiology Didactic Conference, and review of pertinent Sleep studies at our weekly Epilepsy Clinic Conference. Fellows may also attend a weekly IOM conference.

### **OBJECTIVES:**

Patient Care. Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. By the end of the rotation, the fellow will be able to:

1. Evaluate each case that will need monitoring individually, based on the patient's neurological exam, medical history and type of surgery to be performed, in order to determine the most useful neurophysiological test or combination of tests to be used for monitoring
2. Be familiar with all the pertinent technical aspects of each test, including being able to set up and perform each test
3. Determine if changes in the neurophysiological tests seen during monitoring are due to dysfunction of the nervous tissue including differentiating effects of anesthesia, artifacts, and technical difficulties(Troubleshooting)

Medical Knowledge. Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care. By the end of the EEG rotation, the fellow will be able to:

1. Accurately interpret neurophysiological tests used during monitoring, including EEG, EcoG, Somatosensory Evoked Potentials, Motor Evoked Potentials, Brainstem Auditory Evoked Potentials, Free and Triggered EMG
2. Be familiar with the utility of monitoring in specific types of surgical procedures such as anarterectomy, spinal cord surgery, and acoustic neuroma surgery

Practice-based Learning and Improvement. Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. By the end of the rotation, the fellow will be:

1. Familiar with literature on IOM
2. Familiar with some areas of IOM research

Interpersonal and Communication Skills. Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. By the end of the rotation, fellows will be able to:

1. Able to discuss with the surgical and anesthesia team the plan for monitoring
2. Able to explain to the patient the monitoring procedure as well as its risks and benefits
3. Advise the surgeon as far as the possible mechanism through which an injury could occur as well as what steps should be taken in order to reverse the neurological dysfunction
4. Write a comprehensive and informative report for each neurophysiological procedure used

Professionalism. Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. By the end of the rotation, fellows will be able to:

1. Demonstrate responsibility for their patients' care, including responding to communication from patients and professionals in a timely manner
2. Work effectively with the surgical team in the OR environment
3. Use medical records for appropriate documentation of the course of illness, testing, and treatment

Systems-based Practice. Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. By the end of the rotation, fellows will be able to:

1. Understand ethical and legal implications of tests and adhere to highest standards
2. Demonstrate an understanding of risk management

## **EMG ROTATION**

### **OBJECTIVES:**

Currently because of the constraints of the Neuromuscular Fellowship at MGH, our Clinical Neurophysiology Program does not offer an EMG rotation except by special arrangement. Members of the Neuromuscular Unit provide didactic lectures to CNP fellows, and all fellows are encouraged to attend Neuromuscular Conference. In the event that an EMG rotation is agreed for an individual fellow, the following objectives would be outlined:

At the end of the **EMG** rotation, the fellow will be able to:

1. Perform and interpret NCV and needle EMG studies.
2. Evaluate and formulate management strategies for patients with neuromuscular disease.
3. Become familiar with the principles of single fiber EMG and its interpretation.
4. Observe and understand the role of quantitative sensory testing and autonomic testing in the evaluation and management of patients with relevant symptoms.
5. Be familiar with current literature, investigational protocols and research studies in neuromuscular disease.

### **DIDACTIC ACTIVITIES**

Monday 12:00 PM	Clinical Neurophysiology case conference	EEG library
Monday 1:00 PM	MGH Epilepsy Conference	Blake 12 Library
Tuesday 10:00 AM	MGH Epilepsy Research Lab Meeting	ACC 7
Tuesday 11:00 AM	Clinical Neurophysiology Didactic Conference (Teleconferenced with BWH)	Blake 12 Library

Wednesday 8:30 AM	Pediatric Epilepsy Surgery Conference	Blake 12 Library
Thursday 9:00 AM	Neurology Grand Rounds	Ether Dome
Thursday 10:30 AM	Neuromuscular Conference	CRP 9
Thursday 1:00 PM	Journal Club	EEG Library
Friday 12:00 PM	Epilepsy Clinic Conference	WACC 835

## **SUPERVISION POLICY**

### **MGH Clinical Neurophysiology Program Supervision Policy**

The supervision of fellows is accomplished through explicit written descriptions of supervisory lines of responsibility for the care of patients. Such guidelines are communicated to all members

of the program staff. Fellows are provided with prompt, reliable systems for communication and

interaction with supervisory physicians. Direct care of inpatients, including epilepsy monitoring patients, is provided by the Neurology resident staff under the direct supervision of an assigned neurology attending. Clinical neurophysiology issues are handled by the clinical neurophysiology residents and staff on a consultative basis, with ultimate responsibility for patient care resting with the attending physician. For outpatients, all patients seen by clinical neurophysiology residents are staffed one to one by an attending neurologist in the epilepsy, sleep or neuromuscular groups. Attending physicians are ultimately responsible for clinical care in the outpatient setting. All clinical neurophysiology tests are supervised and reviewed by an attending neurophysiologist. Reports are ultimately signed by the staff neurophysiologist.

#### **Clinical**

neurophysiology faculty are assigned to Epilepsy, EEG, Sleep and Neuromuscular Services, generally in one month blocks. The assigned faculty members are available 24/7 by telephone or beeper and are always available to assume direct care responsibility in case the resident is overloaded, uncertain, or incapacitated. The Program Director or his designee is always available by telephone or beeper to provide additional supervision and backup.

The Clinical Neurophysiology Training Program is designed to promote the professional growth and development of our fellows. Our goal is to graduate confident, competent clinical neurophysiologists who are capable of independently performing and interpreting high quality neurophysiologic studies, as well as providing high quality care to patients with epilepsy and neuromuscular disorders. This occurs through the performance and interpretation of hundreds of neurophysiologic studies under the supervision of qualified neurophysiology faculty, as well as through the care of numerous individual patients in the epilepsy and neuromuscular clinics, again under the supervision of expert faculty. Fellows are afforded increasing levels of autonomy as their experience accrues and their procedural and clinical skills advance. That level of autonomy varies for each resident and each patient, and is monitored by teaching staff.

Faculty are ultimately responsible for patient welfare and safety, and, therefore, supervise all patient care encounters. Faculty are on call and available to fellows 24 hours a day and 7 days a week for supervision and consultation, during every clinical experience and rotation.

The following individuals supervise the programmatic and administrative duties of the fellows.

Fellows are instructed to use them as a resource for departmental issues.

Program director, Dr. Andrew Cole, Director, MGH Epilepsy Service and Epilepsy Monitoring Unit

Dr. Mirela Simon, Intraoperative Monitoring

Keith Chiappa, Director, MGH EEG and Evoked Potentials Laboratory

William David, Director, MGH Neuromuscular Center and EMG Laboratory

Jeffrey Ellenbogen, Director, MGH Sleep Laboratory

Fellowship Program Administrative Assistants:

Laura McComb, Kathleen Carlson