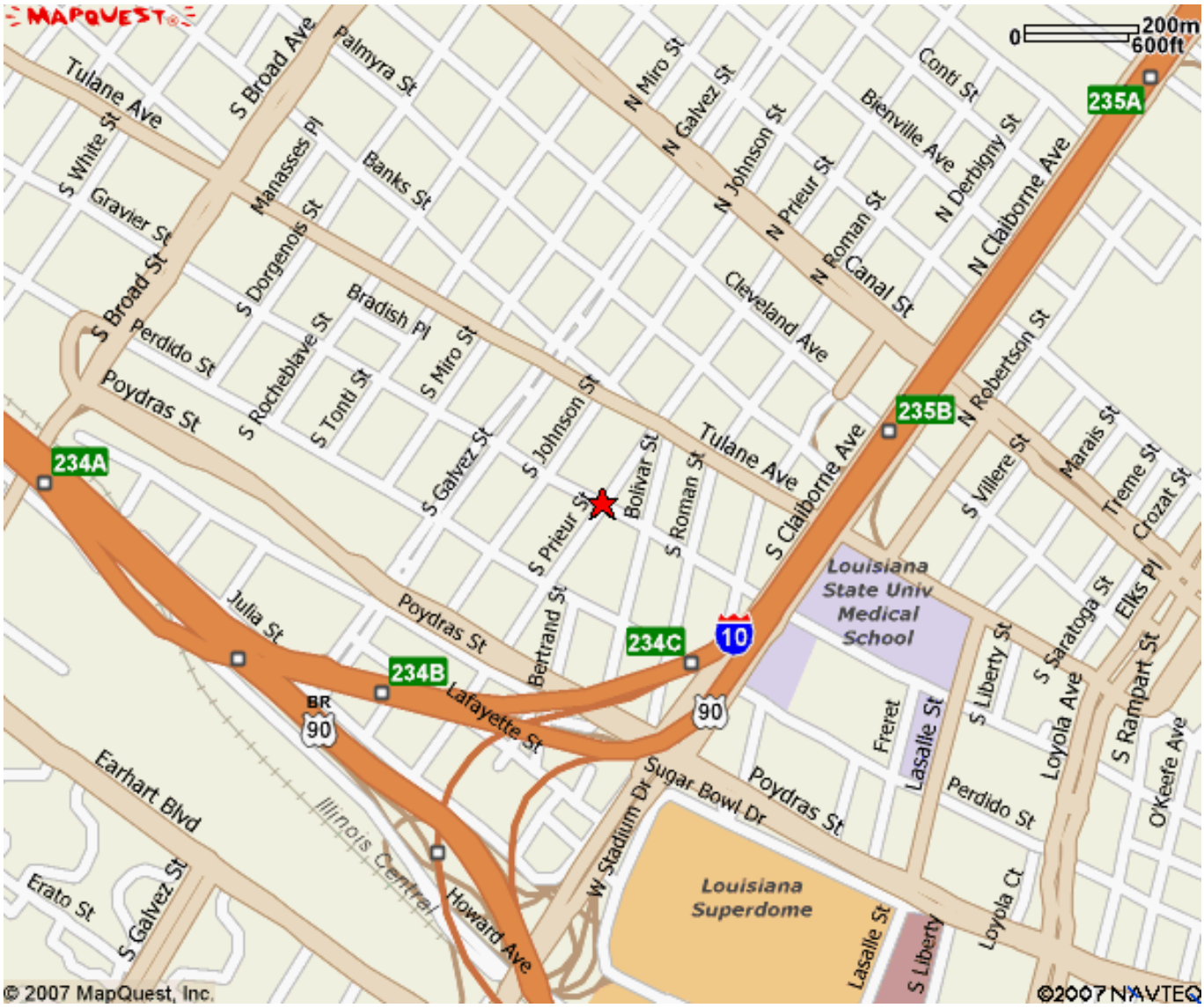
Louisiana State University Health Sciences Center Department of Neurosurgery Resident Manual 2007-2008

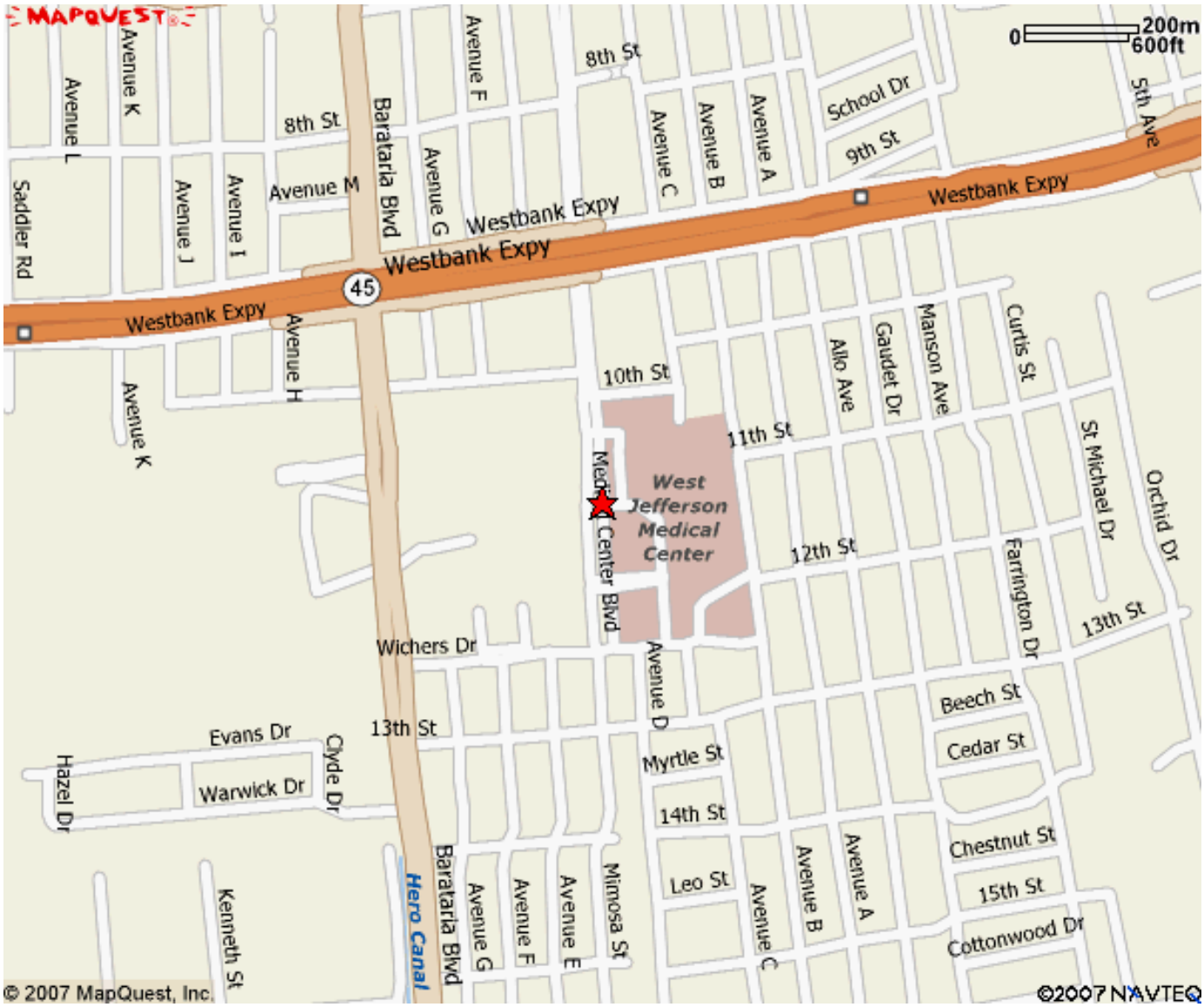
MAPS TO LOUISIANA STATE UNIVERSITY HEALTH SCIENCES CENTER AND AFFILIATED HOSPITALS

LSU Health Sciences Center
Department of Neurosurgery
2020 Gravier Street, 7th floor
New Orleans, LA 70112
Phone: (504) 599-0909
Fax: (504) 568-6127 http://www.medschool.lsuhsc.edu/neurosurgery/



West Jefferson Medical Center
1101 Medical Center Boulevard
Marrero, Louisiana 70072
(504) 347-5511 www.wjmc.org

Map:
http://maps.google.com/maps?q=1101%20Medical%20Center%20Blvd%20Marrero%2C%20LA%2070072



Ochsner Medical Center - New Orleans
1514 Jefferson Hwy., New Orleans, LA 70121
1-866-OCHSNER | (504) 842-3000 www.ochsner.org

Map:
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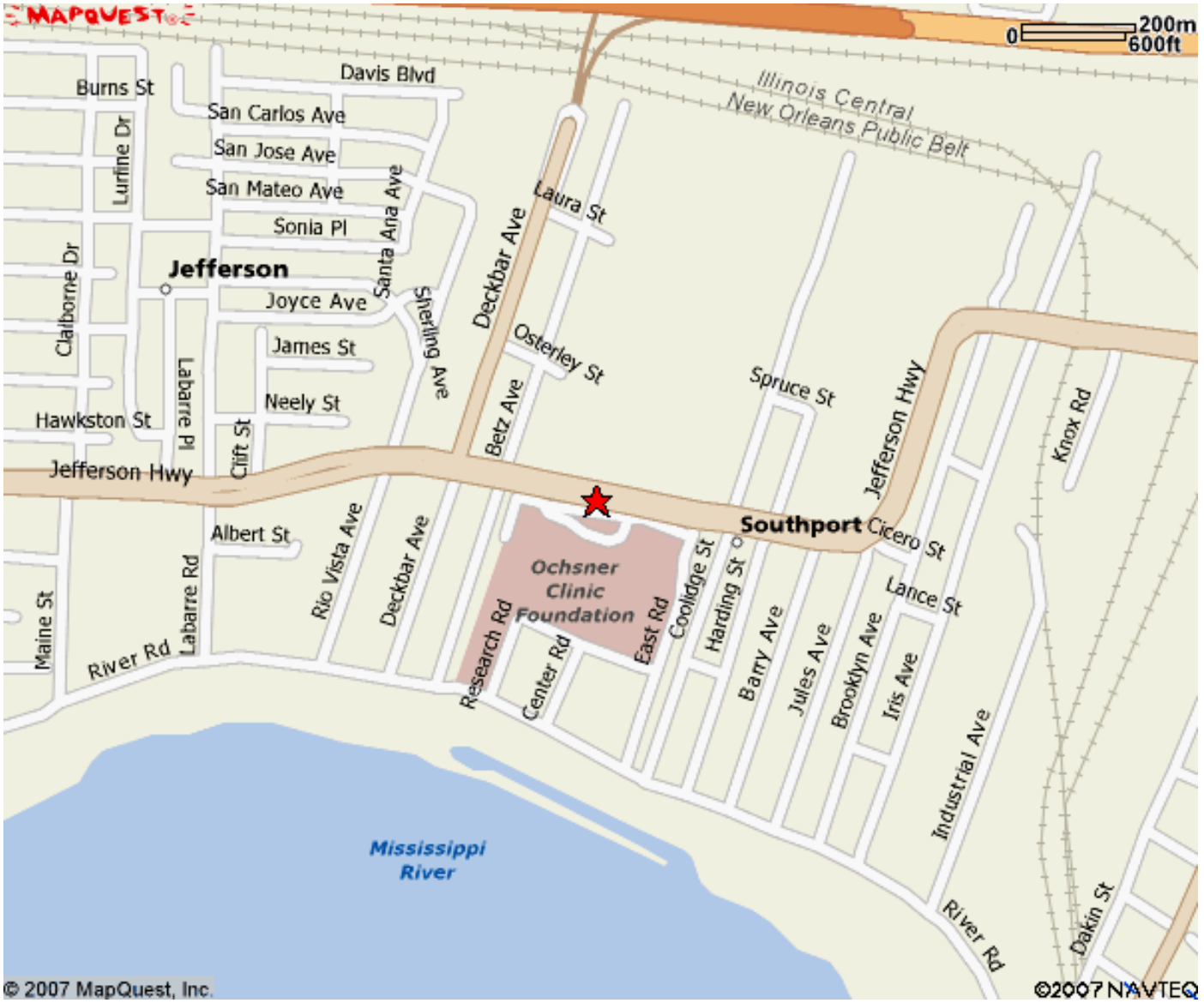


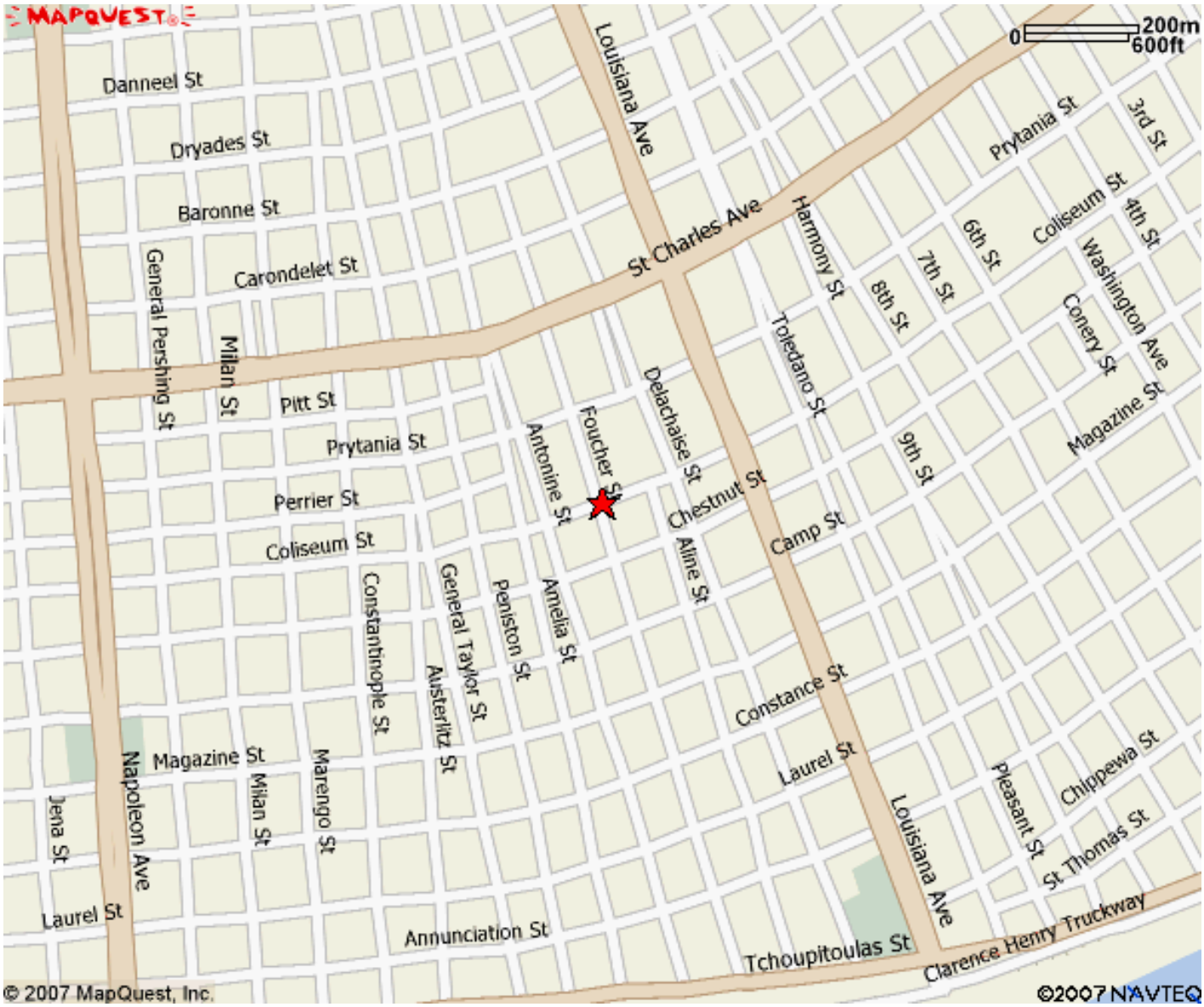
Children's Hospital
200 Henry Clay Avenue
New Orleans, Louisiana 70118
(504) 899-9511 www.chnola.org

Map: http://www.chnola.org/Maps.htm

University Hospital
2021 Perdido St
New Orleans, LA 70112
(504) 903-3000

Map:
http://www.google.com/maps?hl=en&safe=off&q=university+hospital&near=New+Orleans,+LA&radius=0.0&cid=29954444,-90075000,13893491954319098404&li=lmd&z=14&t=m

Touro Infirmary
1401 Foucher Street
New Orleans, Louisiana 70115
504-897-7011
www.touro.com



Resident Education

NEUROSURGERY RESIDENCY EDUCATIONAL GOALS AND OBJECTIVES

Post-Katrina Changes

The LSU Department of Neurosurgery has had to undergo significant changes in the aftermath of Hurricane Katrina which passed over New Orleans on August 29, 2005, causing massive flooding and destroying much of the city, including Charity Hospital, the LSU Health Sciences Center, Tulane University Medical Center, and most of the downtown hospitals. This temporarily displaced most of the LSU residency training programs. Charity Hospital in New Orleans, originally founded in 1732, has been the cornerstone for most of the LSU residency training programs including the Department of Neurosurgery. At this point, the trauma portion of Charity Hospital which is managed by LSU is again functioning, but does not see a caseload that could support a neurosurgical training program. Even prior to the hurricane, it was evident that the LSU neurosurgical training program would need to involve the private sector more.

Ochsner Clinic and Ochsner Foundation Hospital, now named Ochsner Medical Center, has always been and integral part of the LSU neurosurgical training program, with residents rotating through at a junior resident level for 19 months, to gain the broad neurosurgical experience that a large private hospital and academic center can offer. Ochsner Medical Center has remained open and functional through the storm, and has seen a significant increase in neurosurgical patients with more trauma reflecting the loss of Charity Hospital. Ochsner Medical Center has become our primary teaching site with the program director, Dr. Roger Smith located there. Children's Hospital has also been a defined rotation in the LSU neurosurgical residency. The faculty and facilities there remain completely intact, and provide an excellent educational experience in pediatric neurosurgery for our residents. In July, 2006, West Jefferson Medical Center was added as a participating integrated institution. West Jefferson Medical Center provides a particularly rich experience in cerebrovascular surgery and stereotactic radiosurgery. The chief of neurosurgery at West Jefferson, Dr. Frank Culicchia, was appointed Chairman of the LSU Department of Neurosurgery in June, 2006, to replace Dr. David Kline who was chairman of the department for 35 years. Dr. Kline remains active in the department. The LSU Neuroscience Center, under Dr. Nicolas Bazan enjoys an international reputation for its work in the molecular biology of neurological diseases, particularly the lipid membrane changes associated with ischemia. The LSU Health Sciences Center including the School of Medicine has completely reopened with a full complement of medical students.

Program Specifics

The LSU Neurosurgical Residency is a 6 year (72 month) program following one year of General Surgery training. There are 48 months of clinical neurosurgery of which the last 12 months serve as chief residency. The first 12 months (NS1) are spent at West Jefferson Medical Center as a clinical junior neurosurgical resident. The first 6 months of the second year (NS2) are on a clinical rotation at Children's Hospital. The second 6 months of the NS2 year are given to neuroscience, non-clinical rotations including 3 months of neuroradiology, 2 months of neuropathology, and one month of neurophysiology including EEG, EMG, and intraoperative neuromonitoring. The third year (NS3) is a clinical rotation at West Jefferson Medical Center at a junior resident level. The

fourth year (NS4) is a research year at the LSU Neuroscience Center. This is a non-clinical year and the resident does not take call or do other clinical activities. The resident is expected to contribute to the neurosurgical literature. The fifth year (NS5) begins with a six month subspecialty elective rotation to foster a given residents' interest. The location depends on the subspecialty interest. The resident will also prepare to take the ABNS primary examination for credit during this year. The second 6 months of NS5 the resident returns to Ochsner in a clinical rotation as sub chief resident. The last year (NS6) is spent at West Jefferson Medical Center as chief resident. In summary, there are 18 months of clinical junior residency, then a 6 month neurosciences rotation without clinical responsibilities, another year of clinical rotation, a year of research, 6 months of elective, and a final 18 months of clinical neurosurgery of which the last 12 months are serving as chief resident.

Neuro-critical care experience is emphasized throughout the training, and extensive exposure to subspecialty services including neurovascular, neurooncology, spinal neurosurgery, stereotactic radiosurgery, neurotrauma and pediatric neurosurgery. Weekly conferences are totally protected from clinical commitments and include morbidity and mortality conference, core curriculum conference, and subspecialty and case management/neuroradiology/neuropathology conferences. In addition, preparation of scientific manuscripts, review articles, book chapters and abstracts, presentation and leadership/administrative skills are fostered within a structured mentored environment and extensive multidisciplinary interface.

Information on Affiliated Hospitals

Ochsner Medical Center

Ochsner Medical Center is the primary teaching and clinical hospital for the Ochsner Health System, which is composed of 5 hospitals and 42 satellite clinics in Southeast Louisiana. Ochsner Clinic was founded by Alton Ochsner and his associates in 1940 and with the Ochsner Foundation Hospital, moved to its present location on the banks of the Mississippi River just across the Orleans Parish line in 1954. The hospital and clinic were merged in 2001. Ochsner is a 490 bed hospital adjoined to an 11 story clinic. Patients are referred from the many Ochsner community clinics in the area as well as other physicians and providers in and out of the state. The Neurosurgery Department only sees patients at the main campus and only admits patients to Ochsner Medical Center. The department sees about 30 outpatients per day. There is a busy Emergency Department and an active consultative service in the hospital. The neurosurgical inpatient census runs from about 12 to 20 patients. There is a hotel on campus for out of town patients and their families. The Department of Radiation Oncology utilizes the BrainLab LINAC radiosurgery system.There are one interventional, and three additional neuroradiologists. All aspects of neuroradiology including MRI, CT, angiography, myelography, ultrasound, and PET are available on campus. There are large departments in General Surgery, Neurology, Orthopaedics, ENT, Ophthalmology, Endocrinology and most medical and surgical specialties which serve as resources for referral and consultation. Ochsner Medical Center has extensive research facilities for both clinical research and basic science research. The research facilities are organized under a research department and Institutional Review Board.

Ochsner has 24 hospital operating rooms and 12 outpatient surgical center operating rooms. Two of the newest rooms are given to neurosurgery. These operating rooms each have an operating microscope, a variety of surgical tables, an internet system to display radiographic images, intraoperative angiographic capability, and are well staffed. There is a Medtronic Stealth Neuronavigaton Unit. There are generally 2 neurosurgeons working on any given day. Each

neurosurgeon operates 1 to 3 days per week. Each resident works with an attending neurosurgeon. In general the residents do not work simultaneously. Dr. Kline has a peripheral nerve fellow and at times there will be a resident and the fellow with Dr. Kline. The program is designed to have a chief resident (NS 5) and a junior resident (NS 2) at Ochsner Medical Center. There are currently 2 junior residents from the LSU program. A resident who is not in the operating room participates in the outpatient clinic.

The resident on call is assigned to the clinic at Ochsner. He sees patients referred to the department as well as patients returning for post operative follow-up. He first sees the patient by himself or with a medical student. He then presents his findings to the attending neurosurgeon. The attending then sees the patient with the resident and decisions for management are made with the patient. The attending and resident then discuss the findings outside the patient's room. The resident dictates some of the clinic notes, which are then reviewed and corrected by the attending before being entered into the electronic medical record.

Ochsner has a 32 bed adult ICU and a 20 bed Pediatric ICU. Coronary Care and Transplant Surgery have their own ICU's. There are intensivists, primarily pulmonary internists and anesthesiologists who run an intensive care fellowship program in conjunction with LSU School of Medicine. They work well with neurosurgery to help manage ventilators, hypertension, blood glucose levels, DVT and Pulmonary Embolism, cardiac events, etc. The attending neurosurgeon or the neurosurgeon covering for him, with the neurosurgical residents, primarily manages the neurosurgical patient in the ICU. The intensive care service is a consultative service, and helps with critical care patients when asked. The same is for Pediatric ICU where there are full time pediatric intensivists. On the pediatric service however, the pediatricians take a more primary role, writing fluid orders, ordering medications, etc. after discussion with the attending neurosurgeon and neurosurgical resident. The ICU admits both postoperative neurosurgical patients and non operative patients such as trauma and stroke, and the resident is exposed to a full spectrum of critical care patients. Intracranial pressure monitoring is routine.

West Jefferson Medical Center

West Jefferson Medical Center is a 450 bed full-service community hospital owned by Jefferson Parish (County). It is located 8 miles from downtown New Orleans and serves the West Bank of the Mississippi River, which is home to a large part of the New Orleans Metropolitan population. Medical Offices are located in towers attached to the hospital, with the Neurosurgery and Neurology Departments utilizing that space. The Emergency Department is extremely busy and fully staffed. A Cyberknife radiosurgical unit is now in place and managed by neurosurgery. As at Ochsner, there is excellent support from medical and surgical specialists. There is a large ICU and dedicated Stroke Unit and very modern up to date operating theaters. Following Hurricane Katrina, the administration has taken an active role in making West Jefferson Medical Center a first rate teaching institution. At West Jefferson Medical Center there are 20 operating rooms, two of which are designated neurosurgical suites. These rooms are fully equipped with microscopes, angiographic units, navigation systems, etc. Each staff neurosurgeon operates 3 to 4 days per week and holds clinic on other days. The residents work directly with the attending staff at operations and do not work simultaneously. The program is designed to have an NS 1 for a full year and an NS 6 for a full year. At present there are two junior residents at West Jefferson Medical Center. Residents have their own outpatient clinic which is supervised by the attending staff as well as seeing patients with the faculty. The situation is similar to that of Ochsner, with intensivists in all ICU's who are available for consultation, but do not assume primary care of neurosurgical patients.

Children's Hospital

Children's Hospital is a 201 bed nonprofit full service pediatric hospital located in Uptown New Orleans. All aspects of pediatric medical care are managed and patients come from all over the United States and many foreign countries. The clinics are attached to the hospital, and include a general neurosurgery clinic, a spasticity clinic, a craniofacial clinic and an epilepsy clinic. There are four full-time pediatric neurosurgeons based at Children's Hospital and all aspects of neurosurgical pediatric care including rehabilitation are covered. There is a 24 bed pediatric ICU, and a 36 bed Neonatal ICU. Three of the pediatric neurosurgeons operate 2 days per week. Dr. Nadell is chairman of the department and is no longer operating. He runs the rehabilitation unit as well as seeing clinic patients. There is only one neurosurgical resident at Children's Hospital who does surgical procedures with the attending staff. This is a NS 2 rotation. Children's Hospital has many busy subspecialty clinics and the resident participates in these clinics with the attending staff. The situation is similar to that of Ochsner, with intensivists in all ICU's who are available for consultation, but do not assume primary care of neurosurgical patients.

Duties of the Residents in Each Year

(This section is taken from the LSU Department of Neurosurgery ACGME Continued Accreditation Form)

Duties of the residents in the LSU Neurosurgical Residency program are structured to provide a graduated experience and involvement in neurosurgical patent management and preoperative, intraoperative , and postoperative patient care, foster a learning environment to develop the resident as a neuroscientist, and mentor the resident to mature as a thoughtful, caring, and compassionate physician.

PGY 1—First year resident in General Surgery

Prior to entering the LSU Neurosurgical Residency program, one year is spent in the LSU General Surgery residency program. Goals in the general surgery year are to develop skills in patient diagnosis and management, learn basic critical care and emergency management learn to manage ICU patients, recognize the complications of surgery and trauma, and learn basic surgical techniques. The LSU General Surgery program has had to make considerable adjustments following Hurricane Katrina and the destruction of Charity Hospital. This includes many out of town rotations including Earl K. Long Charity Hospital in Baton Rouge, Our Lady of the Lake Hospital in Baton Rouge, and the VA hospital in Biloxi, MS. The Medical Center of Louisiana-New Orleans-LSU University Hospital is treating emergency patients and trauma and is expected to expand its scope of operation, and Children's Hospital in New Orleans remains a valuable resource. Rotations in the first year include general and cardiothoracic surgery, anesthesia, ER and trauma, ICU, and pediatric surgery. Two months are spent on neurology with the LSU Department of Neurology. These two months are to develop expertise in the clinical diagnosis and management of neurological patients. We reserve the third month of neurology for the NS 2 year for a rotation on neurophysiology to cover EEG, EMG, and intraoperative neuromonitoring. One month of neurosurgery is given during the PGY 1 year to familiarize the resident with basic neurosurgical issues.

PGY 2 (NS 1)

The first year of neurosurgical residency is spent at West Jefferson Medical Center. There are three fulltime neurosurgeons and one interventional neuroradiologist working in this hospital.

Educational and Competency Goals

Patient Care

The residents will be able to:

- Perform and document comprehensive Neurosurgery history and physical examination [H&P] abilities
- Understand and interpret indications for laboratory studies and imaging
- Develop and demonstrate patient education and management skills
- Perform selected surgical procedures under direct supervision (lumbar discectomies, simple craniotomies, etc.)
- Assist in major surgical procedures and perform those portions of such procedures (under supervision) that are appropriate for level of training
- Develop skills necessary to establish and implement an effective patient management plan

Medical Knowledge

The residents will be able to:

- Perform above the 15th percentile on the Neurosurgery in-service examination
- Demonstrate a solid foundation of knowledge
- Develop accuracy in clinical evaluation skills
- Develop a solid foundation of knowledge in the specialties associated with each of the four rotations
- Demonstrate the foundation for clinical Neurosurgery problem solving and decision making

Practice-Based Learning and Improvement

The residents will be able to:

- Establish a solid evidence-based approach to patient care

Interpersonal and Communication Skills

The residents will be able to:

- Provide compassionate ward and outpatient care as determined by patients, families, colleagues and ancillary health professionals
- Develop and nurture sound and appropriate interpersonal and communication skills
- Focus on and develop a compassionate approach to deal with patients, to their illness and to the patients' families

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Begin the process of developing and understanding the variety of systems within which health care is provided
- Apply evidence-based information to clinical decision making in a cost effective manner

Clinical and Academic Duties

This is clinical junior neurosurgical resident rotation where early skills and habits will be developed. The service consists of a chief resident (NS 6), the NS 1 resident, and oral surgery resident and 3 to 4 LSU Medical Students. Hospital patients are generally in ICU or on the postop surgical floor although some consultation patients are on other floors. The census runs from about 12 to 20. Residents make early morning rounds, seeing and examining all patients, reviewing charts and studies, and planning dispositions. Rounds may then be made with the attending or later in the day depending on the operative schedule and meetings, emergencies, and other factors. The residents and medical students are fully integrated into the outpatient clinics. Patients are first seen by a resident and/or medical student. The attending then sees the patient with the resident and the case is discussed. The resident may dictate the consultation or postop note but it must be read, corrected, and signed by the attending. Out patient clinic is held every Wednesday afternoon, staffed by one or two faculty members. The caseload is such that the NS 1 resident is "one on one" with the attending in the operating room. The resident is allowed increasing involvement in the operation as surgical skills improve. Following operation the details are discussed and critiqued and recommendations for improvement made. Call is every third to fourth night. There is a neuropathology conference each Monday morning and neuroradiology conference every Wednesday morning where the neurosurgery department and the neurology department participate. On Fridays all residents attend grand rounds, basic science conference, or morbidity and mortality conference. This rotates among the three institutions. All residents also attend Brain Cutting/Neuropathology conference given once a month at West Jefferson Medical Center. When possible the resident is encouraged to attend any of the multiple conferences and lectures given at Ochsner or at the LSU Neuroscience Center. The resident is expected to present a small paper at the annual meeting of the Louisiana Neurosurgical Society, and encouraged to prepare papers for submission to journals and presentation at meetings. **All residents are required to submit one manuscript to a major peer review journal for completion of their academic year.**

PGY 3 (NS 2)

The first 6 months of the second year of neurosurgical residency is spent at Children's Hospital. Here the resident is exposed to a broad spectrum of pediatric neurosurgical disorders. There are four full-time fellowship trained pediatric neurosurgeons working at Children's. The second 6 months are on neuroscience rotations, including 3 months on neuroradiology, 2 months on neuropathology, and one month completing neurology emphasizing EEG, EMG, and intraoperative neuromonitoring.

Educational and Competency Goals

Patient Care

The residents will be able to:

- Teach medical students the fundamentals of the neurosurgical H&P
- Accurately interpret complex laboratory and imaging tests and other fundamental skills
- Develop complex patient diagnostic and managerial skills
- Perform selected surgical procedures under direct supervision e.g. laminectomy for steno sis and intermediate-level craniotomies
- Assist in major surgical procedures and perform those portions of the operation that are appropriate to the resident's level of training under guidance
- Demonstrates competency regarding performance of inpatient and surgical procedures
- Demonstrate clear and concise patient care plans
- Demonstrate the ability to implement the aforementioned patient care plans
- Acquire necessary skills to diagnosis and perform radiosurgery procedures. This includes pre-operative and peri-operative decision-making and dosimetry planning, frame placement, and procedural performance
- Acquire head trauma and commensurate critical care skills

Medical Knowledge

The residents will be able to:

- Perform above the 25^{th} percentile on the Neurosurgery in-service examination
- Demonstrate the ability to evaluate medical literature in journal clubs and on rounds
- Construct, modify, and implement education in neuropathology and neuroradiology

Practice-Based Learning and Improvement

The residents will be able to:

- Demonstrate an ongoing and improving ability to learn from errors
- Develop critical care and trauma care and technical skills
- Perform a clinical or basic research project that is appropriate for presentation at a national scientific meeting and for subsequent publication
- Develop fundamental research skills

Interpersonal and Communication Skills

The residents will be able to:

- Demonstrate ability to provide compassionate care to patients and their families
- Demonstrate a high level of interpersonal communication skills
- Demonstrate a compassionate and objective approach to patient counseling

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Apply cost effectiveness and evidence-based approaches to the previously acquired clinical decision making skills
- Understand practice management issues in Neurosurgery such as patient processing,

Evaluation and Management Coding, procedural terminology, documentation of services rendered, and other reimbursement process related issues

- Demonstrate an understanding of practice opportunities, practice types, health care delivery systems and medical economics

Clinical and Academic Duties

The PGY 3 resident spends six months at Children's Hospital under the direction supervision of the Staff Neurosurgeons. The resident is involved in the work up of patients admitted to the neurosurgical service. He/she is responsible for history and physical examination on elective admits and develops a management plan in conjunction with the attending. He/she reviews with the attending neurosurgeon the findings on diagnostic studies and discusses the treatment options. Surgical treatment is discussed and the procedure reviewed in detail. The resident assists at operation and is included in the postoperative management. Patients admitted to the PICU are provided care by the neurosurgical service with assistance from the intensivists. This includes inserting pressure monitors under the supervision of the attending to manage intracranial pressure.

Rounds are made with the attending on a daily basis. Consults will be answered either with the attending or initially by the resident and then presented to the attending. Emergency Room consults may be answered initially by the resident and presented to the attending. The resident is on call every third night. The resident attends selected clinics and evaluates new patients and presents the findings to the attending. He/she attends specialty clinics where he observes the interdisciplinary approach to craniofacial disorders, spasticity, etc. The resident collects the statistics for the neurosurgery service and presents them at the monthly Morbidity and Mortality conference. The resident keeps a personal log of all cases. To successfully complete the rotation, the resident must engage in a clinical research project to be presented at the annual Louisiana Neurosurgical Society meeting and submitted for publication.

The second 6 months are spent on non-clinical neuroscience rotations, 3 months on neuroradiology, 2 months on neuropathology, and one month on neurophysiology.

Neuroradiology: This 3 month rotation is at West Jefferson Medical Center under the Department of Radiology, Section of Neuroradiology. There are three fellowship trained neuroradiologists, one of whom does interventional neuroradiology. The goal of this rotation is primarily to acquire skill in diagnostic neuroradiology although some exposure to interventional neuroradiology is expected. A 6 month elective in endovascular neuroradiology is available to the NS 5 resident at West Jefferson Medical Center. Interpretation of CT of the brain and spine, CT angiography, MRI of the brain, spine, and peripheral nervous system, MRA, MR Spetroscopy, ultrasound of the cerebrovascular system including transcranial Doppler, intraoperative ultrasound, cisternography, PET, SPECT, and performance and interpretation of myelography will be covered.

Neuropathology: Contact has been made to send the NS 2 resident to M.D. Anderson Hospital in Houston for a two month rotation in neuropathology. While the program will be set there, it is anticipated that the resident will participate in brain cutting, slide review, tumor boards, conferences, and book study to acquire appropriate knowledge and skills in neuropathology

Neurophysiology: Dr. Leo Happel, a Ph.D. neurophysiologist who has been with the LSU Department of Neurosurgery for over 30 years directs this month of neurophysiology. The resident will learn the basics of EEG and EMG and will participate in Dr. Happel's very busy practice in intraoperative neuromonitoring. Dr. Happel is a recognized expert in the clinical use of SSEP's , BAER's, and direct nerve recordings. The resident also spends time reviewing basic neurophysiology. Dr. Happel gives frequent lectures to all neurosurgical residents at basic science conferences.

During this 6 month rotation, the resident is not on call for neurosurgery. **All residents are required to submit one manuscript to a major peer review journal for completion of their academic year.**

PGY 4 (NS 3)

The third year of neurosurgical residency is a junior clinical rotation at Ochsner Medical Center. There are three full time neurosurgeons at Ochsner including the Program Directorof LSU's Department of Neurosurgery, Dr. Roger Smith, and three neuroradiologisst. The busy neurosurgical practice treats most neurosurgical disorders.

Educational and Competency Goals.

Patient Care

The residents will be able to:

- Accurately interpret complex laboratory and imaging tests
- Begin to direct ward and clinic patient care
- Instruct residents and medical students regarding their performance of selected non-complex surgical procedures appropriate to their level of training
- Demonstrate competency regarding performance of inpatient and surgical procedures
- Demonstrate clear and concise patient care plans
- Demonstrate the ability to implement the aforementioned patient care plans
- Provide high level non-operative care
- Perform complex neurosurgery procedures (spine and cranial) and assist with those cases that are CR-level cases.

Medical Knowledge

The residents will be able to:

- Perform above the 50th percentile on the Neurosurgery in-service examination
- Teach and mentor PGY-2 residents
- Demonstrate the ability to evaluate the medical literature in journal clubs and on rounds
- Build upon the previously established foundation of knowledge in the specialties associated with each of the four rotations

Research

The residents will be able to:

- Perform a clinical or basic science research project appropriate for presentation at a national scientific meeting and for subsequent publication
- Demonstrate sound habits of personal scholarship and scientific inquiry

- Finalize the design of the research project to be carried out during the PGY –5 and 6 year
- Demonstrate an ongoing and improving ability to learn from errors
- Learning to identify and improve system problems that impede patient care and/or resident education.

Interpersonal and Communication Skills

The residents will be able to:

- Demonstrate a high level of interpersonal communication skills

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Demonstrate an understanding of practice opportunities, practice types, health care delivery systems and medical economics

Clinical and Academic Duties

This is clinical junior neurosurgical resident rotation where early skills and habits will be developed. The service consists of a chief resident (NS 5) the NS 3 resident, occasionally a general surgery or ER resident, and 3 to 4 LSU Medical Students. Since the hurricane we have had an occasional Tulane medical student also. Hospital patients are generally in ICU or on the postop surgical floor although some consultation patients are on other floors. The census runs from about 12 to 20. Residents make early morning rounds, seeing and examining all patients, reviewing charts and studies, and planning dispositions. Rounds may then be made with the attending or later in the day depending on the operative schedule and meetings, emergencies, and other factors. The residents and medical students are fully integrated into the outpatient clinics. Patients are first seen by a resident and/or medical student. The attending then sees the patient with the resident and the case is discussed. The resident may dictate the consultation or postop note but it must be read, corrected, and signed by the attending. The resident assigned to clinic for that day also covers the ER and inhouse consultations. This is every third day. The other days the resident participates in the operating room. The caseload is such that the NS 1 resident is “one on one” with the attending in the operating room. The resident is allowed increasing involvement in the operation as surgical skills improve. Following operation the details are discussed and critiqued and recommendations for improvement made. Call is every third night. There is a neuroradiology conference every Wednesday morning where the neurosurgery department and the neurology department participate. On Fridays all residents attend grand rounds, basic science conference, or morbidity and mortality conference. This rotates among the three institutions. All residents also attend Journal Club given once a month at Children’s Hospital and Brain Cutting/Neuropathology conference given once a month at West Jefferson Medical Center. When possible the resident is encouraged to attend any of the multiple conferences and lectures given at Ochsner or at the LSU Neuroscience Center. The resident is expected to present a small paper at the annual meeting of the Louisiana Neurosurgical Society, and encouraged to prepare papers for submission to journals and presentation at meetings. **All residents are required to submit one manuscript to a major peer review journal for**

completion of their academic year.

PGY 5 (NS 4)

Educational and Competency Goals

Patient Care

The residents will be able to:

- Demonstrate competency regarding performance of inpatient and surgical procedures
- Demonstrate clear and concise patient care plans
- Demonstrate the ability to implement the aforementioned patient care plans

Medical Knowledge

The residents will be able to:

- Demonstrate the ability to evaluate the medical literature in journal clubs and on rounds
- Pass the in-service evaluation for credit

Research

The residents will be able to:

- Demonstrate a high capacity for work and intensity in the laboratory/research environment
- Develop problem solving skills that can be used to design, implement and report research that is relevant to the clinical arena
- Establish sound research and research-related problem solving habits, which includes becoming extraordinarily familiar with the relevant literature
- Become an integral component of the research team
- Demonstrate an ongoing and improving ability to learn from errors

Interpersonal and Communication Skills

The residents will be able to:

- Demonstrate a high level of interpersonal communication skills
- Communicate effectively with all members of the research team
- Utilize the aforementioned communication, interpersonal, and team building skills to effectively participate in and lead research projects

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Demonstrate an understanding of practice opportunities, practice types, health care delivery systems and medical economics

Clinical and Academic Duties

This year is dedicated to research. Research is carried out at the LSU Neuroscience Center, directed

by Dr. Nicolas Bazan. The Neuroscience Center is widely known for research in cerebral ischemia and degenerative diseases. The Center has recently added a stroke investigator from the University of Miami. Spinal cord regeneration and peripheral nerve pathology are other areas of interest. Dr. Gabriel Tender on our full-time neurosurgical academic faculty has interests in pain and spine biomechanics. The resident is expected to join or design a project that can be reasonably completed within a year and plan to publish this work in a peer-reviewed journal. **All residents are required to submit one manuscript to a major peer review journal for completion of their academic year.**

PGY 6 (NS 5)

Educational and Competency Goals

Patient Care

The residents will be able to:

- Demonstrate competency regarding performance of inpatient and surgical procedures
- Demonstrate clear and concise patient care plans
- Demonstrate the ability to implement the aforementioned patient care plans

Medical Knowledge

The residents will be able to:

- Demonstrate the ability to evaluate the medical literature in journal clubs and on rounds
- Pass the in-service evaluation for credit

Research

The residents will be able to:

- Demonstrate a high capacity for work and intensity in the laboratory/research environment
- Develop problem solving skills that can be used to design, implement and report research that is relevant to the clinical arena
- Establish sound research and research-related problem solving habits, which includes becoming extraordinarily familiar with the relevant literature
- Become an integral component of the research team
- Demonstrate an ongoing and improving ability to learn from errors

Interpersonal and Communication Skills

The residents will be able to:

- Demonstrate a high level of interpersonal communication skills
- Communicate effectively with all members of the research team
- Utilize the aforementioned communication, interpersonal, and team building skills to effectively participate in and lead research projects

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Demonstrate an understanding of practice opportunities, practice types, health care delivery systems and medical economics

Clinical and Academic Duties

The first six months of the NS 5 year are spent on a neurosurgical elective, where the resident can gain additional exposure and experience in a subspecialty of neurosurgery. This can prepare the resident for a post-residency fellowship, develop a beginning for an academic career, or simply develop an area of expertise for future neurosurgical practice. This elective is chosen by the resident and can be done at our or another institution. This is considered a non-clinical rotation, and the resident does not have call obligations at our hospitals, although call for the subspecialty may be part of the elective. Examples might be a 6 month endovascular rotation with Doctor Dawson, a rotation in functional neurosurgery, complex spine, pain management, stereotactic radiosurgery, neurooncology, or another field of special interest. During this time the resident will also study in depth for the ABNS Primary Examination. He is expected to take the exam for credit in the spring of NS 5 year.

The second six months, the resident returns to Ochsner Medical Center at a sub chief resident level. In this capacity, he is responsible for all aspects of patient care at that institution, under the supervision of the attending physicians. He in turn supervises the NS 3 resident, rotating residents, and medical students. He is responsible for organizing morning rounds, advising the attending physicians of problems and discussing patient management issues, assigning resident participation in operative cases, organizing conferences at Ochsner Medical Center, participating in outpatient clinics and studying for the ABNS Primary Exam. **All residents are required to submit one manuscript to a major peer review journal for completion of their academic year.**

PGY 7 (NS 6)

Educational and Competency Goals

Patient Care

The residents will be able to:

- Demonstrate ability to perform all major neurosurgical procedures
- Demonstrate the highest level of patient care skills, problem solving skills and technical skills
- Manage and administrate the complexities of a large clinical and academic service

The residents will be able to:

- Instruct and nurture junior residents in critical care related procedures, intensive care unit, call, etc.
- Demonstrate ability to teach effectively
- Manage and lead the patient care conference
- Assist program director in overseeing personal, academic and clinical growth and development of junior residents

- Participate actively and lead conferences in a manner that demonstrates a high level of global awareness regarding clinical neurosurgery, applied research, an understanding of the literature, neurosurgical education and program building

Practice-Based Learning and Improvement

The residents will be able to:

- Manage and administrate the complexities of a large clinical and academic service
- Develop skills as program builder and an administrator of the neurosurgical service

Interpersonal and Communication Skills

The residents will be able to:

- Demonstrate a high level of interpersonal communication skills

Professionalism

The residents will be able to:

- Demonstrate a high level of professionalism at all times

System Based Practice

The residents will be able to:

- Demonstrate understanding of legal issues in neurosurgery
- Demonstrate a high level of understanding regarding practice types, medical economics and medical politics

Clinical and Academic Duties

The NS 6 year, the resident returns to West Jefferson Medical Center as Chief Resident. In this capacity, the resident is responsible for the day to day running of the neurosurgical service under the supervision of the faculty. He is expected to discuss and plan patient management including surgical operations with the attendings, take a major part in surgical procedures, and take a leading role in postoperative care. He is responsible for making resident assignments to the operating room, developing call schedules, and supervising the junior resident and medical students. He provides overall supervision for conferences including data collection for morbidity and mortality conferences, works with the junior residents to assure compliance with case log recording and monitoring of duty hours, and works with the Chairman of Neurosurgery and the Program Director to provide an academic learning experience. He communicates with Chief Residents in other medical and surgical specialties to coordinate consultations, manage multitrauma or other cases requiring team management. At this level the resident needs to be well versed in billing and coding, medical liability and patient safety issues, governmental regulatory concerns and practice development. It is anticipated that the finishing resident will be fully qualified to practice the highest level of neurosurgery. **All residents are required to submit one manuscript to a major peer review journal for completion of their academic year.**

LSUHSC DEPARTMENT OF NEUROSURGERY CONFERENCES

The conferences occur during a block of time totally protected from elective clinical activity. Attendance is required by all residents and medical students on the service. Faculty will cover emergency clinical calls during this time. Designated faculty are assigned to oversee each conference. All faculty members are encouraged to attend all conferences and are required to attend selected conferences.

	1st Friday	**2nd Friday**	**3rd Friday**	**4th Friday**
12:30-1pm	Lunch: Meet with Chair and/or program director	Lunch:Meet with Chair and/or program director	Lunch:Meet with Chair and/or program director	Lunch:Meet with Chair and/or program director
1-2 pm	Neurophysiology/Board Review	Neurophysiology/Board Review	Neurophysiology/Board Review	Neurophysiology/Board Review
2-3pm	Basic Science Lecture	Basic Science Lecture	Morbidity and Mortality	Basic Science Lecture
3-4:30pm	Neurosurgery Grand Rounds	Neurosurgery Grand Rounds	Morbidity and Mortality 2-4 pm	Neurosurgery Grand Rounds

Resident Core Curriculum Conference: All residents, medical students and designated faculty will attend weekly. Approximately 100 lectures are given that cover the knowledge base requirements of the Neurosurgery Residency Core Curriculum. These are repeated every 2 years. The conferences are held at WJMC, OFH, and CH (one month each).

M&M: Morbidity and Mortality Conference covering the cases of the previous month. Literature relevant to selected cases will be reviewed by the presenting neurosurgery resident. All faculty and residents are required to attend.

OTHER CONFERENCES

Journal Club: Several recent meritorious journal articles are presented and reviewed in depth by a resident with a designated faculty, and placed in context using classically quoted articles on that topic. Designated faculty and all residents are required to attend.

Neuropathology Conference: Faculty and all residents will attend neuropathology conferences held at WJMC. Led by a neuropathologist, this conference will review a general neuropathology topic and highlight interesting cases from the preceding month, the first and third Monday. Brain cutting conference is held the last Monday of each month at WJMC.

Neurosurgery Case conference: This conference is held at West Jefferson Medical Center on the third Monday of each month, 7 AM. An interesting case chosen by the resident or faculty is presented for discussion. Differential diagnosis and management options are discussed in detail to formulate a treatment plan. The residents and students are asked to each present their plans for treatment with explanations for their choices.

Neuroradiology Conference: Faculty and residents will attend weekly (each Wednesday 7 AM) Neuroradiology conferences at West Jefferson Medical Center held by the Neuroradiologist. Interesting cases are reviewed weekly alternating with lectures.

Policies and Procedures

SUPERVISION OF RESIDENTS

Purpose:

To ensure that residents are provided adequate and appropriate levels of supervision during the course of the educational training experience and to ensure that patient care continues to be delivered in a safe manner.

Policy and Procedure:

All program faculty members supervising residents must have a faculty or clinical faculty appointment in the School of Medicine or be specifically approved as supervisor by the Program Director. Faculty schedules will be structured to provide residents with continuous supervision and consultation.

Residents must be supervised by faculty members in a manner promoting progressively increasing responsibility for each resident according to their level of education, ability and experience. Residents will be provided information addressing the method(s) to access a supervisor in a timely and efficient manner at all times while on duty.

The program provides additional information addressing the type and level of supervision for each post-graduate year in the program that is consistent with ACGME program requirements and, specifically, for supervision of residents engaged in performing invasive procedures.

1. To provide patients with quality care and house officers with a meaningful learning experience, a supervising attending physician shall be clearly identified for each patient admitted to or consulted by the neurosurgical service. It is the responsibility of the house officer to notify an attending physician that a consultation or admission have been initiated on his/her service, based on the call schedule and back-up mechanisms established in the department.

2. The supervising attending physician is ultimately responsible for all recommendations rendered

and care delivered by house officers, paramedical personnel and other trainees on the neurosurgical service.

3. Supervision shall be readily available to all house officers on duty. Each program or service in the department shall maintain a clear call list of attending physicians, with appropriate back up in the event the supervising physician is not immediately available (this typically represents another attending faculty on call that same day). A comprehensive call list of house officers and attending physicians is disseminated to all switchboard operators, patient affair coordinators, clinical care areas and all covering house officers on a monthly basis.

4. Supervision shall be conducted to ensure that patients receive quality care and house officers assume progressively increased responsibility in accordance with their ability and experience, based on curriculum objectives for the respective level of training.

5. Levels of supervision include attending physician demonstrating a procedure, assisting with the procedure, present physically in the area where intervention is performed, attending available by telephone, senior house officer or other supervisor present physically or available by telephone. The attending physician in charge of a respective procedure shall determine the level of supervision for a particular house officer and the specific invasive procedure.

6. The responsible attending physician may delegate supervision of more junior house officer to a more senior resident as appropriate. These determinations shall be consistent with the individual house officer's knowledge base and skills, the complexity of the case and procedure, and the house officer's prior evaluations regarding levels of performance per the residency program core curriculum objectives for each level of training.

7. House officers must request help when the need for assistance is perceived, and responsible attending physicians must respond personally when such help is requested. When a patient's attending physician is not available, a previously designated physician or the attending on call shall assumes all coverage responsibilities for the patients.

8. The Chief Resident shall relay to the Department Chair or the Program Director any incident where another house staff did not notify a responsible faculty member, a responsible faculty member was not responsive, or any other breach of supervision as outlined in this policy.

MOONLIGHTING

Purpose

To ensure that professional activities falling outside the course and scope of the training program are consistent with policies and guidelines set forth by the Accrediting Council for Graduate Medical Education (ACGME) and Graduate Medical Education Committee. Moonlighting is defined as any professional activity not considered an integral part or required rotation of the curriculum for a postgraduate training program, irrespective of remuneration. Residents will not be required to participate in moonlighting activities.

Policy

Moonlighting is not permitted at any time during Neurosurgery Residency

Resident Schedules

VACATIONS

Each resident will have four weeks of vacation in every academic year, **not consecutive**.

It is expected that the vacation weeks will take place at a time convenient for the other residents as well as the faculty in the program.

A vacation request must be submitted to the chief resident and/or program director three months in advance of time requested.

In arranging schedules, special circumstances and needs are always given the highest priority. If all things are otherwise equal, resident seniority is considered in cases of timing conflicts.

If present, chief resident will then submit the years' vacation plan to the Program Director for approval or conflict resolution.

If there are questions or concerns from any of the resident staff they are welcome to contact the Program Director at any time.

No vacations are allowed in June or July of each year unless special circumstances arise.

MEETINGS:

Residents may go to conferences if they have had an abstract accepted as a poster or presentation. The Department will pay for reasonable travel expenses. No more than one resident may leave a service to attend a meeting.

The Chief Resident may attend AANS meeting in the fall of their Chief Year, the junior resident, PGY6 may attend the CNS meeting.

Generally, during the PGY 4 year, the resident attends the one-week Research Update in Neuroscience for Neurosurgeons RUNN course in Woods Hole, MA to assist in preparation for research rotations.

ROTATIONS:

Resident rotations are designed to optimize the educational experience of each individual resident, to allow progression per curriculum objectives and to satisfy the requirements of the ACGME in Neurological Surgery.

On all rotations, all residents may be asked to participate in the call schedule to some degree, unless on vacation.

The rotation schedules are generally available a year in advance. All residents should feel free to contact the Program Director with questions or other concerns regarding the rotations. The rotation

schedule should not be changed without the knowledge and consent of the Program Director.

SURGICAL HOUSESTAFF ASSIGNED TO NEUROSURGERY SERVICE

Surgical interns and housestaff assigned to the neurosurgical service shall be integrated under the oversight of neurosurgery residents. They shall assist in clinical and call activities, although the priority of assignment to surgical procedures shall be for neurosurgery residents.

NEUROSURGERY RESIDENT ROTATION

The proposed neurosurgery block rotation appears on the following page.

PROPOSED NEUROSURGERY BLOCK ROTATION

ROTATION	7/06-12/06	1/07-6/07	7/07-12/07	1/08-6/08	7/08-12/08	1/09-6/09	7/09-12/09	1/10-6/10	7/10-12/10	1/11-6/11	7/11-12/11	1/12-6/12
Cherqui	OMC NS3	CH NS3	NSCI NS4	R NS4	R NS5	WJ NS5	CH Res OMC NS6	CH Res WJ NS6	X	X	X	X
Robert	WJ NS3	WJ NS3	CH NS4	NSCI NS4	R NS5	R NS5	CH Res WJ NS6	CH Res OMC NS6	X	X	X	X
Gachiani	CH NS1	OMC NS1	OMC NS2	WJ NS2	NSCI NS3	WJ NS3	S.R. NS4	WJ NS4	CH Res OMC NS5	CH Res WJ NS5	R NS6	R NS6
Badr	WJ NS1	WJ NS1	OMC NS2	OMC 2 m Neuro NS2	CH NS3	OMC NS3	R NS4	R NS4	NSCI NS5	S.R. NS5	CH Res OMC NS6	CH Res WJ NS6
Owen	OMC NS1	OMC NS1	WJ NS2	CH NS2	WJ 2 m Neuro NS3	NSCI NS3	S.R. NS4	R NS4	R NS5	OMC NS5	CH Res WJ NS6	CH Res OMC NS6
Yeremeyeva	PGY1	PGY1	WJ NS1	WJ NS1	OMC NS2	CH NS2	NSCI NS3	OMC NS3	R NS4	R NS4	S.R. NS5	OMC/CH /WJ NS5
Trahan	X	X	PGY1	PGY1	OMC NS1	OMC NS1	CH NS2	NSCI NS2	WJ NS3	WJ NS3	R NS4	R NS4
2009 Resident	X	X	X	X	PGY1	PGY1	OMC NS1	OMC NS1	CH NS2	NSCI NS2	WJ NS3	WJ NS3
2010 Resident	X	X	X	X	X	X	PGY1	PGY1	OMC NS1	OMC NS1	CH NS2	NSCI NS2
2011 Resident	X	X	X	X	X	X	X	X	PGY1	PGY1	OMC NS1	OMC NS1

1 OMC= Ochsner Medical Center
2 WJ= West Jefferson Medical Center
3 CH= Children's Hospital
4 NSCI = Neuroscience: Neuroradiology, Neuropathology, Neurophysiology
5 R = Research
6 S.R.= Elective

CALL SCHEDULES

The call schedule for each hospital is primarily the responsibility of the covering residents. Problems with and changes in the schedule must be made known to the Chief of the respective service.

Neurosurgery call is taken from resident's home. No in-house call is expected unless necessitated by patient care needs.

The call (taken from home) schedule is expected to be every 2nd or 3rd night on all services, averaged during a month.

No resident will take more than two consecutive nights of call. At their request, the residents are allowed take call one full weekend (sat and sun) call from home and then have the following two weekends totally off. Patient care and educational objectives shall be monitored, and if the long weekends are too great a burden for one resident, the schedule will be changed. On-call rooms are available at each hospital for resident use.

Resident work hours shall be monitored on an on-going basis, with the aim of modifying call policies to insure continued full compliance with the ACGME requirements.

POLICY ON RESIDENT – DUTY HOURS

Duty hours are defined as all clinical and academic activities related to the residency program, i.e. patient care (both inpatient and outpatient), administrative duties related to patient care, the provision for transfer of patient care, time spent in-house during call activities, and scheduled academic activities such as conferences. Duty hours do not include reading and preparation time spent away from the duty site.

Duty hours will be limited to 88 per week at Ochsner, 80 hours per week at WJMC and Children's, averaged over a four-week period, inclusive of all in-house call activities.

Residents will be provided with a minimum of 1 day in 7 free from all educational and clinical responsibilities, averaged over a 4-week period. One day is defined as one continuous 24-hour period free from all clinical, educational, and administrative activities.

Adequate time for rest and personal activities will be provided. This will consist of a 10-hour time period provided between all daily duty periods and after in-house call.

Residents are not to work longer than 30 hours continuous at any time. Some exceptions can be made for unusual cases offering great educational value. These cases must be brought to the attention of the program director.

MEALS

WJMC, OFH, and Children's Hospital offer free meals to physicians. Contact the faculty of each site for instructions.

PAGERS

The Louisiana State University provides digital pagers for the residents. Each resident retains the same pager number for the duration of their training. Each pager is allowed one free battery per month which can be obtained form the hospital operators. At each of the main Neurosurgery offices, extra batteries are available from the secretarial staff.

If a pager is lost or stolen please contact the Program Coordinator for immediately for replacement.

RESIDENT EVALUATIONS

Purpose

The program recognizes the need to provide a structure by which performance related to the training program will be assessed and consideration given for promotion to the next level of training. Evaluation will be provided in accordance with Graduate Medical Education Committee policy and ACGME common program requirements.

Note: This policy addresses performance relating to academic program requirements and does not supersede other institutional or legal requirements that must be met by the resident to remain in a training program.

Policy

Residents will receive written evaluation, goals and objectives from their faculty for each year and/or major rotation of their training program. All residents participating in training will be provided, at a minimum, a semi-annual formal evaluation developed by the faculty. Residents shall be allowed to review semi-annual evaluations contained in permanent records and other evaluations as determined by program policy.

The formal written evaluation shall:

1. Address each of the six ACGME core competencies.
2. Include well defined scoring and rating criteria that seek to minimize subjective assessment of performance.
3. Include language indicating satisfactory performance, advancement to the next level of training (if applicable) or provide specific actions and performance requirements by the resident to return to a level of satisfactory performance or advancement to the next level of training.
4. Be signed and dated by the resident and faculty.
5. Become a part of the permanent record file for the resident.

A sample copy of the formal written evaluation appears on the next three pages.

ROTATION EVALUATION FORM FOR NEUROSURGERY

RESIDENTS ON CLINICAL ROTATIONS

LSUHSC – DEPARTMENT OF NEUROSURGERY

Name: _____PGY _____

Evaluator:_____ Rotation: _____Dates of Rotation: _____

Critically Evaluate Using This Rating Scale: 6 5 4 3 2 1 0

PATIENT CARE: Setting and enforcing high standards for the quality of patient care delivered on the unit. Incorporating patient and physician needs and concerns into decision making and organizational skills	**Rating 6-0** (see scale above)	**Not Assessed**
-Enforces highest standards for excellence in patient care (e.g. state –of-the-art clinical practices and safeguards).		
-Ensures the highest possible satisfaction of patients and their families.		
- Resident developed, negotiated, and implemented effective patient management plans.		
-Develops and implements effective patient management.		
-Resident is technically competent regarding the performance of inpatient and surgical procedures.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

MEDICAL KNOWLEDGE: Residents are expected to demonstrate knowledge of established and evolving biomedical, clinical, and social science principles, and to apply this knowledge to patient care and the education of others.	**Rating 6-0**	**Not Assessed**
-Resident applied an open-minded, analytical approach to acquiring knowledge.		
-Resident accessed and critically evaluated current (medical)information applicable to neurosurgery/neuroscience.		
-Resident acquired and developed a clinically applicable foundation of knowledge regarding clinical neurosurgery and relevant medical diagnostic and therapeutic principles. -Resident applied this knowledge to clinical problem solving, clinical decision making, and critical thinking.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

PRACTICE-BASED LEARANING AND IMPROVEMENT: Residents are expected to be able to use scientific evidence and methods to investigate, evaluate, and improve patient care practices.	**Rating 6-0**	**Not Assessed**
-Resident identified areas for improvement and implemented strategies to enhance knowledge, skills, attitudes, and processes of care.		
-Resident developed and maintained a willingness to learn from errors and use errors to improve the system or process of care.		
-Resident used information technology or other available methodologies to access and manage information, support patient care decisions, and enhance both patient and physician education.		
-Resident analyzes and evaluates practice opportunities and implemented strategies to continually improve the quality of patient practice.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

INTERPERSONAL AND COMMUNICAITON SKILLS: Residents are expected to demonstrate interpersonal and communication skills that enable them to establish and maintain professional relationships with patents, families, and other members of healthcare teams.	**Rating 6-0**	**Not Assessed**
-Resident provided effective and professional consultation to other physicians and healthcare professionals and sustained therapeutic and ethically sound professional relationships with patients, their families, and colleagues.		
-Resident used effective listening, nonverbal, questioning, and narrative skills to communicate with patients and families.		
-Resident interacted with consultants in a respectful, appropriate manner.		
-Resident maintained comprehensive, timely, and legible medical records		
-Resident communicates effectively and has established professional relationships with clerical, nursing, and other allied health personnel.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

PROFESSIONALISM: Residents are expected to demonstrate behaviors that reflect a commitment to continuous professional development, ethical practice, and understanding and sensitivity to diversity, and a responsible attitude towards their patients, their patients, their profession, and society.	**Rating 6-0**	**Not Assessed**
-Resident demonstrated respect, compassion, integrity, and altruism in his/her relationship with patients, families, and colleagues.		
-Resident demonstrated sensitivity and responsiveness to the gender, age, culture, religion, sexual preference, socioeconomic status, beliefs, behaviors, and disabilities of patients and professional colleagues.		
-Resident adhered to principles of confidentiality, scientific/academic integrity, and informed consent.		
-Resident identified deficiencies in peer performance.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

SYSTEM BASED PRACTICE: Residents are expected to demonstrate both an understanding of the context and systems in which healthcare is provided, and ability to apply this knowledge to improve and optimize healthcare.	**Rating 6-0**	**Not Assessed**
-Resident understood, accessed, and utilized resources, providers, and systems necessary to provide optimal care.		
-Resident applies evidence-based, cost conscious strategies to prevention, diagnosis, and disease management.		
-Resident collaborated with other members of healthcare team to assist patient in dealing effectively with complex healthcare systems and to improve the systematic process of care.		
-Resident understood limitations and opportunities inherent in various practice types and delivery systems, and developed strategies to optimize care for the individual patient.		
☐ **PERFORMANCE NEEDS ATTENTION OVERALL EVALUATION IN THIS AREA**		

Comments:_____

Overall Comments:

_____

_____

I have discussed this evaluation with the resident (required prior to submission; faculty must counsel and obtain resident signature_____ YES

Attending's Signature_____

Resident Signature_____ _____ **Date:**_____

RESIDENT EVALUATION OF FACULTY/FACULTY EVALUATION POLICY

Residents are required to complete evaluations of the faculty twice a year in conjunction with the residents' evaluation (July-December and January-June). The Residency Coordinator will distribute and collect the evaluations. He/she will combine all the evaluations onto one form, and distribute the cumulative report to the faculty member in order for the process to be confidential. A sample copy of each required evaluation appears below.

TRAINEE EVALUATION OF FACULTY FORM

LSUHSC-New Orleans		
DEPARTMENT OF NEUROLOGICAL SURGERY		
FACULTY EVALUATION		
ROTATION:	**FACULTY:**	
SERVICE DATES:		
RATING SCALE: **Please enter the number in parentheses**	**Outstanding (5)** **Above Average (4)** **Average (3)** **Unsatisfactory (2)** **Poor (1)**	
Is the faculty member sharing knowledge and experience with the residents?		
Is the faculty member including residents in the outpatient decision-making process?		
Is the faculty member discussing operative plans effectively with residents before arrival in the OR?		
Is the faculty member sharing technical experience with residents at a level consistent with post graduate year		
Is the faculty member helpful/involved/available for post-operative management?		
Are you being treated fairly by this faculty member?		
Is this faculty member participating in educational conferences?		
RATING SCALE: **Please enter the number in parentheses**	**Outstanding (5)** **Above Average (4)** **Average (3)** **Unsatisfactory (2)** **Poor (1)**	
PLEASE RATE THE FACULTY MEMBER ON THE FOLLOWING QUALITIES		
Clinical Skills		
Communication Skills		
Surgical Technique		
Teaching Ability		
Research Ability		
Quality of instruction in the clinic setting		

Quality of instruction in the inpatient setting		
Quality of instruction in the operating room		
Leadership		
SUGGESTIONS FOR IMPROVEMENT OF FACULTY MEMBER'S PERFORMANCE REGARDING PATIENT CARE/RESIDENT EDUCATION:		

Trainee Evaluation of Rotation (Site) Form

DEPARTMENT OF NEUROLOGICAL SURGERY	
RESIDENT ROTATION EVALUATION	
ROTATION:	
SERVICE DATES:	
RATING SCALE: **Please enter the number in parentheses**	**Outstanding (5)** **Above Average (4)** **Average (3)** **Unsatisfactory (2)** **Poor (1)**
SERVICE	
Educational Value of the Rotation	
Operative Experience	
Exposure to patients in the outpatient setting	
Time for reading and study	
Sufficient "physician extenders" to reduce workload (PA's, APN's,Nurses)	
RATING SCALE: **Please enter the number in parentheses**	**Strongly Agree (5)** **Agree (4)** **Neutral (3)** **Disagree (2)** **Strongly Disagree (1)**
CLINICAL EXPERIENCE	
OUTPATIENT SETTING	
There was an adequate variety of problems seen	

Residents were given appropriate responsibility for patient care	
INPATIENT SETTING	
There was an adequate variety of problems seen	
There was an appropriate quantity of patient volume	
Residents were given appropriate responsibility for patient care	
Residents were given enough time to attend to each patient	
Residents received ample staff support relative to patient load	
LEARNING EXPERIENCE	
Residents had appropriate access to procedures	
Quality feedback was provided to the residents	
Independent thinking was encouraged	
Residents received quality supervision	
The rotation offered quality library facilities	
Educational programs/conferences were regularly conducted	
Educational programs/conference were of high quality	
Faculty regularly attended educational programs/conferences	
FACULTY	
The faculty had a strong knowledge of medicine	
The faculty were appropriately available for consultation/supervision	
The faculty demonstrated strong interest in the resident's progress	
The faculty demonstrated quality teaching skills	
The faculty served as quality role models	
RESIDENT CALL COVERAGE	
The on call schedule was appropriate for the service	
The call schedule regularly exceeded the Q3 guidelines	
RATING SCALE: Please enter the number in parentheses	**Agree(3) N/A (2) Disagree(1)**
PROFESSIONAL DEVELOPMENT	
Training in practice management skills was of good quality	
Training in consulting and referral skills was of good quality	
Training in clinical problem solving was of good quality	
Training in charting skills awas of good quality	
Training in professional judgement was of good quality	
Training in time management skills was of good quality	
Training in teaching skills was of good quality	
Teaching about patient-doctor relationships was of good quality	
Teaching about relationships with colleagues was of good quality	
Training in communication skills was of good quality	
Training in team participation skills was of good quality	
	0

APPENDIX A

Resident Curriculum Guidelines for Neurosurgery

CONTENTS

INTRODUCTION

This curriculum was created in an effort to detail the body of knowledge, which should be attained by an individual completing residency training in Neurological Surgery. The American Board of Neurological Surgery defines the specific structure of resident education in Neurological Surgery and the Residency Review Committee periodically examines each program for compliance. It is not the intent of this curriculum to direct or influence these two entities in any way. The curriculum is meant to serve as a template to be utilized by individual Neurosurgery Residency Program Directors and residents as they see fit. In many respects, this comprehensive and specific curriculum delineates the "ideal" and therefore complete compliance to the curriculum will be difficult or impossible to achieve for most if not all programs. Nevertheless, it represents a goal toward which to strive.

This document will assist program directors, faculty, and residents in structuring an adequate postgraduate experience in Neurological Surgery. It should serve to create an organizational structure of academic, clinical, and technical criteria for the training of residents in Neurological

Surgery. The curriculum should prompt established training programs to examine their educational experience and assist new programs in designing a comprehensive educational experience. The goal is to improve patient care by assuring residents completing training have achieved the highest possible level of competency in Neurological Surgery.

Although each portion of the curriculum has been examined by a number of recognized experts and leading educators in Neurological Surgery, it is recognized that an absolute consensus concerning the definition of essential knowledge for the practice of Neurological Surgery has not, and will not, be achieved. Despite this inevitable shortcoming, wide distribution of this resource to program directors, faculty, and residents will allow for each program to maximize its strengths and address its weaknesses and promote constructive dialogue amongst all involved parties.

It is noted that there is redundancy in the curriculum. This has arisen because many areas of neurosurgery overlap. The curriculum structure is based on performance. This will hopefully facilitate self-directed resident study. It also will impart some objectivity to periodic resident evaluations. The curriculum is constructed in such a manner that the educational experience is divided into three levels - Junior, Middle, and Senior. The resident should display competency in each level before progressing to the next. Those individuals who do not stay on track will be promptly identified in an objective manner, thereby enabling more timely remedial attention or dismissal. Furthermore, it will force each program to examine its faculty and the structure of the basic and clinical training to assure an optimal educational experience. The curriculum does not define how information is imparted, only the body of knowledge which must be mastered. It is up to each program to determine whether achievement of the goals will be accomplished through conferences, required readings, scheduled lectures or workshops, etc.

Adequate supervision of the resident performance is critical to assure proper care of the patient and learning of the resident. It is recognized, however, that a great deal of learning also takes place without supervision. Programs should be structured to allow residents to act independently at various tasks commensurate with their skills and the specific medical situation.

Although the assessment of resident, faculty, and program performance is extremely important, the curriculum does not include specific outcomes measures. Presently, resident evaluation is performed in a non-uniform manner by the faculty and directors of each individual program. Hopefully there will be homogeneous evaluation of the knowledge and performance for each level of residency in the future.

Finally, it should be recognized that a great number individuals have provided input and reviewed this work. Many of these persons are not listed as authors but without their assistance the completion of this curriculum would not be possible.

NEUROANATOMY

UNIT OBJECTIVES

Demonstrate knowledge of anatomy that is pertinent to the diagnosis of diseases of the nervous system and the practice of neurological surgery.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

General

1. Review the embryological development of the brain, cerebellum, brain stem, glial elements, spinal cord, conus medullaris, cauda equina, sympathetic and parasympathetic systems and the peripheral nervous system.
2. Discuss the embryologic development of the skull, craniovertebral junction, and spine.
3. Describe and differentiate the different types of neurons.
4. Discuss the microanatomy of the neuron including the:
    a. cell body
    b. dendritic process
    c. axonal process
5. Diagram and describe the microanatomy of the synapse.
6. List the microglial elements and review their microanatomy:
    a. astrocytes
    b. oligodendrocytes
    c. microglia
    d. ependyma
    e. choroid epithelium
7. Diagram and describe in detail the carotid and vertebral arteries and their branches which provide blood supply to the face, scalp, skull, meninges, brain, brain stem, cerebellum, and rostral spinal cord.
8. Discuss in detail the arterial blood supply to the spinal cord. Include in the discussion the spinal and radicular arteries and the concept of watershed ischemia.
9. Identify and review the venous drainage of the central nervous system.
10. List and identify the bones of the skull.
11. Describe each of the sutures of the skull.
12. Identify each named foramen of the skull and list its contents.
13. Describe the anatomy of the meninges including the:
    a. dura mater
    b. arachnoid mater
    c. pia mater
14. Describe the anatomy of the dura including the falx cerebri and tentorium.
15. Review the layers of the scalp and discuss its innervation.
16. Diagram the cerebral ventricles.
17. Discuss the major arachnoid cisterns.
18. Review the anatomy of the arachnoid villi.
19. Discuss the anatomic correlates pertinent to the production, flow, and reabsorption of cerebrospinal fluid.
20. Identify and describe the gross anatomy of the spine including:
    a. atlas
    b. axis
    c. subaxial cervical vertebrae
    d. thoracic vertebrae
    e. lumbar vertebrae
    f. sacrum

g. coccyx
h. intervertebral disc complex
i. supporting ligaments of the spine

21. List the muscles related to the skull and spine.
22. Describe the gross anatomy of the neck.
23. Discuss the anatomical basis for the blood-brain barrier in detail.

Central Nervous System

1. Describe the gross anatomy of the brain, brain stem, cerebellum, cranial nerves, and spinal cord in detail.
2. Describe the anatomy of the cerebral cortex in detail including:
    a. cortical layers
    b. sensory areas
    c. motor areas
    d. prefrontal cortex
    e. fiber tracts
    f. calcarine cortex
3. Describe the anatomy of the olfactory pathways, hippocampal formation and amygdala in detail including:
    a. rhinencephalon
    b. olfactory pathways
    c. anterior commissure
    d. hippocampal formation (including cytoarchitecture)
    e. amygdala
    f. limbic system
4. Describe the anatomy of the corpus striatum in detail including:
    a. striatum
    b. globus pallidus
    c. claustrum
    d. subthalamic region
    e. striatal afferent and efferent connections
    f. pallidal afferent and efferent connections
    g. pallidofugal fiber systems
5. Describe the anatomy of the hypothalmus and pituitary in detail including:
    a. cytoarchitecture of the hypothalmus
    b. afferent and efferent connections of the hypothalmus
    c. supraoptic nuclei and tracts
    d. hypophysial portal system
    e. anatomy of the pituitary stalk
    f. anterior and posterior pituitary
    g. cellular organization of the anterior pituitary
    h. hormonally active cells of the hypothalmus and pituitary
6. Describe the anatomy of the diencephalon in detail including:
    a. midbrain-dienencephalon junction
    b. caudal diencephalon
    c. epithalamus
    d. thalamus (including nuclei)

   e. thalamic radiations
   f. internal capsule
   g. visual pathways
7. Describe the anatomy of the cerebellum in detail including:
   a. cerebellar cortex including organization
   b. deep cerebellar nuclei
   c. cerebellar connections
   d. cerebellar peduncles
8. Describe the anatomy of the mesencephalon in detail including:
   a. superior colliculus
   b. inferior colliculus
   c. pretectal region
   d. posterior commissure
   e. mesencephalic nuclei
   f. oculomotor nerve
   g. tegmentum
   h. mesencephalic reticular formation
   i. substantia nigra
   j. crus cerebri
   k. ascending and descending tracts
9. Describe the anatomy of the pons in detail including:
   a. vestibulocochlear nerve
   b. facial nerve
   c. abducens nerve
   d. trigeminal nerve
   e. ascending and descending tracts
10. Describe the anatomy of the medulla in detail including:
   a. olivary nucleus
   b. medullary reticular formation
   c. cranial nerves of the medulla
   d. ascending and descending tracts
11. Review the location and connections of each cranial nerve nuclei. Trace the course of each cranial nerve from nucleus to end organ termination.
12. Describe the external topography and landmarks of the fourth ventricle.
13. Describe the anatomy of the spinal cord in detail including:
   a. nuclei and cell groups
   b. cytoacrchitectural lamination (Rexed laminae)
   c. somatic and visceral efferent neurons
   d. posterior horn neurons
   e. descending tracts
   f. ascending tracts
   g. upper and lower motor neurons
   h. somatotopic organization

Autonomic Nervous System

1. Distinguish pre- and postganglionic neurons.
2. Describe the sympathetic nervous system.
3. Describe the parasympathitic nervous system.
4. Review the visceral afferent fibers.
5. Describe the structure of the autonomic ganglia.
6. Discuss the central autonomic pathways.

Peripheral Nervous System

1. Differentiate between segmental and peripheral innervation.
2. Diagram the anatomy of the spinal nerve root.
3. Diagram and dDiscuss the cervical, brachial, and lumbosacral plexi.
4. Outline the anatomy of the major peripheral nerves of the upper and lower extremity including:
    a. axillary
    b. suprascapular
    c. median
    d. ulnar
    e. radial
    f. long thoracic
    g. musculocutaneous
    h. lateral femoral cutaneous
    i. femoral
    j. obturator
    k. sciatic
    l. saphenous
    m. peroneal
    n. tibial
5. Describe the microanatomy of the peripheral nerves in detail.
6. Explain the difference between myelinated and unmyelinated nerves.
7. Review the anatomy of the Schwann cell.
8. List the peripheral afferent receptors and describe the anatomy of each.
9. Segregate peripheral neurons by size and explain the rationale for such a classification scheme.

Muscle

1. Explain the concept of the motor unit.
2. Describe the anatomy of the motor end plate.
3. Describe the microscopic anatomy of striated and smooth muscle.
4. Discuss the subcellular components of muscle.

Middle Level:

1. Discuss the clinical presentation in anatomical terms of syndromes of the brain and its coverings including:
    a. epidural hematoma
    b. acute subdural hematoma

c. chronic subdural hematoma
d. subgaleal hematoma
e.injury to innervation of the scalp

2. Discuss the syndromes produced by mass lesions affecting the cranial nerves including:
   a. suprasellar lesions
   b. lesion of jugular foramen
   c. lesion of internal auditory canal
   d. lesions or distortion at the incisura
3. Review the expected effects of stroke or mass lesion at different locations within the brain stem and cerebellum.
4. List the expected effects of destructive lesions in the basal ganglia and cerebellum.
5. Describe the expected effects of ischemic or destructive lesions of the white matter tracts of the cerebrum.
6. Discuss the expected effect of destructive lesions of specific regions of the cerebral cortex. 7. Review the clinical presentation of strokes in the distribution of the supratentorial cerebral blood vessels.
8. Discuss the relationship of the spinal nerves to the vertebral level of exit.
9. Diagram the structures comprising the boundaries of the spinal neural foramina.
10. Discuss the clinical manifestation of injury for each of the major peripheral nerves.
11. Describe the anatomy and presentation of common entrapment syndromes of peripheral nerves including:
    a. thoracic outlet syndrome
    b. carpal tunnel syndrome
    c. ulnar nerve entrapment syndrome at wrist and elbow
    d. anterior interosseous syndrome
    e. posterior interosseous syndrome
    f. meralgia paresthetica
    g. peroneal nerve palsy
    h. tarsal tunnel syndrome
12. Describe the surgical exposure of common peripheral nerve entrapments including:
    a. carpal tunnel
    b. ulnar nerve at elbow
    c. ulnar nerve at wrist
    d. lateral femoral cutaneous nerve
    e. peroneal nerve
13. Discuss the clinical presentation and neurological deficits associated with common lesions of and injuries to the spinal cord and nerve roots.

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

Middle Level:

1. Identify at the time of surgery:
   a. occipital artery
   b. superficial temporal artery
   c. frontalis muscle
   d. pterion

e. inion
f. asterion
g. coronal suture
h. sagittal suture
i. middle meningeal artery
j. sagittal sinus
k. transverse sinus
l. foramen rotundum
m. foramen ovale
n. foramen spinosum
o. superior orbital fissure
p. jugular foramen
q. internal auditory canal
r. superior sagittal sinus
s. sigmoid sinus
t. incisura
u. each cranial nerve
v. each named cerebral artery and vein
w. components of the brain stem
x. named structures on the floor of the fourth ventricle
y. Foramina of Magendie and Luschka
z. cerebral peduncles
aa. components of the cerebellum
bb. cerebellar tonsils
cc. brachium cerebelli
dd. vermis
ee. major supratentorial gyri
ff. supratentorial lobes
gg. sylvian fissure
hh. central sulcus

2. Identify at the time of surgery structures visible in the lateral ventricles including:
a. Foramen of Monro
b. fornix
c. caudate
d. thalamus
e. choroidal fissure
f. named veins
g. glomus of the choroid plexus
h. hippocampus

3. Identify the parts of the vertebral column, spinal cord, and nerve roots at the time of surgery including:
a. spinous process
b. lamina
c. superior facet
d. inferior facet
e. pedicle
f. pars interarticularis
g. uncovertebral joint

h. neural foramen and nerve root
i. nerve root ganglion
j. disc space
k. vertebral artery
l. dorsal column and lateral column of spinal cord
m. intradural afferent and efferent rootlets

NEUROPHYSIOLOGY

UNIT OBJECTIVES

Demonstrate knowledge of physiology that is pertinent to the understanding of neurological disease.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Review the basic biology of the nerves including:
   a. synthesis and movement of proteins in the nerve
   b. membrane potential and membrane properties
   c. ion channels
   d. generation and conduction of an action potential
2. Discuss synaptic transmission including:
   a. types of synaptic transmission
   b. transmitter release
   c. nerve-muscle transmission
   d. chemical messengers
   e. direct gated receptors
   f. second messenger linked receptors
3. Describe the physiology of the sensory systems including:
   a. sensory receptor physiology
   b. anatomy of somatic sensory system
   c. coding of modality specific sensory information
   d. pain and analgesia
   e. cortical integration of sensory perception
   f. visual system
      1. processing of information in the retina
      2. processing of vision in the central visual pathways
      3. columnar units of visual cortex
      4. processing in the geniculate nucleus 5. visual perception of motion and form.
   g. auditory system. Within this description review the processing of hearing in the cochlea and the central auditory pathways.
   h. olfaction and taste
4. Discuss the physiology of the motor system including:

a. mechanisms of muscle contraction
b. muscle receptors, spinal reflexes
c. spinal reflexes concerned with position
d. brain stem reflexes controlling motion
e. vestibular nuclei control of movement and posture
f. red nucleus control of movement
g. cortical control of movement
h. cerebellar control of movement
    1. regional and cellular organization of the cerebellum
    2. functional divisions of the cerebellum
    3. the role of the cerebellum in planning movement
i. basal ganglia
    1. the anatomy of basal ganglia pathways
    2. neural transmitters in the circuits within the basal ganglia
j. thalamus

5. Describe the attributes of the autonomic nervous system including both the sympathetic and parasympathetic systems.
6. Review the physiological basis of arousal and emotion. Include within this review the:
    a. noradrenergic systems
    b. limbic system. Include within this review the physiologic basis for emotion and memory
    c. sleeping and sleep states
    d. reticular activating system
7. Describe the higher cortical functions including:
    a. anatomy of language
    b. function of association cortex
8. Describe the physiological basis for cerebrospinal fluid production and reabsorption.
9. Review the physiological control of the cerebral vasculature.
10. Discuss, in detail, the physiology of the hypothalamus and pituitary, particularly as related to endocrinology.

NEUROPATHOLOGY

UNIT OBJECTIVES

Demonstrate knowledge of neuropathology that is pertinent to the diagnosis of diseases of the nervous system and practice of neurological surgery.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Middle Level:

General Neuropathology

1. Describe the techniques available for examination of surgical specimens from central nervous system, peripheral nervous system, skeletal muscle, pineal and pituitary.
2. Review the use of standard chromatic, histochemical and selected immunohistochemical

stains employed in the evaluation of surgical specimens from the central nervous system, peripheral nervous system, skeletal muscle, pineal and pituitary.

3. List the techniques available for morphological examination of cerebrospinal fluid and the abnormalities observed in cerebrospinal fluid from patients with meningeal carcinomatosis, meningeal lymphomatosis, pyogenic meningitis and aseptic meningitis.

Central Nervous System

1. Describe the gross and histopathological features and, when applicable, the genetic basis of the following congenital and perinatal disorders:
    a. encephaloceles and cranial meningoceles
    b. myelomeningoceles and meningoceles
    c. hydromyelia
    d. diastematomyelia and diplomyelia
    e. syringomyelia and syringobulbia
    f. Chiari I malformation
    g. Chiari II malformation
    h. Dandy-Walker malformation
    i. arachnoid cysts
    j. porencephaly
    k. aqueductal stenosis
    l. subependymal germinal matrix hemorrhages
    m. posthemorrhagic hydrocephalus
    n. periventricular leukomalacia (white matter infarcts)
2. Describe the gross and histopathological features and characteristics of the causative agents of the following infectious diseases:
    a. cranial and spinal epidural abscesses
    b. cranial and spinal subdural abscesses
    c. pyogenic bacterial meningitis and ventriculitis
    d. brain abscesses
    e. tuberculous meningitis and tuberculomas
    f. central nervous system sarcoidosis
    g. central nervous system cryptococcosis
    h. central nervous system mucormycosis
    i. central nervous system toxoplasmosis
    j. central nervous system cysticercosis
    k. Herpes simplex encephalitis
    l. central nervous system HIV infections
    m. central nervous system cytomegalovirus infection
3. Describe the gross and histopathological features of the following vascular lesions:
    a. acute, subacute, and remote infarcts
    b. border zone and watershed infarcts
    c. manifestations of embolic infarcts including those secondary to atheromatous embolization and embolization from extracoporeal pumps
    d. vasculitis including temporal arteritis, primary central nervous system vasculitis, granulomatous angiitis, and Wegener's granulomatosis
    e. moyamoya
    f. hypertensive intracerebral hemorrhages

g. lobar intracerebral hemorrhages
h. amyloid angiopathy
i. malformations including arteriovenous malformations, cavernous angiomas, venous angioma and capillary telangiectases
j. Vein of Galen "aneurysms"
k. saccular aneurysms
l. infectious ("mycotic") aneurysms
m. giant aneurysms
n. traumatic and dissecting aneurysms
o. venous and dural sinus occlusive disease
p. vascular malformations of the spinal cord
q. spinal cord infarcts

4. Describe the gross and histopathological features of the following traumatic lesions:
   a. skull fractures
   b. entrance and exit gunshot wounds of the skull
   c. gunshot wounds of the brain including internal ricochet
   d. epidural hematomas
   e. acute subdural hematomas
   f. chronic subdural hematomas
   g. recent and remote cerebral contusions
   h. traumatic intraparenchymal hemorrhages
   i. diffuse axonal injury
   j. traumatic cranial nerve injuries
   k. spinal cord injuries
   l. cerebral herniation syndromes
   m. fat embolization
   n. central nervous system trauma in infancy
   o. central nervous system radiation injuries
   p. manifestations of prior surgical intervention
5. Describe the gross and histopathological features and, when applicable, the metabolic basis for the following intoxications and deficiency states:
   a. hypoxic-anoxic encephalopathy
   b. carbon monoxide intoxication
   c. ethanol intoxication
   d. alcoholic cerebellar degeneration
   e. central pontine myelinolysis
   f. CNS complications of diagnostic agents including contrast material
   g. CNS complications of antimicrobial therapy
   h. CNS complications of antineoplastic therapy
   i. CNS complications of "street drugs"
   j. Wernicke's encephalopathy and thiamine deficiency
   k.Subacute combined degeneration and B12 deficiency
6. Describe the gross and histopathological features of the following demyelinating diseases:
   a. multiple sclerosis
   b. progressive multifocal leukoencephalopathy
   c. HIV vacuolar myelopathy
   d. postinfectious encephalomyelitis
7. Describe the gross and histopathological features and the metabolic basis for the

following leukodystrophies:

a. adrenoleukodystrophy and adrenomyeloneuropathy
b. Krabbe's disease

c.metachromatic leukodystrophy

8. Describe the gross and histopathological features and, when applicable, the genetic basis for the following dementias and degenerations:
    a. Alzheimer's disease including familial forms
    b. vascular dementia including Binswanger's disease and cerebral autosomal dominant arteriopathy (CADASI L)
    c. Pick's disease
    d. other fronto-temporal dementias
    e. Creutzfeldt-Jacob disease and other prion diseases
    f. Parkinson's disease
    g. diffuse Lewy body disease
    h. Huntington's disease
    i. amyotrophic lateral sclerosis
    j. paraneoplastic degenerative diseases
9. Describe the gross and histopathological features and, when applicable, the biochemical and genetic basis for the following metabolic diseases:
    a. Wilson's disease
    b. Tay Sachs disease and other GM-2 gangliosidoses
    c. neuronal ceroid-lipofuscinoses
    d. hepatic encephalopathy
    e. Reye's syndrome
10. stopathological features and, when applicable, the grading criteria for the following central nervous system neoplasms:
    a. diffuse fibrillary astrocytomas
    b. gemistocytic astrocytomas

    c.anaplastic astrocytomasglioblastoma multiforme including giant cell glioblastoma and gliosarcomas

        d. pilocytic astrocytomas including cerebellar, diencephalic, dorsal exophytic pontine, and cerebral pilocytic astrocytomas
        e. subependymal giant cell astrocytomas
        f. pleomorphic xanthoastrocytoma
        g. oligodendrogliomas including anaplastic oligodendrogliomas and mixed oligoastrocytomas
        h. ependymomas including myxopapillary ependymomas
        i. subependymomas
        j. choroid plexus tumors
        k. colloid cysts
        l. gliomatosis cerebri
        m. gangliocytomas and gangliogliomas
        n. dysembryoplastic neuroepithelial neoplasms
        o. central neurocytomas
        p. medulloblastomas
        q. atypical teratoid/rhabdoid tumors
        r. primitive neuroectodermal tumors and cerebral neuroblastomas
        s. olfactory neuroblastoma

t. spinal paragangliomas
u. meningiomas including meningothelial (syncytial) fibrous, transitional, psammomatous, angiomatous, and papillary meningiomas
v. anaplastic and malignant meningiomas
w. meningeal hemangiopericytomas
x. other meningeal mesenchymal tumors
z.meningeal melanomatosis and melanomas
aa. hemangioblastomas
bb. lipomas
cc. primary central nervous system lymphomas
dd. metastatic carcinomas including leptomeningeal carcinomatosis
ee. teratomas
ff.dermoids and epidermoids
gg. schwannomas including acoustic neurinomas or vestibular schwannomas, schwannomas of other cranial nerves, and spinal root schwannomas

11. Describe the gross and histopathological features and the genetic basis for the following tumor syndromes:
    a. Neurofibromatosis type 1
    b. Neurofibromatosis type 2
    c. von Hippel-Lindau syndrome
    d. Tuberous sclerosis
    e. Cowden syndrome
    f. Turcot syndrome

Peripheral Nervous System

1. Describe the gross and histopathological features and, when applicable, the genetic and biochemical basis for the following disorders of peripheral nerves:
    a. compressive and traumatic neuropathies
    b. leprosy
    c. diabetic and uremic neuropathy
    d. Charcot-Marie-Tooth disease
    e. Guillain-Barre syndrome
    f. sympathetic dystrophy
2. Describe the gross and histopathological features of the following neoplastic and tumorous disorders of peripheral nerves:
    a. peripheral schwannoma
    b. neurofibromas
    c. malignant peripheral nerve sheath tumors
    d. spinal root and peripheral nerve root cysts

Pituitary and Pineal

1. Describe the gross and histopathological features of the following pituitary conditions:
    a. pituitary adenomas including null cell adenomas, growth hormone secreting adenomas, prolactin secreting adenomas, ACTH secreting adenomas, and oncocytomas
    b. craniopharyngiomas including adamantinomatous and squamopapillary craniopharyngiomas

c. Rathke pouch (cleft) cysts
d. pituitary involvement by metastatic neoplasms
e. lymphocytic hypophysitis
f. pituitary infarcts including pituitary "apoplexy"
g. pituitary lesions resulting from closed head trauma
h. empty sella syndromes

2. Describe the gross and histopathological features of the following lesions of the pineal:
   a. germinomas
   b. teratomas and embryonal carcinomas
   c. pineoblastomas and pineocytomas
   d. metastatic carcinoma

Skull and Spine (including intervertebral discs)

1. Describe the gross and histopathological features of the following disorders of the skull:
   a. dermoids and epidermoids
   b. hemangiomas
   c. osteomas
   d. chordomas
   e. solitary and multifocal eosinophilic granuloma
   f. Paget's disease including secondary osteosarcoma
   g. metastatic carcinomas
   h. plasmacytoma including myeloma
2. Describe the gross and histopathological features of the following disorders of the spine and intervertebral discs:
   a. herniated intervertebral discs
   b. pyrophosphate disease including involvement of ligamentum flavum
   c. tumoral calcinosis
   d. hemangiomas
   e. chordomas
   f. eosinophilic granulomas
   g. metastatic carcinomas including epidural metastases
   h. plasmacytoma including myeloma
   i. lymphomas
   j. primary bone tumors
   k.spinal osteomyelitis including tuberculous and fungal spinal osteomyelitis

Eye and Orbit

1. Describe the gross and histopathological features of the following ocular lesions:
   a. retinoblastomas
   b. ocular melanomas
2. Describe the gross and histopathological features of the following orbital lesions:
   a. optic nerve gliomas
   b. optic nerve meningiomas
   c. orbital lymphomas and pseudotumors
   d. orbital metastases

Miscellaneous

1. List the gross and histopathological features found in temporal lobectomy and cerebral hemispherectomy specimens removed during epilepsy surgery.
2. Review the gross, histopathological, and cytopathological features that can be observed in shunt revision specimens.
3. Describe the gross, histopathological, and cytopathological features that can be observed with indwelling pump and intrathecal catheter specimens.
4. Cite the techniques for examination of foreign objects removed from the nervous system and the need for documentation of chain of custody when of potential legal significance.
5. Describe the histopathological features of myotonic dystrophy and central core myopathy and list the potential implications of these diseases with regard to adverse anesthetic reactions including development of malignant hyperthermia.

NEUROPHARMACOLOGY

UNIT OBJECTIVES

Demonstrate knowledge of pharmacology that is pertinent to the treatment of neurological disorders and diseases which affect the nervous system.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Review basic cellular neurotransmission. In the course of this review discuss:
    a. the synapse
    b. membrane potentials
    c. ion pumps
    d. ion channels
    e. transmitter secretion
    f. transmitter identification
2. Define and discuss receptors and receptor pharmacodynamics including:
    a. receptor classification
    b. receptor identification
    c. dose response curves
    d. agonists and antagonists
    e. receptor modulation
3. Discuss the neurotransmitter acetylcholine in detail. Include within the context of the discussion:
    a. cholinergic receptor classification
    b. functional aspects of cholinergic receptors
    c.synthesis, storage, and release of acetylcholine
4. Discuss the catecholamine neurotransmitters (norepinephrine and dopamine) in detail. Include within the context of the discussion:
    a. biosynthesis of catecholamines
    b. storage and release of catechola mines

c. anatomy of catecholamine receptors
d. adrenergic receptors
e. dopaminergic receptors

5. Discuss the neurotransmitter serotonin in detail. Include within the context of the discussion:
   a. anatomy of serotonin receptors
   b. biosynthesis, storage and release of serotonin
   c. sub-types of serotonin receptors
6. Discuss the neurotransmitter glutamate in detail. Include within the context of the discussion
   a. biosynthesis, storage and release of glutamate
   b. ionotropic glutamate receptors
      1. NMDA receptors and subunits
      2. non-NMDA receptors and subunits
   c. metabotropic glutamate receptors
      1. Group I metabotropic receptors and subunits
      2. Group II metabotropic receptors and subunits 3. Group III metabotropic receptors and subunits
   d. role in neurological disorders
7. Discuss the neurotransmitters GABA and glycine in detail.
   a. synthesis, uptake, and release
   b. physiology and pharmacology
   c. clinically relevent agonists and antagonists of GABA and glycine receptors
8. Discuss the peptide neurotransmitters.
9. Describe the pharmacology of each of the drugs used to treat neurological disorders.

NEUROLOGY

UNIT OBJECTIVES

Demonstrate an understanding of the neurologic examination, diagnostic neurologic testing, neurologic diseases and their treatment.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels::

1. Discuss electroencephalography. Recognize normal and abnormal EEG patterns. Identify specific epileptic conditions by EEG findings.
2. Describe the principles of sensory evoked potential testing (SEPs). Discuss how SEPs may be useful diagnostically.
3. List the indications for using intraoperative SEP monitoring and describe in detail how the procedure may be performed.
4. Describe the principles of visual evoked potential testing (VEPs). Discuss how VEPs may be useful diagnostically.
5. Describe the principles of motor evoked potential testing (MEPs). Discuss how MEPs may be useful diagnostically.
6. List the indications for using intraoperative MEP monitoring and describe in detail how the procedure may be performed.

7. Discuss electromyographic (EMG) testing in detail. Describe how the testing is performed and review the diagnostic capabilities of EMG testing. Describe the EMG changes associated with neuromuscular pathology.
8. List the indications for using intraoperative EMG testing and describe in detail how the procedure may be performed.
9. Discuss nerve conduction velocity (NCV) testing in detail. Describe how the testing is performed and review its diagnostic capabilities. List the transmission velocities of the major nerves. Describe NCV changes observed in neuropathy.
10. Define delirium and dementia. List the differential diagnoses for each.
11. Define and discuss coma and altered states of conciousness.
12. Describe the evaluation of a patient with syncope.
13. Describe the etiology and pathogenesis of cerebrovascular disease.
14. Review the clinical presentation and discuss the radiographic evaluation, clinical evaluation, and management of the following:
    a. transient ischemic attacks
    b. cerebral infarction
    c. cerebral and cerebellar hemorrhage
    d. subarachnoid hemorrhage
    e. venous infarction
15. Identify the primary causes of stroke in the pediatric population.
16. Comprehensively discuss the etiology, clinical presentation, diagnostic evaluation, and management of cerebral vasculitis.
17. Differentiate between basal occlusive disease with and without telangiectasia. Review the prognosis and treatment options for each.
18. Describe the acute and chronic effects of ionizing radiation on the central nervous system.
19. Review the diagnosis and management of pseudotumor cerebri.
20. Discuss the diagnosis and management of normal pressure hydrocephalus.
21. Discuss the management of hyperosmolar hyperglycemic nonketotic diabetic coma.
22. Review the neurological manifestations of altitude sickness.
23. List the neurological manifestations of decompression sickness.
24. Describe autism.
25. Revivew the general topic of chromosomal abnormalities as they may relate to the central nervous system including etiology, inheritance patterns, penetrance, and laboratory diagnosis.
26. List the major syndromes characterized by obesity and hypogonadism, including Prader-Willi syndrome.
27. Discuss agenesis of the corpus callosum.
28. Discuss anencephaly, microencephaly, and megalencephaly.
29. List the major disorders of amino acid and purine metabolism. Discuss the neurological manifestations of each.
30. Review each of the major storage diseases including:
    a. GM1-Gangliosidoses
    b. GM2-Gangliosidoses
    c. Fabry disease
    d. Gaucher disease
    e. Niemann-Pick disease
    f. Farber disease

g. Wolman disease
h. Refsum disease
i. Cerebrotendinous Xanthomatosis
j. Neuronal ceroid lipofuscinoses

31. Review each of the major leukodystrophies including:
    a. Krabbe leukodystrophy
    b. metachromatic leukodystrophy
    c.X-linked leukodystrophies with and without adrenal involvement.
32. Review each of the major mucopolysaccharidoses including:
    a. Hurler syndrome (MPS IH)
    b. Hunter syndrome (MPS II)
    c. Sanfilippo syndrome (MPS III)
    d. Morquio syndrome (MPS IV)
    e.Maroteaux-Lamy syndrome (MPS VI)
33. Review the disorders of carbohydrate metabolism including:
    a. glycogen storage diseases
    b. Lafora disease and other polyglucosan storage diseases
34. Discuss hyperammonemia as it relates to neurological dysfunction.
35. Discuss adrenoleukodystrophy as it relates to neurological dysfunction including Reye's syndrome.
36. Review the major syndromes of dysfunctional copper metabolism including:
    a. hepatolenticular degeneration (Wilson disease)
    b. trichopoliodystrophy (Menkes' syndrome)
37. Review the pathogensis, clinical presentation, diagnosis, and treatment of acute intermittent porphyria. List drugs to avoid in patients with porphyria (i.e., sulfa drugs, etc.).
38. Review the pathogensis, clinical presentation, diagnosis, and treatment of abetalipoproteinemia.
39. Orders associated with xeroderma pigmentosum.
40. List the major cerebral degenerative disorders of childhood including:
    a. progressive sclerosing poliodystrophy
    b. spongy degeneration
    c. infantile neuraxonal dystrophy
    d. Hallervorden-Spatz disease
    e. Pelizaeus-Merzbacher disease
    f. Alexander disease
    g. Cockayne syndrome
    h. peroxisomal diseases
    i. Leigh disease
41. Review in detail the major neurocutaneous disorders including:
    a. neurofibromatosis, Type 1 and Type 2
    b. encephalotrigeminal angiomatosis
    c. incontinentia pigmenti
    d. tuberous sclerosis
42. Discuss Leber Herditary Optic Atrophy.
43. Review the salient features of progressive external ophthalmoplegia.define peripheral neuropathy, polyneuropathy, mononeuropathy, mononeuropathy multiplex, and neuritis.
44. Review the major inherited neuropathies including:
    a. peroneal muscle atrophy
    b. Dejerine-Sottas disease

c. Refsum disease
d. hereditary sensory neuropathy e. porphyric neuropathy

46. Discuss the etiology, clinical presentation, diagnosis, treatment, and prognosis of Guillain-Barre syndrome.
47. List the major acquired neuropathies other than Guillain-Barre syndrome including:
    a. chronic demyelinating polyneuritis
    b. acute and chronic idiopathic sensory neuropathy
    c. acute pandysautonomia
    d. tick paralysis
    e. brachial neuropathy (neuralgic amyotrophy)
    f. radiation neuropathy
    g. cold neuropathy
    h. cryoglobin neuropathy
    i. diabetic neuropathy
    j. hypothyroid neuropathy
    k. acromegalic neuropathy
    l. vasculitic neuropathy
    m. uremic neuropathy
    n. hepatic neuropathy
    o. infectious neuropathies
        i. leprosy
        ii. acquired immunodeficiency virus
        iii. Lyme
        iv. herpes zoster
    p. sarcoid neuropathy
    q. paraneoplastic neuropathy
    r. amyloid neuropathy
    s. polyneuropathy associated with plasma cell dyscrasia
    t. polyneuropathy associated with dietary deficiencies
    u. neuropathy induced by metals
        i. arsenic
        ii. lead
        iii. mercury
        iv. thallium
    v. drug-induced neuropathy
    w. neuropathy produced by aliphatic chemicals
48. Discuss the major hereditary ataxias including:
    a. Friedreich ataxia
    b. Levy-Roussy syndrome c. hereditary cerebellar ataxia
49. Review the major noninherited forms of cerebellar ataxia including:
    a. acute cerebellar ataxia in children
    b. ataxia telangiectasia
    c. Marinesco-Sjögren syndrome
    d. Ramsay-Hunt syndrome e. Joseph disease
50. Discuss the pathophysiology, clinical presentation, treatment, and prognosis of Alzheimer's

disease, Pick disease, and diffuse Lewy body disease.
51. Define hemichorea and hemiballismus.
52. Review the pathophysiology, clinical presentation, treatment, and prognosis of Syndenham chorea, Huntington's disease, and senile chorea.
53. Define myoclonus.
54. Review Tourette's syndrome.
55. Review the major general and focal dystonic conditions.
56. Define benign essential tremor.
57. Discuss the pahtophysiology, clinical presentation, diagnosis, treatments and prognosis of Parkinsonism in detail.
58. Define progressive supranuclear palsy.
59. Review the pathophysiology, clinical presentation, diagnosis, and treatment of tardive dyskinesia.
60. Discuss hereditary spastic paraplegia.
62. List the major generalized and focal forms of spinal muscular atrophy including:
    a. Wernig-Hoffmann disease
    b. Kugelberg-Welander syndrome
    c. benign focal amyotrophy
63. Describe the pathophysiology and neurological manifestations of poliomyelitis.
64. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of amyotrophic lateral sclerosis.
65. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of subacute combined degeneration of the spinal cord.
66. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of juvenile and adult myasthenia gravis.
67. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of botulism.
68. Review the common muscular dystrophies including:
    a. Duchenne muscular dystrophy
    b. fascioscapulohumeral muscular dystrophy
    c. myotonic muscular dystrophy
    d. myotonia congenita
    e. congenital muscular dystrophy
69. Review the major periodic paralysis syndromes including:
    a. familial periodic paralysis
    b. hypokalemic periodic paralysis
    c. hyperkalemic periodic paralysis
    d. paramyotonia congenita
70. Discuss polymyositis.
71. Review the epidemiology, pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of multiple sclerosis.
72. Define Marchiafava-Bignami disease.
73. Review central pontine myelinolysis in detail.
74. Discuss multiple system atrophy.
75. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of migraine headaches.
76. Discuss the diagnosis and management of non-migrainous headache syndromes.
77. Review the pathophysiology, clinical presentation, diagnosis, treatment, and prognosis of the

common epileptic disorders in detail.
78. Define status epilepticus and discuss the medical treatment of same.
79. Describe the neurological implications of the common collagen-vascular diseases.
80. Describe the neurological implications of alcoholism.
81. Discuss the neurological aspects of pregnancy.
82. Review malignant hyperthermia.

NEURORADIOLOGY

UNIT OBJECTIVES

Demonstrate an understanding of neuroradiological imaging and interventions as they specifically relate to neurosurgical patients.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Describe the precautions which should be taken when performing radiologic examinations.
2. Identify the normal anatomical structures of the skull on antero-posterior, lateral, Towne, and submental vertex radiographs.
3. List the indications for carotid and cerebral angiography.
4. Review the potential complications to intravenous contrast agents and discuss the management of same.
5. Identify the major arteries and veins of the neck and brain on angiograms.
6. Describe the concepts of computerized tomographic (CT) scanning.
7. Identify the normal anatomical structures of the scalp, skull, dura, brain, and cranial vasculature on CT scans.
8. Describe the concepts of magnetic resonance (MR) scanning. Review the various imaging sequences which may be obtained.
9. Identify the normal anatomical structures of the scalp, skull, dura, brain, and cranial vasculature on MR scans.
10. Recognize common traumatic injuries which may be detected by skull radiographs including:
    a. linear skull fractures
    b. depressed skull fractures
    c. pneumocephalus
    d. foreign bodies
11. Recognize common pathologic conditions which may be detected by skull radiographs including:
    a. neoplasms
    b. fibrous dysplasia
    c. congenital bone diseases
    d. metabolic bone disorders
    e. infections
12. Recognize common traumatic injuries which may be detected by head CT including:
    a. skull fractures
    b. pneumocephalus

c. intracranial hematomas
    i. epidural
    ii. acute subdural
    iii. chronic subdural
    iv. intraparenchymal
    v. intraventricular
d. cerebral contusions
e. subarachnoid hemorrhage
f. foreign bodies

13. Recognize common pathologic conditions which may be detected by head CT including:
    a. ischemic infarction
    b. venous infarction
    c. hydrocephalus
    d. cysts
    e. tumors
    f. cerebral edema
    g. infections
    h. congenital abnormalities
    i. infections
14. Recognize common traumatic injuries which may be detected by head MR scans including:
    a. pneumocephalus
    b. intracranial hematomas
        i. epidural
        ii. acute subdural
        iii. chronic subdural
        iv. intraparenchymal
        v. intraventricular
    c. cerebral contusions
    d. diffuse axonal injury
15. Recognize common pathologic conditions which may be detected by head MR scans including:
    a. ischemic infarction
    b. venous infarction
    c. hydrocephalus
    d. cysts
    e. tumors
    f. cerebral edema
    g. vascular occlusions
    h. infections
    i. congenital abnormalities
16. Identify the normal anatomical structures of the craniovertebral junction on plain radiographs.
17. Review the radiographic diagnoses of platybasia and cranial settling.
18. Describe the plain radiographic findings of common traumatic injuries to the craniovertebral junction including:
    a. occipital condyle fractures
    b. atlanto-occipital dislocation
    c. Jefferson fractures
    d. posterior atlas fractures

e. dens fractures
f. axis body fractures
g. hangman's fracture
h. atlas and axis facet fractures
i.atlanto-axial rotatory dislocation

19. Distinguish between orthotropic and dystropic os odontoideum.
20. Describe the common congenital abnormalities of the craniovertebral junction.
21. Recognize common spinal congenital abnormalities on plain radiographs.
22. Recognize common spinal traumatic injuries which may be detected by plain radiographs including:
    a. vertebral body fractures
    b. facet fractures and dislocations
    c. posterior element fractures
    d. transverse process fractures
    e.vertebral subluxation/dislocation
23. Recognize common spinal degenerative conditions which may be detected by plain radiographs.
24. Discuss the indications for CT and MR scanning of the spine in the setting of trauma.
25. Describe the CT scan appearance of each of the traumatic spinal lesions previously listed.
26. Describe the MR scan appearance of:
    a. spinal ligament injury
    b. traumatic disc herniation
    c. spinal cord contusion
    d. spinal epidural hematoma
27. Recognize common spinal degenerative conditions which may be detected by MR including:
    a. disc degeneration
    b. disc herniation
    c. degenerative spinal stenosis
    d. facet hypertrophy
    e. osteophyte formation
    f. foraminal stenosis
    g. degenerative spondylolisthesis
    h. degenerative scoliosis
    i.ossification of the posterior longitudinal ligament
28. Identify spinal and spinal cord tumors on CT and MR scans.
29. Discuss the indications for spinal myelography.
30. Review the indications for spinal angiography.
31. Discuss the use of both the radiographic contrast and radionuclide shuntogram in evaluating neurosurgical patients.

Middle Level:

1. Identify the common carotid and vertebral circulation congenital variants on angiograms.
2. Recognize intracranial aneurysms on angiograms.
3. Identify and characterize intracranial vascular malformations on angiograms. Recognize:
    a. arteriovenous malformations
    b. venous angiomas

   c. arteriovenous fistula
   d. feeding vessels
   e. draining veins
   f. associated aneurysms
   g. degree of shunting
4. Discuss the angiographic evaluation of carotid and vertebral disease.
5. Review the role of MR angiography and venography in the evaluation of cerebrovascular disease, neoplasms, and trauma.
6. Describe the radiological evaluation of CNS vasculitis.
7. Describe the radiological evaluation of spinal vascular malformations.
8. Discuss the role of myelography in the evaluation of neurosurgical patients.
9. Discuss the radiological evaluation of suspected CNS and spinal infection.
10. Review MR neurography.
11. Describe the appearance of peripheral nerve tumors on MR scans.
12. Revie the role of radionuclide scans in the evaluation of patients with suspected cranial and spinal disease.
13. Discuss the use of intraperative radiographs and fluoroscopy.
14. List the indications for CT- and MR-guided biopsies.
15. Describe the concepts of ultrasonography.
16. Review the findings of normal and abnormal neonatal cranial ultrasound.
17. Review the findings of normal and abnormal carotid ultrasounds.
18. Discuss the use of transcranial doppler ultrasonography in the management of patients with subarachnoid hemorrhage, trauma, and occlusive vascular disease.

Senior Level:

1. Review the indications for interventional endovascular therapies for:
   a. aneurysms
   b. vasospasm
   c. cranial vascular malformations
   d. spinal vascular malformations
   e. tumor embolization
   f. carotid and vertebral stenosis
   g. carotid and vertebral dissection
2. Describe the indications and techniques of endovascular trial occlusions.
3. Review the role of quantitative cerebral blood flow studies in the management of neurosurgical patients.
4. Describe the concepts of positron emission tomography. Review the indications for obtaining such scans.
5. Describe the concepts of functional MR imaging. Review the indications for obtaining such scans.
6. Describe the concepts of MR spectroscopy. Review the indications for obtaining such evaluations in neurosurgical patients.
7. Discuss the indications and technique of discography. Describe the procedure.
8. Discuss the indications for percutaneous vertebroplasty. Describe the procedure.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Order appropriate radiological evaluations in a timely fashion.
2. Complete radiological requisitions properly.
3. Demonstrate the ability to accurately interpret the radiographic studies of trauma patients.

Middle Level:

1. Demonstrate the ability to accurately interpret carotid and vertebral angiograms.
2. Demonstrate the ability to accurately interpret spinal angiograms.
3. Demonstrate the ability to accurately interpret spinal myelograms and post-myelogram CT scans.
4. Demonstrate the ability to accurately interpret cranial and spinal CT and MR scans of nontraumatic lesions.

Senior Level:

1. Demonstrate the ability to accurately interpret radiological examinations of neurosurgical patients.
2. Demonstrate the ability to use intraoperative ultrasonography.GENERAL CLINICAL TOPICS

FLUIDS, ELECTROLYTES, AND NUTRITION

UNIT OBJECTIVES

Demonstrate an understanding of normal and pathologic fluid and electrolyte homeostasis. Demonstrate an ability to maintain normal electrolyte balance. Demonstrate an understanding of the basics of nutritional management in neurosurgical patients.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Discuss the normal distribution of intracellular and extracellular fluid and electrolytes including:
    a. sodium and water distribution and metabolism
    b. clinical assessment of water and sodium balance and the concept of osmolality
    c. normal maintenance requirements
    d. management of pathologic conditions such as diabetes insipidus and the syndrome of inappropriate antidiuretic hormone secretion
    e. cerebral salt wasting
2. Review the potential implications of diuresis and fluid restriction on water and electrolyte balance.
3. Briefly review the potential clinical implications of calcium, phosphorous, and magnesium

excesses and deficiencies and the treatment of same.
4. Review the criteria for nutritional assessment including:
    a. history of significant weight loss
    b. hypoalbuminemia
    c. impaired immune response including diminished total lymphocyte count and anergy
    d. physical signs of malnutrition
5. Briefly describe the metabolic responses to starvation and stress.
6. Describe and contrast the indications, contraindications, complications, and benefits of enteral and parenteral nutrition.
7. Analyze the implications of specific nutritional deficiencies as they relate to neurological and neurosurgical diseases.
8. Briefly review swallowing disorders.
9. Describe the common changes of metabolism and nutritional requirements of trauma patients and their evaluation.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Demonstrate an ability to manage the fluid and electrolyte requirements of neonatal, pediatric, and adult neurosurgical patients.
2. Demonstrate the ability to place central venous catheters.
3. Demonstrate the ability to place enteral feeding tubes.
4. Demonstrate an ability to prescribe appropriate parenteral and enteral nutrition.
5. Recognize and treat the complications of parenteral and enteral feeding including:
    a. line sepsis
    b. glucose intolerance
    c. diarrhea
    d. dehydration
6. Recognize swallowing disorders and manage same.

GENERAL CRITICAL CARE

UNIT OBJECTIVES

Demonstrate an ability to triage neurosurgical patients to and from a critical care setting. Demonstrate a knowledge of and the ability to manage neurosurgical patients in the critical care setting.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Define the adult and pediatric patient which would be best served in a critical care setting; include both medical and neurosurgical issues within the context of this discussion.
2. Review general medical issues pertinent to the management of neurosurgical patients in a critical care setting including:
    a. prophylaxis of gastrointestinal hemorrhage
    b. prophylaxis of pulmonary morbidity

c. prophylaxis, diagnosis, and treatment of venous thrombosis and pulmonary embolism
d. skin care
e. eye care
f. physical therapy to maintain strength and joint range of motion
g. universal precautions
h. workup and treatment of sepsis

3. Describe the indications and pharmacokinetics for medications commonly used in the management of critically ill neurosurgical patients including:
   a. vasoactive drugs
   b. ionotropic drugs
   c. bronchodilators
   d. diuretics
   e. antiarrhythmics
   f. antihypertensives
   g. antimicrobials
   h. anticonvulsants
4. Describe the clinical presentation, evaluation, and treatment of infections which commonly occur in critical care neurosurgical patients.
5. Review the indications for intubation including:
   a. loss of patient airway
   b. respiratory insufficiency
   c. inability to protect airway
6. Discuss commonly used pulmonary values including:
   a. measured pulmonary functions
      i. rate
      ii. minute ventilation
      iii. spontaneous tidal volume
      iv. forced vital capacity (FVC)
      v. functional residual capacity (FRC)
      vi. maximum ventilatory volume (MVV)
   b. ventilator modes and settings
      i. pressure versus volume ventilation
      ii. continuous positive airway pressure (CPAP)
      iii. intermittent positive airway pressure (IPAP)
      iv. pressure support
      v. assist control
      vi. intermittent mandatory ventilation (IMV)
      vii. positive end expiratory pressure (PEEP)
      viii. rate
      ix. tidal volume
7. Review the indications for weaning patients from ventilatory support. Describe the methods by which this is accomplished and the general pulmonary parameters a patient must demonstrate prior to extubation.
8. Discuss the medications used to improve pulmonary function.
9. Briefly review the following cardiac function parameters:
   a. preload
   b. afterload

c. contractility

10. Review the indications for implementing the following monitoring devices. Briefly describe how the information obtained is utilized to optimize patient management:
    a. arterial catheters
    b. central venous catheters
    c. Swan-Ganz catheters
    d. pulse oximetry
    e. electrocardiographic monitoring
    f. end-tidal CO2 monitors
11. List the signs of acute myocardial ischemia and briefly discuss the emergent treatment of this condition.
12. Review the impact of renal insufficiency as it pertains to the management of neurosurgical patients.
13. Briefly discuss the diagnosis and management of acute renal insufficiency.
14. Describe the diagnosis and management of an ileus. List the differential diagnosis for an ileus.
15. Review the diagnosis and management principles of the following endocrine disorders:
    a. hypo/hyperthyroidism
    b. hypo/hyperparathyroidism
    c. adrenal cortical excess and deficiency
    d. diabetes mellitus
    e. diabetes insipidus
16. Review the medical and legal definitions of brain death.
17. Discuss moral and ethical issues pertaining to critically ill neurosurgical patients including:
    a. patient or family requests to withhold or withdraw treatment
    b. organ donation.
18. Summarize the physiology of hydrogen ion production and excretion.
19. Briefly discuss acute and chronic buffering systems.
20. Discuss metabolic acidosis and alkalosis.
21. Discuss respiratory acidosis and alkalosis.
22. Review the effects of acid-base disturbances on the central nervous system and intracranial pressure.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Obtain ACLS and AILS certification.
2. Demonstrate the ability to perform an initial evaluation and management of critically ill neurosurgical patients.
3. Perform the following procedures:
    a. orotracheal intubation
    b. nasogastric intubation
    c. bladder intubation
4. Serve on a trauma team.
5. Demonstrate an ability to manage neurosurgical patients in a critical care setting.
6. Diagnose and treat acid-base abnormalities in neurosurgical patients.

7. Demonstrate an understanding of the management of complex acid-base disturbances in the critical care setting.

Senior Level:

1. Oversee and direct the junior and middle level resident management of critically ill neurosurgical patients.

INFECTION

UNIT OBJECTIVES

Demonstrate an understanding of the factors related to the acquisition, diagnosis, and treatment of infections as they pertain to neurosurgical patients. Describe the typical presentation and treatment of common neurosurgical infections. Review the methods used to minimize infectious complications in neurosurgical patients. Demonstrate an understanding of the techniques to minimize the risk of spread of viral infections, including hepatitis and human immunodeficiency virus (HIV).

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. List the common organisms responsible for meningitis in an age related fashion.
2. List the common CNS infections and describe the populations which are most at risk for each.
3. List the common opportunistic CNS infections and describe the populations which are most at risk for each.
4. Describe in detail the clinical and pathological symptoms and findings associated with CNS infections.
5. Discuss the radiological evaluation of patients with suspected and known CNS infections.
6. Review the indications for alerting individuals at risk for infections based on exposure to a patient with a known CNS infectious process.
7. Review each major class of antimicrobial drugs:
    a. describe the potential of resistance to each drug
    b. list the potential complications of each agent
    c. review the serological monitoring of each antimicrobial agent including the need for monitoring renal, hepatic, and hemopoietic function
    d. indicate which drugs will traverse the blood-brain barrier and which will not
    e. demonstrate a knowledge of the pharmacokinetics of each antimicrobial agent
    f. describe the potential complications of each antimicrobial drug and explain how to monitor for and detect same
    g. review the rationale for monitoring drug levels and list the therapeutic levels of antimicrobials commonly used to treat neurosurgical infections
8. Discuss the advantages and disadvantages of treatment of CNS infections with corticosteroids.
9. Review the role of anticonvulsant therapy in the management of CNS infections.

10. List the universal precautions for prevention of infection as they pertain to health care workers in general and neurosurgeons in particular.
11. Discuss the role of hand washing as the most important method of preventing infection.
12. Describe the role of the clinical epidemiologist in tracking infectious disease incidence and potential sources of infection within the hospital and community setting.
13. Review the mode of transmission, diagnosis, and treatment of non-CNS infections which may commonly arise in neurosurgical patients such as:
    a. respiratory infections
    b. urinary tract infections
    c. wound infections
14. Review the prevention, diagnosis and management of sepsis.
15. List the common sources of a postoperative fever.
16. Describe the workup for a febrile patient.
17. Discuss the use of prophylactic antibiotics.
18. Review the symptoms, clinical evaluation and management of patients with shunt infections.
19. Discuss prion disease and precautions to be taken when it is suspected.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Demonstrate the ability to use universal precautions.
2. Demonstrate the ability to use sterile technique.
3. Appropriately diagnose and treat non-CNS infections in neurosurgical patients.
4. Appropriately diagnose and treat CNS infections in neurosurgical patients.

PRACTICE MANAGEMENT, LEGAL AND
SOCIOECONOMIC ISSUES

UNIT OBJECTIVES

Demonstrate an understanding of the principles of practice management and the business aspects associated with the delivery of health care.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Discuss the ethical and moral factors associated with the practice of neurosurgery.
2. Review the role of the neurosurgical leadership in the community and hospital setting.
3. Explain the neurosurgeon's responsibilities in terms of health care cost containment.
4. Review the features and relationships of the healthcare system including:
    a. treatment facilities
    b. third party payment systems
        1. Medicare
        2. Medicaid

3. employer-provided insurance
4. private insurance

c. physician practice organizations
d. medical equipment manufacturers
e. pharmaceutical companies

5. Recite the rules and regulations of the training hospital(s) as they pertain to the practice of neurosurgery in which the residency is performed.
6. Name the institutional and social service agencies in your community and review their role in the overall management of neurosurgical patients.
7. Demonstrate a knowledge of the rules and regulations of your State Medical Board.
8. Discuss the concept of informed consent.
9. Discuss mandatory reporting laws.
10. Discuss issues pertinent to the topic of the impaired physician.
11. Name and describe the local, regional, and national neurosurgical organizations including their purposes, roles, activities, and interactions.
12. Discuss the importance of tracking morbidity, mortality, and patient outcomes.
13. Review the career options available at the completion of neurosurgical residency in detail including:
    a. private practice
    b. academic practice
    c. subspecialty fellowship
    d. research
    e. administration
    f. military
14. Discuss post-residency fellowship training program availability, application process, and career usefulness.
15. Describe the types and characteristics of surgical practice organizations including:
    a. solo practice
    b. group practice
        1. partnership
        2. professional association
        3. corporation
    c. academic practice
    d. Health Maintenance Organizations (HMO)
        1. Preferred Provider Organizations (PPO)
        2. Individual Practice Associations(IPA)
        3. staff model (Kaiser-Permanente type)
    e. Federal
        1. Department of Veterans Affairs
        2. Military
        3. Public Health Service
16. Discuss hospital payment systems (e.g., DRGs, per diem rates) and describe their incentives and how they affect hospital profitability.
17. Discuss the role and influence of national quality oversight and review organizations for hospitals and health plans (JCAHO, NCQA).
18. Discuss the history, changes, eligibility, funding, and problems associated with the Medicare program.
19. Describe the Medicare program features, such as eligibility, funding, administration,

federal-state relationship, benefits, and payment methods.

20. Discuss federal funding of graduate medical education and how current federal budget allocations and proposals for changes in funding affect or will affect neurosurgical training programs.
21. Discuss the significance of the following issues as they relate to the practice of neurosurgery:
    a. legislative/regulatory requirements
        1. Americans with Disabilities Act
        2. Clinical Laboratory Improvement Amendments (CLIA)
    b. Federal/professional regulatory institutions
        1. Health Care Financing Administration (HFCA)
        2. Joint Commission on Accreditation of Healthcare Organizations (JCAHO) 3. Occupational Safety and Health Administration (OSHA)
    c. miscellaneous
        1. affirmative action
        2. equal opportunity
        3. sexual harassment
22. Discuss the common causes of malpractice actions and effective measures to reduce the risk of malpractice complaints.
23. Describe the ways, means, and reasons physicians influence the political process at the national, state, and local level.
24. Discuss the demongraphics of neurosurgeon distribution, numbers, workload studies, and workforce needs.
25. Outline the requirements for certification by the American Board of Neurological Surgery.
26. Formulate a strategy to evaluate personal and professional considerations in making a career choice.
27. Appraise the importance of family involvement in making career choices, including geographic location.

Senior Level:

1. Review the requirements to obtain certification from The American Board of Neurological Surgery.
2. Discuss the available opportunities to obtain continuing medical education credits.
3. Describe the political, economic, and social factors which impact on the practice of medicine generally and neurosurgery specifically.
4. Demonstrate a working knowledge of the International Classification of Diseases (ICD) and the Current Procedural Terminology (CPT) coding and analysis.
5. Discuss the concept of relative values units (RVUs).
6. Summarize the process of impairment determination as it relates to the neurosurgical patient population.
7. Review the availability, requirements, and application procedures for post-residency fellowship if appropriate.
8. Discuss the following issues as they relate to planned neurosurgical practice:
    a. healthcare delivery systems, including managed care
    b. health care economics
    c.political and legislative processes in healthcare
9. Obtain a demographic profile of potential practice locations to include population and

medical demographics.

10. Outline the essential business characteristics of neurosurgical practice including:
    a. content and interpretation of financial reports
    b. management of human resources
    c. facility design and maintenance
    d. billing and collection processes
11. Discuss the key elements of a provider professional services agreement, such as a PPO or HMO contract, and identify provisions that require particular attention.
12. Describe the typical provisions and considerations in a physician employment contract including what to look for and what to avoid.
13. Describe, compare, and contrast partnership versus corporate practice structures, including the tax and liability advantages and disadvantages of each.
14. Describe the advantages and disadvantages of solo, single specialty group, and multispecialty group practice.
15. Review the financial issues associated with the neurosurgical career options under consideration.
16. Describe the administrative structures and processes required for managing an office practice including:
    a. billing and collection for medical services
    b. financial accounting and reporting
    c. scheduling
    d. transcription
    e. medical record management
    f. appointment scheduling
    g. information system
    h. facility selection and maintance
    i. secretarial services
17. Describe the content, interpretation, and utilization of the following financial documents:
    a. balance sheet
    b. income and expense statement
    c. accounts payable and receivable
    d. collection analysis
18. Discuss the insurance requirements associated with neurosurgical practice including:
    a. personal and professional liability
    b. personal health and disability
    c. casualty, fire, and theft
    d. personal life
19. Discuss the issues of quality assurance as related to neurosurgical practice including:
    1. maintenance of the clinical record
    2. review and documentation of morbidity and mortality
    3. risk management
20. Discuss the theory and organization of CPT coding, along with examples of complex procedural coding.
21. Describe the considerations in Evaluation and Management (E & M) coding, including documentation requirements.
22. Describe the work, practice expense, and malpractice expense components of Medicare's Resource-based Relative Value Scale (RBRVS) and how they are derived.
23. Explain how Medicare and commercial payer conversion factors are derived and used to create

a fee schedule from the RBRVS.

24. Describe commonly used methods of physician risk contracting, such as capitation payment, and explain the considerations in negotiating such a contract.
25. Describe the practice information necessary to safely and profitably manage a neurosurgical risk contract.
26. Review the features, similarities, and differences in various third party payment systems including:
    . Medicare
    a. Medicaid
    b. commercial insurance
    c. worker's compensation
27. Contrast HMO and PPO health plans.
28. Describe the meaning of "managed care" and its typical components including:
    a. contractual discounts
    b. provider risk arrangements
    c. utilization management
    d. provider report cards
    e. practice guidelines
    e. restricted access models
        i. primary gatekeeper
        ii. point of service
        iii. open access
29. List and discuss the ethical issues and conflicts of interest involved in managed care treatment decisions such as:
    . capitation reimbursement
    a. risk pools
    b. cost saving incentive bonuses
30. Discuss antitrust considerations faced by physicians in payer contract negotiations including the concepts of collective bargaining, price fixing, and group boycott.
31. Describe types of retirement plans and funding considerations and limitations.
32. Explain the differences between occurrence and claims-made professional liability insurance and considerations made in selecting insurer and coverage levels.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior and Middle Levels:

1. Demonstrate an ability to interact effectively, professionally, and respectfully with:
    a. patients and their families
    b. fellow residents
    c. allied health care personnel
    d. hospital staff
    e. medical students
    f. faculty physicians
    g. referring physicians
2. Demonstrate the ability to maintain accurate and current medical records.

3. Discuss neurosurgical career options with:
    a. faculty
    b. peers
    c. family
    d. non-faculty neurosurgeons and other mentors
4. Accumulate information about post-residency career options.
5. Create and keep current a resume/curriculum vitae.
6. Record CPT codes for office visits and procedures performed on service.
7. Accurately document H&P and consultations according to the AMA-CPT E&M documentation guidelines.

Senior Level:

1. Demonstrate the ability to properly code neurosurgical activities.
2. Accurately assign and justify medical impairment ratings for neurosurgical patients.
3. Outline a post-residency career track.
4. Apply for post-residency fellowship if appropriate.
5. Obtain information about specific practice, research, or administrative career opportunities as appropriate.
6. Compose a list of questions to ask and things to see when interviewing for a neurosurgical position.
7. Read and interpret a financial report.
8. Design a structure for an office practice including a listing of the generic office processes and how to arrange staffing.
9. Prepare lists of neurosurgical instruments/equipment needed for specific operative procedures.
10. Select a proper practice, research, or administrative opportunity if appropriate.
11. Complete license and registration requirements for your chosen location.
12. Complete applications for hospital staff membership and clinical privileges.
13. Complete resident case data sheet for the American Board of Neurological Surgery and have same signed by Program Chair.

NEUROSURGICAL CLINICAL TOPICS
CEREBROVASCULAR SURGERY

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology and presentation of cerebrovascular diseases, including ischemic and hemorrhagic stroke, and other diseases and malformations of intracranial, extracranial, and spinal vasculature. Demonstrate the ability to formulate and implement a diagnostic and treatment plan for cerebrovascular diseases, including medical and surgical management.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Describe the anatomy of the extracranial and intracranial vessels, including the carotid, vertebral, and spinal arteries.
2. Describe the location of key perforating arteries involving the anterior and posterior circulation, their target distribution, and the consequence of occlusion or injury.
3. Review the anatomy of the venous circulation as it pertains to the central nervous system.
4. Identify the classic syndromes of vessel occlusion of the following:
    a. internal carotid artery
    b. middle cerebral artery
    c. anterior cerebral artery
    d. recurrent artery of Heubner
    e. anterior choroidal artery
    f. vertebral artery
    g. posterior inferior cerebellar artery (PICA)
    h. lower and upper basilar trunk
5. Identify the classic brain stem ischemic syndromes.
6. Explain the concepts of cerebral blood flow, cerebral autoregulation (hemodynamic and metabolic), ischemic thresholds, intracranial pressure, and cerebral perfusion pressure. Describe the impact of intracranial hypertension with and without mass lesion on cerebral blood flow.
7. Recognize the common causes of brain ischemic states including:
    a. cardiac embolism
    b. embolism from proximal vasculature
    c. large vessel occlusion
    d. intracranial conducting vessel occlusion
    e. small vessel disease
8. Associate computed tomography (CT) and magnetic resonance (MR) evidence of ischemic injury with likely anatomic substrate.
9. Describe the epidemiology, physiology, and underlying pathophysiology of ischemic brain injury, including concepts of critical therapeutic window.
10. Recognize the common causes of intracranial and intraspinal hemorrhage including:
    a. aneurysmal disease
    b. vascular malformations
    c. hypertension
    d. vasculopathies
    e. degenerative diseases
    f. hemorrhagic arterial infarction
    g. venous infarction.
11. Relate typical imaging characteristics of central nervous system hemorrhagic lesions to probable causes.
12. Categorize common causes of intracranial hemorrhage, subarachnoid hemorrhage, and ischemic stroke.
13. Explain the principles of fluid and electrolyte resuscitation and maintenance, respiratory physiology, cardiac physiology, and nutritional physiology, as applied to the neurological

patient following ischemic or hemorrhagic stroke. Integrate this knowledge with the specific issues of the perioperative period.

14. Recognize the need for laboratory evaluation for systemic illness.
15. List the appropriate diagnostic neuro-imaging studies utilized to evaluate ischemic and hemorrhagic stroke.
16. Recognize the typical clinical course of patients with ischemic and hemorrhagic stroke, including peak risk intervals for edema, vasospasm, re-bleeding, etc.
17. Identify the periods of high vulnerability to systemic complications of cerebrovascular illness, including deep venous thrombosis, pulmonary embolism, bacterial pneumonia, aspiration, congestive heart failure, etc.
18. Explain the principles of augmentation of cerebral blood flow during cerebral vasospasm.
19. Discuss the principles and indications for medical, endovascular, and surgical interventions for ischemic and hemorrhagic stroke.
20. Relate the principles of timing of medical, endovascular, and surgical intervention in these same disease states.
21. Explain the principles, indications for, and complications of barbiturate coma.
22. Recognize the principles and interpretation of normal and common abnormal findings on skull, chest, and abdominal x-rays in the Critical Care Unit.
23. Describe the fundamentals of CT scanning, including the typical appearance of acute, subacute, and chronic blood, calcification, ventricular anatomy, and mass effect.
24. Describe the typical CT appearance of hemorrhagic and ischemic stroke. Provide a detailed explanation for the typical delay between the onset of stroke and appearance of confirmatory CT findings.
25. Explain the fundamentals of MR imaging. Distinguish between normal and abnormal findings within the realm of cerebrovascular disease. Recognize the classic MR appearance of:
    a. arteriovenous malformations
    b. venous angiomas
    c. cavernous malformations
    d. aneurysms
26. List the indications for non-invasive vascular imaging, including ultrasound, magnetic resonance angiography (MRA), and CT angiography. Recite the limitations of non-invasive studies.
27. Describe the practical application of commonly employed non-invasive studies, such as transcranial Doppler, in the setting of cerebral vasospasm.
28. List the indications for catheter angiography. Interpret the findings of angiography in ischemic and hemorrhagic cerebrovascular conditions. Identify the key segments of the internal carotid artery including the upper cervical, petrous, cavernous, and supraclinoid components.
29. Recite the principles of localizing focal intracranial and spinal vascular pathology by the use of traditional topographic measurements and the application of stereotactic guidance.
30. Describe the surgical anatomy and the principles of exposure of the cervical carotid artery.
31. Describe the principles of pterional craniotomy, including scalp and bony anatomy, as well as the anatomy of the sphenoid ridge.
32. Explain the principles of cerebrovascular surgery detailed in the previous objectives to medical students and allied health personnel during conferences.

Middle Level:

1. Recognize controversies regarding the basic neuroscience knowledge concepts mastered during junior residency.
2. Explain the principles of ischemic neuronal protection and salvage.
3. Review the principles of guideline development and outcome assessment related to the basic knowledge objectives achieved during junior residency.
4. Display an understanding of the principles of hypothesis development and testing, and statistical analysis as applied to clinical research trials, as well as the critique of scientific manuscripts.
5. Recognize areas of controversy related to management protocols in cerebrovascular patients achieved during junior residency.

Senior Level:

1. Demonstrate a sophisticated understanding of current literature related to basic neuroscience knowledge objectives acquired as a junior and middle resident. Define scientific hypotheses in relationship to controversies and evolving knowledge regarding these same objectives and demonstrate the ability to interpret and adapt new knowledge to evolving patient-care paradigms.
2. Demonstrate a mature fundamental knowledge in clinical and teaching conferences, specialty conferences, and in publications and scientific presentations.
3. Understand the guidelines, protocols, and literature controversies regarding the diagnostic imaging modalities available in cerebrovascular disease.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Perform a comprehensive neurological history and clinical examination.
2. Perform a comprehensive systemic evaluation.
3. Adapt comprehensive evaluation to specific pertinent positives and negatives with regard to ischemic and hemorrhagic stroke.
4. Demonstrate an understanding of urgency and the ability to prioritize during emergent aspects of hemorrhagic and ischemic disease states.
5. Demonstrate the ability to manage cardiac and pulmonary complications following cerebrovascular illness and therapy, and review the need for specialty and subspecialty consultations.
6. Apply the principles of perioperative care following common endovascular and surgical procedures directed at cerebrovascular disease.
7. Demonstrate the ability to be vigilant in the clinical detection of subtle neurological change during the acute and subacute phases of illness.
8. Demonstrate the ability to place an arterial catheter, central venous catheter, and pulmonary artery catheter. Perform placement of a ventricular catheter via a burr hole or twist-drill craniostomy.
9. Perform lumbar puncture and cerebrospinal fluid (CSF) reservoir tapping.
10. Define the proper placement of a craniotomy flap in the planned surgical evacuation of hematoma. This should be performed using both topographical as well as stereotactic-

assisted navigation techniques.
11. Assist in the opening, exposure, and closure of cervical carotid procedures.
12. Assist during pterional craniotomy for vascular disease.
13. Assist in the performance of intracranial hematoma evacuation.
14. Demonstrate the ability to keep accurate and timely records.

Middle Level:

1. Perform pterional craniotomy for vascular disease.
2. Demonstrate the ability to make independent management decisions regarding ischemic and hemorrhagic stroke states.
3. Supervise care delivered by PGY1 and junior resident physicians for cerebrovascular patients.
4. Demonstrate efficient prioritization skills for clinical assessment of multiple simultaneous problems in the same or different patients. Display a clear sense of prioritization regarding timing and urgency of medical and surgical intervention for ischemic and hemorrhagic stroke states. Recognize the impact of systemic conditions on prioritization and timing issues.
5. Correctly interpret and respond to changes in patient status related to systemic and neurological parameters.
6. Implement patient-care protocols regarding perioperative management.
7. Display independence in making decisions regarding the critical care of cerebrovascular patients. Recognize the need for reporting to senior resident and attending staff such decisions.
8. Demonstrate the ability to obtain appropriate medical and surgical consultation.
9. Display skills in prioritization of diagnostic interventions, including the choice and sequence of studies in the setting of ischemic and hemorrhagic states.
10. Interpret invasive and noninvasive diagnostic imaging studies in relationship to cerebrovascular disease.
11. Formulate preliminary and surgical planning.
12. Perform frameless navigation procedures.
13. Perform routine and complicated twist drill or burr-hole procedures for the drainage of the ventricular system or intracranial hematomas.
14. Peform exposure of the cervical carotid artery for endarterectomy or proximal arterial control.
15. Observe and assist in the performance of plaque removal and arterial closure during carotid endarterectomy.
16. Practice microsurgical techniques in the laboratory setting.
17. Demonstrate a mature understanding of the planning and performance of pterional craniotomy for intracranial vascular pathology. Perform pterional craniotomy with initiation of microsurgical clinical skills. Observe the microsurgical dissection of the Sylvian fissure and basal cisterns for vascular pathology.
18. Perform the surgical approach to vascular structures via a craniotomy other than pterional.
19. Supervise and assist junior residents in burr-hole and twist-drill procedures for ventricular access or intracranial pressure monitoring.
20. Realize an increasingly progressive teaching responsibility to medical students, interns, and junior residents in the various educational objectives of the cerebrovascular curriculum.

21. Supervise the junior residents in the technical performance of cerebrovascular procedures, as well as critical-care catheter procedures commensurate with their level of expertise.
22. Organize clinical and teaching rounds and conferences, as well as the presentation of cases. 23. Prepare topic reviews in lecture and manuscript formats, including literature summaries and reference compilations.

Senior Level:

1. Review fundamental concepts of cerebrovascular disease during conferences and clinical rounds with the house staff and medical student.
2. Demonstrate a mature clinical judgment related to the spectrum of problems encountered in hemorrhagic and ischemic stroke states.
3. Formulate independent plans for patient assessment and management, including prioritization in cerebrovascular disease while maintaining a clear reporting relationship with faculty.
4. Supervise house staff and medical student team in daily patient assessment and care.
5. Identify the indications and controversies of endovascular catheter procedures, perioperative management, and follow-up. Implement and supervise patient care protocols related to these procedures.
6. Display a mature and detailed understanding of indications, principles, and interpretation of the full spectrum of neurodiagnostic armamentarium. Formulate independent management plans based on sophisticated interpretation of diagnostic studies for concise presentation to faculty.
7. Apply evolving technology and new methods to patient protocols and the education of house staff and medical students.
8. Demonstrate a mature understanding of surgical strategies and approaches to common and unusual vascular disease.
9. Apply the principles of intraoperative anesthetic management, proximal and distal control, temporary arterial occlusion, brain protective strategies, and intraoperative localization as applied to vascular disease.
10. Complete the planning, positioning, and execution of pterional craniotomy for common vascular disease.
11. Perform microsurgical dissection of the Sylvian fissure and exposure of the basal cisterns for vascular disease.
12. Perform microsurgical exposure and clipping of intracranial aneurysm.
13. Complete the planning, positioning, and execution of non-pterional craniotomy for intracranial vascular disease.
14. Assist in the microsurgical management of highly complex cerebrovascular disease.
15. Plan and execute the craniotomy for the evacuation of intracranial hematomas.
16. Supervise other house staff in meeting their surgical objectives.
17. Describe the exposure and treatment of intraspinal vascular lesions. Assist in such operations.
18. Oversee all aspects of patient care, identification of appropriate cases for database analysis, morbidity, mortality, conferences, and discussions. Supervise medical students and house staff in every aspect of patient care.
19. Report appropriate patient care issues to responsible faculty members in a timely fashion.
20. Organize and administer teaching conferences.
21. Display mature participation in specialty conferences.

22. Assign responsibilities to junior residents and residents, with the aim of fulfilling their respective educational objectives.

NEUROSURGICAL ONCOLOGY

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology, and presentation of tumor-related diseases of the cranium. Demonstrate the ability to formulate and implement a diagnostic and treatment plan for tumor-related diseases of the cranium that are amenable to surgical intervention.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Summarize the epidemiology, incidence, and risk factors for intracranial neoplasms.
2. Summarize the tenets of tumor biology including genetic factors and biochemical processes associated with invasion. Describe the natural history of intracranial neoplasms.
3. List a differential diagnosis of lesions requiring biopsy and describe their pathophysiology.
4. List the various types of bone tumors involving the calvarium.
5. Describe and differentiate:
    a. astrocytomas, including the accepted World Health Organization (WHO) grading scheme
    b. gliomas other than astrocytomas
    c. metastatic tumors, including location and common origins
    d. infectious, granulomatous, and cystic lesions that may present in a tumor-like manner
6. Define the cell or origin of meningioma, its common intracranial locations, and the expected presentation for each location.
7. Define the embryological origin of arachnoid cysts and their natural history; list the etiologies of other cystic lesions of the brain, including tumoral and infectious.
8. Describe the anatomic location, cell of origin, clinical presentation, age at presentation, and natural history of common intrinsic posterior fossa neoplasms, including cerebellar astrocytoma, medulloblastoma, and ependymoma.
9. Describe the anatomy of the posterior fossa and the relation of the cranial nerves to the brain stem and skull.
10. Illustrate the relationship of the facial, vestibular, and cochlear components of the acoustic nerve at the internal auditory meatus.
11. Describe the various tumors that may arise in the cerebellopontine angle (CPA).
12. Describe the management of a patient with a brain abscess, including the role of stereotactic drainage or open drainage.
13. Explain the medical workup of a patient with a diagnosed brain abscess.
14. Specify the follow-up and evaluation of the patient with a brain abscess following surgical treatment.
15. Describe the embryological origin of craniopharyngioma. List the common locations of the tumor.
16. Describe the common presentations of pituitary tumors, the cell of origin, and

endocrinopathies associated with:

a. null cell adenomas
b. somatotrophic adenomas
c. prolactinomas
d. corticotrophic secreting adenomas
e. thyrotrophic-secreting adenoma

17. Define the medical management of the secreting pituitary tumors. Explain the role of surgery in each of the tumors above.
18. Describe the etiology of fibrous dysplasia, its presentation and general management. List the indications for surgery for benign tumors of bone at the base of the skull, and potential adjuvant therapy. 19. List the tumors that may be routinely approached through a transtemporal route.
20. Describe the indications for use of lumbar spinal drainage in skull base surgery, and its implementation. List all complications associated with continuous lumbar spinal drainage.
21. Illustrate the general principles of stereotaxis and the underlying localization techniques used in the presently used frame-based and frameless systems.

Middle Level:

1. Describe appropriate postoperative management with drainage of brain abscess or cyst.
2. Describe the appropriate surgical management and postoperative treatment of bony skull lesions.
3. Describe the role of surgery in arachnoid cysts, infectious cysts, and tumor-related cystic lesions. Describe the adjuvant treatment of parasitic cysts.
4. Explain the rationale and indications for various skull base approaches to the anterior, middle and posterior cranial fossae. Identify the important anatomical landmarks for each approach. Illustrate the general principles used in prophylaxis of CSF leaks employed in skull base surgery.
5. Describe the neurosurgical management for the following tumors involving the anterior cranial fossa:

a. meningioma
b. fibrous dysplasia
c. esthesioneuroblastoma
d. osteoma of the frontal sinus
e. chondroma, chordoma
f. mucocele
g. bony metastasis

6. Explain the use of the balloon occlusion test of the carotid artery, its indication for use in skull base tumor surgery, how it is performed, and how the information gained influences surgical management.
7. Explain the surgical advantage of transposing the facial nerve during a transtemporal skull base approach.
8. Describe the transcondylar approach, the relationship of the lower cranial nerves, and the exposure gained over a routine suboccipital craniectomy.
9. llustrate the transpetrosal approach and the relationship of the transverse and sigmoid sinuses with skull bony landmarks such as the asterion, mastoid and inion.
10. Describe the intradural course of the trochlear nerve, trigeminal nerve through Meckel's cave

and the abducens nerve and Dorello's canal.

11. Describe the surgical management of the frontal sinus which has been exposed during craniotomy for anterior skull base surgery. Illustrate the development and use of a frontal vascularized pericranial flap and explain its indication. Similarly, illustrate the use of a myocutaneous flap of the temporalis muscle and list the locations for application.
12. Describe the general methods employed for embolization of tumors of the head and neck, and the indications for such procedures.
13. Compare and contrast the methods for stereotactic radiation, including particle beam, gamma ray or linear accelerator, and the indications for each technique.

Senior Level:

1. Describe the indications for transcranial orbitotomy and list the lesions which require this approach.
2. Discuss the surgical management and postoperative treatment of astrocytomas, gliomas other than astrocytomas, metastatic brain tumors, infectious granulomas, and cystic lesions presenting in a tumorlike manner. Review the role of radiotherapy, chemotherapy, and other adjunctive treatments of these neoplasms.
3. Describe the role of surgery for intracranial meningioma, and the relation between the surgical option and location of tumor. Discuss adjuvant treatments of meningioma and their efficacy.
4. Discuss the surgical treatment of common intrinsic posterior fossa neoplasms, including cerebellar astrocytoma, medulloblastoma, and ependymoma including the role of ventricular drainage, and surveillance imaging. Present adjuvant treatment options and outcomes for the various posterior fossa intrinsic tumors.
5. Address the surgical goals of treatment, complications of surgical treatment, and adjuvant therapy for posterior fossa meningioma.
6. List and illustrate the various approaches for removal of a vestibular schwannoma, and the rationale and indication for each approach.
7. Describe the role of stereotactic radiosurgery and microsurgery in the management of vestibular schwannoma.
8. List the various approaches to the midline clivus and review the indications for each approach. Outline the surgical and medical management of tumors of the clivus and midline skull base.
9. Explain the management goal for a patient with craniopharyngioma, and the risks of surgical treatment and conservative treatment. Describe the various surgical approaches used to resect craniopharyngiomas and the options for adjuvant treatment, including radiotherapy and chemotherapy (systemic and local).
10. Illustrate the transnasal-transphenoidal approach and its indications. Define the options for treatment of recurrent pituitary tumors of all types (including medical management). Describe the risks of the approach and the management of the complication of CSF leak.
11. Illustrate the various skull base approaches to the anterior, middle and posterior cranial fossae in detail, explaining the key anatomical landmarks and strict indications for the approach. List the complications relevant to each approach and the management of each complication.
12. List a differential diagnosis of orbital tumors, their usual location within the orbit, medical and surgical management of the tumor and the approach used to remove the tumor if indicated.
13. List the various tumors and their location in which an orbitocranial approach may be indicated

for their removal.
14. Compare and contrast the exposure offered by the pre-and postauricular infratemporal approach, and the indications for each approach.
15. Illustrate transposition of the facial nerve during a transtemporal skull base approach.
16. Describe the location of meningiomas intracranially which are amenable to preoperative embolization.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Perform a complete history and physical examination on patients with intracranial neoplasms.
2. Review appropriate radiographic studies with a radiologist and formulate a differential diagnosis for patients with intracranial neoplasms.
3. Prepare patients for cranial tumor surgery.
4. Understand the positioning of patients for craniotomy and craniectomy.
5. Assist in the opening and closing of craniotomies and craniectomies for neoplasms.
6. Place lumbar drains.
7. Demonstrate the ability to open and close scalp incisions.
8. Perform ventriculostomies.
9. Demonstrate proper postoperative wound care.

Middle Level:

1. Independently determine a differential diagnosis based on the patient's history, physical examination, and radiographic studies.
2. Position patients for craniotomy and craniectomy.
3. Perform the opening and closing of craniotomies and craniectomies.
4. Assist in the resection of intracranial neoplasms.
5. Resect skull lesions.
6. Operatively treat supra- and infratentorial brain abscess.
7. Demonstrate the ability to manage postoperative complications including but not limited to:
    a. brain edema
    b. meningitis
    c. cranial flap infection
    d. postoperative seizures
8. Assess the need for appropriate pre-, intra-, and postoperative monitoring.
9. Obtain proper nonneurosurgical consultation in tumor patients.
10. Identify patients requiring rehabilitation services
11. Utilize appropriate support agencies and groups for patients with intracranial neoplasms.

Senior Level:

1. Demonstrate the capability to function independently in all phases of management of patients with intracranial neoplasms.

2. Perform resection of supra- and infratentorial intra-axial and extra-axial neoplasms.
3. Perform resection of pituitary lesions.
4. Perform or serve as first assistant for skull base procedures.
5. Oversee the pre- and postoperative management of patients with intracranial neoplasms.
6. Assume teaching responsibilities for junior residents as assigned.
7. Assume responsibility for managing the pyschosocial aspects of intracranial neoplasms.

NEUROTRAUMA AND NEUROSURGICAL CRITICAL CARE

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology, and presentation of traumatic injuries of the brain, spinal cord, and peripheral nervous system, including their supporting structures. Demonstrate the ability to formulate and implement appropriate diagnostic and treatment plans for traumatic injuries to the nervous system, including both surgical and nonsurgical management.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Describe the systematic assessment of polytrauma patients.
2. Rank management priorities in polytrauma patients appropriately.
3. Discuss principles of resuscitation of polytrauma patients including appropriate fluid resuscitation, and explain the anticipated effects of shock and resuscitation on fluid shifts and on electrolyte balance.
4. Name an initial choice for intravenous fluids for a newly admitted Intensive Care Unit (ICU) patients with the following diagnoses and explain changes in that choice based upon specific changes in the patient's diagnosis, clinical condition, electrolyte and volume status:
    a. head injury
    b. stroke
    c. tumor
    d. infection
    e. hydrocephalic
5. Propose appropriate initial ventilator settings for patients with different types of common neurosurgical conditions and explain changes in that choice based upon specific changes in the patient's metabolic or pulmonary status.
6. List the mechanisms of action and potential complications of commonly used pressors and hypotensive agents.
7. Discuss indications, pharmacologic mechanism, duration of action, and effect on the neurologic examination for sedative, paralytic, and analgesic agents commonly used in the ICU.
8. Explain the indications, advantages, and risks for various hemodynamic monitoring tools (e.g., pulmonary artery catheters, indwelling arterial lines) used in critically ill patients.
9. Discuss the pathophysiology and management of coagulopathy after head injury.
10. Describe basic principles of nutritional management in neurosurgical critical care.
11. Explain the treatment of posttraumatic seizures.

12. Outline basic principles of ICU management of patients with spinal cord injury.
13. name the major structures supplied by the major vessels of the brain and spinal cord.
14. Discuss the evaluation, treatment, and prognosis of subarachnoid hemorrhage, both traumatic and spontaneous.
15. Explain the pathophysiology and treatment of cerebral vasospasm.
16. Formulate a diagnostic and treatment plan for patients with cerebral ischemia.
17. Explain the evaluation and management of birth-related intracranial hemorrhage, spinal cord injury, and brachial plexus injury.
18. Describe a systematic approach to the examination of the peripheral nervous system.
19. Describe the basic principles of management of peripheral nerve injuries.
20. List principles of rehabilitation of different types of neurosurgical patients.
21. Define brain death and discuss methods of making such a diagnosis.
22. Describe the pathophysiology of electrical injuries to the nervous system and review treatment of same.

Middle Level:

1. Describe the pathophysiology of intracranial hypertension and explain a plan for its management, including arguments for and against various treatments.

Senior Level:

1. Discuss management priorities in polytrauma patients with severe neurological and systemic trauma.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Perform and document pertinent history, physical findings, and radiologic findings in a polytrauma patient.
2. Differentiate central from peripheral nervous system injuries.
3. Insert intravascular monitoring devices for use in the hemodynamic management of critically ill patients, including central venous lines, pulmonary artery catheters, and arterial catheters.
4. Insert intracranial pressure monitoring devices, including ventriculostomy catheters and electronic (fiberoptic or miniaturized strain gauge) devices.
5. Perform twist-drill or burr-hole drainage of subdural fluid collections.
6. Decide appropriately which patients require emergency craniotomy and other procedures.
7. Position patients appropriately for procedures/surgery and begin emergency procedures if more experienced neurosurgeons have not yet arrived.
8. Assist with opening and closure of craniotomies.
9. Perform elective tracheotomies and be able to perform emergency tracheotomies.
10. Be able to intubate patients in both emergency and elective situations.

Middle Level:

1. Perform the following surgical procedures in uncomplicated cases:

a. craniotomy for subdural and/or epidural hematoma
b. craniotomy for penetrating head injury
c. craniotomy for intracerebral hematoma or contusion
d. craniotomy for depressed skull fracture
e. decompressive craniectomy
f. repair/cranialization of frontal sinus fracture
g. craniotomy/craniectomy for posterior fossa epidural, subdural, or intracerebral hematoma
h. simple cranioplasty

2. Manage traumatic skull base fractures with CSF leak.
3. Manage infections associated with open CNS injuries.

Senior Level:

1. Perform the above procedures (listed under #1 for "A Middle Level" in complicated cases.
2. Reconstruct complex cranial defects, with assistance from other specialties as indicated.
3. Reconstruct traumatic skull base defects, with assistance from other specialties as indicated.
4. Explore and repair peripheral nerve injuries.
5. Supervise and teach junior and middle level residents with cases appropriate for their level.
6. Lead the critical care team in the treatment of patients with neurological injuries, either in isolation or in polytrauma patients.

PAIN MANAGEMENT

UNIT OBJECTIVES

Illustrate an understanding of the anatomical and physiological substrates of pain and pain disorders. Demonstrate an ability to formulate and execute diagnostic and therapeutic plans for management of pain and disorders giving rise to pain.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Describe the anatomy and physiology of nociception within the peripheral and central nervous system.
2. Differentiate the basic categories of pain syndromes:
   a. acute
   b. chronic
   c. nociceptive
   d. neuropathic (including complex regional pain syndromes)
   e. myofascial
   f. cancer-related
   g. postoperative
3. Explain the concept of pain as a biopsychosocial disorder.
4. Discuss the role of rehabilitation in pain management.

5. Describe methods for assessing pain in pediatric patients.
6. Discuss ethical standards in pain management and research.
7. Discuss methods of assessing outcomes of pain treatment and describe common assessment tools.
8. Describe a typical history of a patient with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
9. Diagram the anatomy of the following: trigeminal nerve divisions (ophthalmic, maxillary and mandibular nerves), foramen ovale, Meckel's cave, trigeminal (gasserian) ganglion, cistern of Meckel's cave, retrogasserian root, descending tract and nuclei, nervus intermedius, glossopharyngeal nerve.
10. Illustrate the appropriate medical management of patients with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
11. Discuss the potential complications of percutaneous procedures for trigeminal neuralgia.
12. Describe the brain stem anatomy and physiology of the spinothalamic and trigeminothalamic systems.
13. Describe the anatomy of the primary sensory cortex (S1), Rolandic fissure, and the relationship of S1 to the primary motor cortex.
14. Describe the functional anatomy of the following thalamic nuclei: ventral posterolateral (VPL), ventralis caudalis externus (Vce), ventral posteromedial (VPM), and ventralis caudalis internus (Vci). Review the functional anatomy of the medial thalamic nuclei (e.g., n. parafascicularis).
15. Identify the primary indications for spinal cord stimulation, peripheral nerve stimulation, and intraspinal (epidural, intrathecal) drug infusion therapy.
16. Diagram the spine anatomy pertinent to SCS and intraspinal drug administration, including the spinous process/interspinal ligament/spinous process complex, ligamentum flavum and dorsal epidural space. Review the different degrees of angulation of the spinous processes at various spine levels in the cervical and thoracic area.
17. Diagram the spinal cord anatomy pertinent to spinal ablative procedures for pain management.
18. Recognize complications arising from implantation of pulse generators/receivers and infusion pumps.
19. Describe the anatomy of the major peripheral nerves, brachial plexus, and lumbosacral plexus.
20. Describe the anatomy of the sympathetic nervous system and explain its role in pain.
21. List the common mechanisms of peripheral nerve injury and describe the changes which occur in an injured nerve at both the microscopic and macroscopic level. Explain the theories of pain generation in peripheral nerve injury.
22. Describe the pharmacology of local anesthetic agents (e.g., lidocaine, procaine, tetracaine, bupivacaine) and the use of epinephrine with local anesthetic agents.
23. Discuss the indications for peripheral neural blockade. Explain the principles of blocking procedures including the techniques and expected outcomes. Cite the complications of peripheral neural blockade (including anaphylaxis, neural injury, intravascular or intrathecal administration). List the alternatives to temporary blockade including neurolytic blocks, ablative neurosurgical procedures, augmentative neurosurgical procedures, alternative traditional pain management procedures, and alternative medicine approaches.
24. Review the indications for radiofrequency facet rhizolysis.
25. Discuss the anatomy and biomechanics of the facet complex with emphasis on bone, cartilage, fibrous capsule, synovial fluid, and innervation of this structure.

Middle Level:

1. Name and differentiate the major classes of medications that are used commonly for pain treatment (opioids, non-steroidals and acetaminophen, antidepressants, anticonvulsants).
2. Review the psychosocial issues that may influence a pain disorder and describe the role of behavioral interventions in pain management.
3. Explain the rationale for multidisciplinary management of pain disorders.
4. Contrast impairment and disability.
5. Explain the basis of chemical, balloon compression, and radiofrequency neurolysis in the treatment of trigeminal neuralgia.
6. Relate subcortical and brain stem sites that appear to be involved in the modulation of nociception to targets for deep brain stimulation (DBS) for pain control.
7. Explain how central neurostimulation (cortical, subcortical) is thought to produce analgesia.
8. Explain the role of ablative brain and brain stem procedures, (e.g., cingulotomy, mesencephalic tractotomy, trigeminal tractotomy) in the management of chronic benign pain and cancer pain.
9. Discuss the possible complications of subcortical and brain stem ablative procedures for deafferentation pain.
10. List the primary indications for the following spinal ablative lesions: dorsal root entry zone lesion, open and percutaneous anterolateral cordotomy, myelotomy.
11. Discuss spinal cord stimulation (SCS), including types of stimulation systems and electrodes available, basic techniques of insertion of percutaneous and plate electrodes, the rationale and goals of intraoperative SCS testing (paresthesia coverage of painful area, avoidance of undesirable stimulation), the rationale and techniques for trialing SCS, and advantages and disadvantages of different sites of implantation of SCS pulse generator/receiver.
12. Explain the key aspects of intraspinal drug administration, including the pharmacology of intraspinal drugs, the various types of infusion systems available, the rationale for trialing intraspinal drug infusions, basic techniques for insertion of intrathecal and epidural catheters, and the proper location for infusion pump implantation.
13. Discuss the role of neuroectomy and neurolysis for pain control in nerve injury and compare alternative techniques for pain control.
14. Describe the anatomy of the dorsal root ganglion, the bony anatomy of the nerve root foramen and the location of the ganglion within that foramen. Discuss indications for ganglionectomy and describe longterm outcome from ganglionectomy with emphasis on pain recurrence and deafferentation.
15. Describe the indications for peripheral nerve stimulation and contrast to spinal cord stimulation.
16. Describe indications for ablative peripheral neurolysis. Review the pharmacology and histopathologic effects of neurolytic agents (e.g., phenol, glycerine/glycerol, chlorcreosol, absolute alcohol, ammonium chloride/sulfate).
17. Discuss basic principles of ablative neurolytic procedures in terms of technique, expected outcomes, and complications including neural injury, injury to surrounding soft tissue, inadvertent intravascular or intrathecal administration. Describe the alternatives to neurolysis, including temporary anesthetic blocks, ablative neurosurgical procedures, augmentative procedures, alternative traditional pain management procedures, and alternative medicine approaches.
18. Describe the principles of radiofrequency lesioning. Include in the discussion the following topics:

   a. probe
   b. thermocouple and thermistor
   c. time
   d. intensity of heat
   e. isotherm fields
19. Discuss basic principles of radiofrequency facet rhizolysis and list the equipment utilized, technique employed, expected outcomes, and complications (including damage to other nerve root branches, potential for spinal instability, inadvertent damage to radicular artery, CSF leak, and spinal cord injury).
20. Compare the alternatives to radiofrequency lesioning:
   a. local anesthetic facet blocks
   b. epidural injections
   c. neurolytic facet blocks
   d. ablative neurosurgical procedures
   e. augmentative neurosurgical procedures
   f. alternative traditional pain management procedures
   g. alternative medicine approaches
   h. surgical intervention such as instrumentation and fusion

Senior Level:

1. Distinguish the indications for surgical and non-surgical treatment of pain.
2. Construct a management strategy relating to application of percutaneous trigeminal neurolytic procedures, retrogasserian rhizotomy, and microvascular decompression in the care of patients with trigeminal neuralgia.
3. Describe and contrast the approaches to the cerebellopontine angle for microvascular decompression or rhizotomy of the trigeminal and glossopharyngeal nerves.
4. Identify the various target spine levels for spinal cord stimulation according to the pain topography (simple and complex).
5. Identify the various intraspinal structures based on their responses to mechanical and electrical stimulation (dura mater, lateral canal wall, dorsal columns, dorsal roots, ventral roots, motor neurons).
6. Compare the different methods of intraspinal drug administration (epidural, intrathecal, tunneled catheter, implanted infusion system).
7. Describe the techniques for trialing intraspinal drugs.
8. Compare the pharmacodynamics of different drugs delivered intrathecally (e.g., hydrophilic vs. lipophilic).
9. Describe the possible complications of spinal cord stimulation electrode or spinal catheter insertion and their evaluation and treatment:
   a. paralysis
   b. nerve root damage
   c. electrode or catheter migration
   d. electrode or catheter breakage
   e. epidural hematoma
   f. cerebrospinal fluid leak
10. Describe the common drug side effects associated with intraspinal analgesic administration.
11. Describe the correct placement of lesions for DREZ, cordotomy, and myelotomy, including lesion depth and structures affected.

12. Discuss the possible neurological sequellae of spinal ablative procedures with both correct and incorrect lesion placement, with anatomical correlates.
13. Describe the role of DREZ lesioning in the overall management of the patient with deafferentation pain.
14. Describe the techniques for exposure of the major peripheral nerves.
15. Demonstrate knowledge of basic principles of nerve grafting, including regeneration, graft length considerations, and use of allograft donor nerves.
16. Describe the role and outcomes of ganglionectomy in the management of various pain syndromes, contrasting it with augmentative techniques.
17. Discuss in detail the surgical technique of ganglionectomy.
18. Describe percutaneous methods of gangliolysis.
19. Explain the effects of blocking agents at the membrane and synaptic cleft, and the biochemistry and histology of neurotoxicity.
20. Explain the histologic effects of neurolytic agents at the membrane level and display a comprehensive level of understanding with regard to toxicity.
21. Describe the histologic effects of radiofrequency lesioning.
22. discuss in detail the evaluation and management of a patient selected for radiofrequency lesioning of the facets.
23. Discuss the alternatives to radiofrequency lesioning, with particular emphasis on the potential surgical remedies including decompression, instrumentation, and fusion.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Obtain a pertinent history and perform an appropriate physical examination for a patient with a primary complaint of pain.
2. Formulate and implement treatment plans for simple pain syndromes (e.g., acute postoperative pain, acute low back pain).
3. Evaluate and diagnose a patient with trigeminal neuralgia, trigeminal neuropathic pain, and atypical facial pain.
4. Assist with radiofrequency, glycerol or balloon compression neurolysis of the trigeminal nerve in patients with trigeminal neuralgia.
5. Assist with surgical exploration of the trigeminal nerve, nervus intermedius, or glossopharyngeal nerve for MVD or rhizotomy.
6. Illustrate appropriate patient selection for spinal ablative or augmentative procedures for pain management.
7. Locate the spinal epidural space and place a percutaneous spinal cord stimulation electrode with supervision.
8. Assist with implantation of a plate electrode for spinal cord stimulation.
9. Insert with supervision a spinal catheter for drug administration.
10. Implant with supervision a spinal cord stimulation system pulse generator/receiver and extension wire.
11. Implant with supervision an intraspinal drug infusion pump.
12. Assist with spinal ablative procedure for pain management (cordotomy, myelotomy, DREZ).
13. For peripheral nerve repair, neurectomy, and neurolysis perform, record, and report complete patient evaluation and assessment, including comprehensive neuromuscular examination of

affected nerve distribution.

14. Evaluate electrodiagnostic studies pertaining to peripheral nerve injury.
15. Recognize and treat the potential complications of peripheral nerve repair, neurectomy, and neurolysis including hematoma formation, infection, and local wound problems.
16. Assist in surgical treatment of peripheral nerves.
17. Assist with implantation of a peripheral nerve stimulation system.
18. Perform, record, and report complete patient evaluation and assessment for dorsal root ganglionectomy.
19. Recognize and treat the potential complications of dorsal root ganglionectomy including cerebrospinal fluid leak, infection, and local wound problems.
20. Assist in foraminotomy and exposure of dorsal root ganglion.
21. Assess patients for appriateness of local anesthetic block(s).
22. Perform simple superficial blocks with supervision and assist in complicated procedures. Following such procedures:
    a. assess outcome of nerve block
    b. recognize and treat complications
    c. record and monitor effects of block over a specified time interval
    d. assess need for repeat blocks
23. Assess patient for appropriateness of ablative neurolysis. Perform simple superficial neurolysis with supervision and assist in complicated procedures. Following ablative neurolysis:
    a. assess outcome of procedure
    b. recognize and treat complications
    c. record and monitor effects of neurolysis over a specified time interval
    d. assess need for repeat procedures

Middle Level:

1. Formulate and implement an appropriate treatment program for complicated pain syndromes (e.g., chronic back pain, "failed back surgery syndrome").
2. Assess the need for multidisciplinary management of pain disorders.
3. Demonstrate appropriate management of psychosocial factors complicating a pain disorder.
4. Employ the Hartel technique to perform radiofrequency, glycerol or balloon compression neurolysis of the trigeminal nerve in patients with trigeminal neuralgia.
5. Implant a plate electrode.
6. Demonstrate appropriate methods for trialing spinal cord stimulation and intraspinal drug administration systems.
7. Implant a peripheral nerve stimulation system.
8. Assess patient for appropriateness of radiofrequency facet blocks. Perform radiofrequency facet blocks with supervision. Following the performance of such procedures:
    a. assess outcome of facet blocks
    b. recognize and treat complications
    c. record and monitor effects of facet blocks over a specified time interval
    d. assess need for repeat facet blocks
9. Diagnose and formulate appropriate treatment plans for sympathetically-maintained pain.
10. Diagnose and formulate an appropriate treatment plan for a patient with occipital neuralgia.

Senior Level:

1. Recognize and execute intelligent treatment choices for different pain syndromes including nociceptive, neuropathic, and cancer pain.
2. Demonstrate appropriate use of each of the major classes of medications in common use for treating pain.
3. Demonstrate appropriate selection of patients for surgical treatment of pain disorders.
4. Perform microvascular decompression and rhizotomy of the trigeminal nerve and glossopharyngeal nerves.
5. Assist a junior resident in performing a percutaneous ablative procedure for trigeminal neuralgia.
6. Formulate and implement an appropriate treatment plan for management of pain using spinal ablative and augmentative techniques according to pain etiology, pain topography, and status of spinal column (e.g. previous surgery at implant level, scoliosis, stenosis, etc.).
7. Select and implant an appropriate SCS system, recognizing how to modify electrode insertion technique and location based upon intraoperative responses.
8. Implant a plate electrode in a patient with previous spinal surgery at the same level.
9. Demonstrate proficiency with maintenance and programming of spinal drug administration systems and spinal cord stimulation systems.
10. Recognize and evaluate malfunctions of SCS and intraspinal drug administration systems.
11. Perform surgical revision of SCS and intraspinal drug administration systems.
12. Demonstrate proficiency in identification and lesioning of the dorsal root entry zone, even in cases of nerve root avulsion.
13. Demonstrate proficiency in performing myelotomy and cordotomy.
14. Expose major peripheral nerves and perform closure of extremity incision for peripheral neurectomy/neurolysis.
15. Demonstrate proficiency in neurolysis and nerve grafting techniques.
16. Plan and execute surgical approaches to injuries of the major peripheral nerves.
17. Plan a peripheral nerve reconstruction including exposure, preparation of donor site, and nerve graft.
18. Demonstrate proficiency in technique of ganglion resection.
19. Incorporate ganglionectomy as one part of an integrated approach to the patient with intractable pain.
20. Display appropriate patient selection for local anesthetic blocks.
21. Perform simple superficial blocks with minimal supervision. Relative to these blocks perform the following:
    a. assess outcome of block
    b. recognize and treat complications
    c. maintain detailed records of effects of block and follow-up
    d. assess need for repeat blocks
22. Provide information regarding alternatives for failed nerve block.
23. Perform complicated nerve block procedures with direct supervision. Recognize and treat the complications of these procedures.
24. Display appropriate patient selection for ablative peripheral neurolysis.
25. Perform simple neurolytic procedures with minimal supervision. Relative to these procedures perform the following:
    a. assess outcome of the procedure
    b. recognize and treat complications
    c. maintain detailed records of effects of neurolysis and follow-up
    d. assess need for repeat neurolysis

26. Provide information regarding alternatives for failed neurolysis.
27. Perform complicated neurolytic procedures with direct supervision.
28. Display appropriate patient selection for radiofrequency facet rhizolysis.
29. Perform simple facet blocks with minimal supervision. Relative to these procedures perform the following:
    a. assess outcome of the procedure
    b. recognize and treat complications
    c. maintain detailed records of effects of facet blocks and follow-up
    d. assess need for repeat facet blocks
30. Provide information regarding alternatives for failed facet blocks.
31. Perform complicated facet blocks with direct supervision.
32. Perform sympathectomy.

PEDIATRIC NEUROSURGERY

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology, and presentation of diseases in children which a neurosurgeon may be called upon to diagnose and treat. Demonstrate the ability to formulate and implement a diagnostic and treatment plan for these diseases.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

Myelomeningocele and its Variants, Meningocele, Encephalocele, Chiari Malformations, Occult Spinal Dysraphism, Split Cord Anomalies, Segmentation Anomalies, Craniofacial Syndromes and Phakomatosis

1. Review the embryology of the central nervous system (CNS) and its supporting structures.
2. List the abnormalities a neurosurgeon may treat which are congenital/developmental in nature and classify them with respect to their embryology defect.
3. Describe the incidence, epidemiology and inheritance patterns.
4. State other disorders associated with this set of diseases.
5. Describe the anatomic and pathophysiologic parameters which distinguish amongst these diseases.
6. Develop a diagnostic treatment plan along with prognostication of outcome with optimal management.
7. List disorders which may be referred for neurosurgical care but do not require surgery.
8. Display current knowledge of the molecular basis for these diseases where known.
9. Describe the expected outcome if treatment is not undertaken.

Hydrocephalus and Other Disorders of CSF Circulation

1. Describe the normal physiology of CSF.
2. Delineate the different etiologies of hydrocephalus and their relative incidence.
3. Explain how to differentiate between CSF collections which require treatment and those which do not.

4. Indicate the various treatment options for the management of hydrocephalus.
5. Distinguish between treatment options for hydrocephalus with normal CSF and contaminated (e.g. infection, blood) CSF.
6. List the complications associated with each treatment option for hydrocephalus and the diagnosis and treatment of same.
7. Differentiate between low-pressure and high-pressure hydrocephalus.
8. Describe the presentation and diagnostic approach to a patient with suspected shunt malfunction.
9. Define how the diagnosis of hydrocephalus is made.
10. List nonsurgical diseases which may be mistaken for hydrocephalus but require treatment different than surgery.
11. Review the causes of cerebral atrophy.

Neoplasia

1. Delineate the differences between pediatric and adult tumors.
2. List the common tumor types occurring in children and their typical location.
3. Describe the changing tumor type and location based upon age.
4. Identify lesions which require biopsy as part of the treatment/diagnostic plan.
5. Describe the typical presentations of tumors.
6. Describe appropriate evaluation for patients suspected of having a tumor.
7. Classify tumor types as to degree of malignancy, role of surgical vs. nonsurgical therapy, and outcomes of optimal treatment.
8. Discuss the possible complications associated with specific tumor types.
9. Describe the pertinent anatomy for surgical treatment of midline or hemispheric cerebellar tumors and hemispheric cerebral tumors.
10. Discuss appropriate preoperative management of patients with tumors.
11. Compare the role of biopsy, subtotal resection and total resection in the management of tumors.
12. List possible complications of the treatment options, their diagnostic evaluation and treatment.

Infection

1. Describe the presentations of a shunt infection.
2. List the indications for ventricular lumbar and subarachnoid CSF sampling.
3. List the common organisms seen in shunt infections.
4. Describe treatment plans for shunt infection.
5. List risk factors and risks of shunt infection and the proper diagnostic protocol to establish the presence of a shunt infection.
6. Describe common presentations of intracranial and intraspinal suppuration.
7. List host risk factors which are associated with CNS infections.
8. Describe appropriate diagnostic protocol to establish the presence of CNS infection.
9. Discuss the timeliness and utility of surgical therapy for the treatment of CNS infection both shunt-related and non-shunt-related.

Other

1. Delineate the various types of spasticity and movement disorders seen in children.
2. List seizure types.
3. Describe surgical lesions which may be related to seizures.
4. Describe surgical and non-surgical treatment options regarding the alleviation of spasticity in children. 5. Discuss the pathophysiology of craniosynostosis.

Cerebrovascular

1. Delineate the possible causes of an atraumatic intracerebral or subarachnoid hemorrhage.
2. Delineate the possible causes of cerebral infarction/ischemia.
3. Discuss the common locations of arteriovenous shunts and their presentation, evaluation, and treatment (includes dural AVM).
4. Discuss the embryology of the cerebral and spinal vasculature and its possible role in vascular anomalies in children.
5. Describe the common locations and types of aneurysms seen in children and how they differ from those seen in adults.
6. List the possible presentations of Vein of Galen aneurysms, their diagnosis and management.
7. List the possible causes of aneurysms in children which are not congenital in nature.
8. Describe the pathophysiology, treatment, and outcome of intraventricular hemorrhage in the neonate.

Trauma

1. List the appropriate diagnostic tests to evaluate a children who has sustained multisystem trauma.
2. Describe the Glasgow Coma Scale and its use.
3. List the salient historical and exam features which lead one to the diagnosis of non-accidental trauma.
4. Discuss the management of the cervical spine in a child who is comatose.
5. Describe the anatomy of the child's spine which causes the epidemiology of spinal cord injury to differ from adults.
6. Describe the common injuries seen as a result of birth trauma and discuss their diagnosis and management.
7. Describe the use of antibiotics and anticonvulsants in CNS trauma.
8. Review the evaluation and management of a child who has sustained a head injury with loss of consciousness but is now awake.
9. Discuss the management of depressed skull fractures, both open and closed.
10. Describe the diagnosis and management of spinal column injury.
11. Discuss the diagnosis and management of spinal cord injury without radiologic abnormality (SCIWORA).
12. Describe the intracranial pressure (ICP) compliance curve and discuss its utility in the management of head injury.
13. List the parameters needed to decide on letting an athlete who has sustained a CNS injury return to activity.
14. Discuss the concept of "brain death", its diagnosis and role in organ donation.
15. Discuss the importance and interplay between ICP and cerebral perfusion pressure (CPP)

in the management of head and spinal cord injury.
16. Define the concept of "secondary injury".
17. Discuss the role of invasive monitoring in all its forms in closed head injury (CHI).

Middle Level:

Myelomeningocele and its Variants, Meningocele, Encephalocele, Chiari Malformations, Occult Spinal Dysraphism, Split Cord Anomalies, Segmentation Anomalies, Craniofacial Syndromes and Phakomatosis

1. Enumerate the indications for surgery, surgical options and expected outcomes for each disease entity.
2. Explain the indications for and utility of intraoperative monitoring.
3. Describe appropriate timing of intervention and its rationale.
4. Describe the pathophysiology and presentation of the tethered cord syndrome.

Hydrocephalus and Other Disorders of CSF Circulation

1. Describe normal ICP dynamics and their relation to establishing a differential diagnosis of CSF flow disturbance.
2. Define "slit ventricle system" and how it is diagnosed and treated.
3. Define "brain compliance" and relate how that can affect ventricular size.
4. List indications for and describe technique of accessing a shunt for CSF samples.
5. List disease states which are commonly associated with hydrocephalus.

Neoplasia

1. Discuss the differential diagnosis and evaluation of tumors located in the following areas:
    a. suprasellar
    b. pineal region
    c. intraventricular
2. Discuss the treatment/diagnostic options for tumors in each location listed in #1 including surgical approaches.
3. Describe the appropriate evaluation and treatment of patients with neoplastic processes associated with:
    a. neurofibromatosis
    b. tuberous sclerosis c. von Hippel Lindau
4. Discuss the appropriate use of skull base approaches for specific tumor locations.
5. List tumors which will require adjunctive therapy and describe those therapies and potential complications thereof.
6. Discuss the global management of tumoral hydrocephalus.
7. Cite the long-term outcome and complications for treatment of the common cerebellar and supratentorial hemispheric tumors.

Infection

1. Compare the differing patterns of infection as seen in immune-compromised patients to those

with a functioning immune system.
2. Discuss the sequelae of CNS infection, both shunt-related and non-shunt-related.
3. List all acceptable treatment options for CNS infection with the pros and cons of each plan.
4. Demonstrate an understanding of the different etiologies for subdural and epidural empyema and brain abscess and differing treatments thereof.
5. Provide a complete differential diagnosis in regard to infectious disease for ring enhancing brain lesions.
6. Discuss the role of osteomyelitis in CNS infection.
7. Differentiate radiographically between infection and tumor of bone.

Other

1. Discuss variance in the surgical management of tumoral vs non-tumoral seizure foci.
2. Discuss surgical options, indications and outcome for non-lesional approaches (e.g., callosotomy).
3. Discuss various surgical options for the management of spasticity.
4. Discuss preoperative evaluation and planning for seizure treatment.
5. Discuss preoperative evaluation and planning for treatment of spasticity and postoperative management.

Cerebrovascular

1. Describe the nomenclature for congenital vascular anomalies and what, if any, role inheritance plays.
2. Describe the pathology, risk factors, diagnosis and treatment of moyamoya in children. 3. List the phakomatoses which have vascular anomalies associated with them and their treatment.

Trauma

1. Discuss the role of apoptosis in brain and spinal cord injury.
2. Compare the utility of epidural, subdural, parenchymal, and intraventricular ICP monitoring.
3. Differentiate between retinal hemorrhages and Terson's syndrome.
4. Describe the role of electrophysiological monitoring in the management and prognostication of the CNS injured patient.
5. Discuss the evidence for and role of steroid therapy in CNS injury.
6. Discuss the prognosis and management of penetrating injuries to the brain and spine.
7. Discuss the management of CSF leaks after head injury.
8. Describe the diagnosis and treatment of a traumatic leptomeningeal cyst.

Senior Level:

Myelomeningocele and its Variants, Meningocele, Encephalocele, Chiari Malformations, Occult Spinal Dysraphism, Split Cord Anomalies, Segmentation Anomalies, Craniofacial Syndromes and Phakomatosis

1. Differentiate between the use of rigid and non-rigid skeletal fixation in the appropriate surgical setting for this group of disorders.
2. Explain the rationale for surgical treatment of a symptomatic disease.

Hydrocephalus and Other Disorders of CSF Circulation

1. Discuss the utility of expansion craniotomy in the treatment of hydrocephalus.
2. Differentiate between ventriculomegaly, compensated hydrocephalus, and pseudotumor cerebri.
3. Describe the pertinent anatomy of the ventricular system and prepontine cisterns.
4. Describe the role of venous outflow obstruction in hydrocephalus.

Neoplasia

1. Describe the pertinent surgical anatomy for approaches to tumors in the following locations:
    a. suprasellar
    b. pineal region
    c. intraventricular
2. Discuss the role of endoscopic third ventriculostomy in management of tumoral hydrocephalus.
3. Cite the long-term outcome and complications of all treatment options for tumors arising in the following locations:
    a. suprasellar
    b. pineal region
    c. intraventricular
4. Discuss the utility of preoperative embolization and/or chemotherapy in the surgical management of specific tumors.
5. Discuss the role of stereotactic radiosurgery in the management of selected tumors.
6. Describe the presentations of hypothalamic hamartomas and the role of surgery in management.
7. Describe options for CNS monitoring during surgical therapy and their efficacy.
8. Discuss options for treatment and expected outcomes for recurrent tumors.

Infection

1. Describe in detail the differential diagnosis, evolution and treatment options of an immune-compromised patient with a ring enhancing brain lesion.
2. List the important aspects of the patient's history which may lead one to entertain the diagnosis of CNS infection, both shunt-related and non-shunt-related.
3. List diagnostic tools, other than CSF culture, which are utilized to diagnose a shunt infection.

Cerebrovascular

1. List the locations for traumatic vascular lesions and their risk factors, diagnosis, and treatment.
2. Discuss management options and controversies in the treatment of vascular disease in children.

Trauma

1. Discuss the potential complications and evaluation of comatose patients with skull base fractures.
2. Discuss the utility of lumbar drains and expansion craniectomy and the removal of frontal or temporal lobe in the management of refractory elevated ICP.
3. Describe the approaches to the management of traumatic ICH and its supporting data, both surgical and non-surgical.
4. List the vascular and endocrine complications seen after head injury.
5. Discuss the long-term management of a child who has sustained CNS trauma including rehabilitation and neuro-cognitive issues.
6. Discuss the management of peripheral nerve injuries in a child.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Perform complete history, physical examination and assessment on newborns, infants, and children.
2. Interpret results of the physical examination, laboratory and radiological studies to arrive at a differential diagnosis.
3. Perform subdural, intraventricular and lumbar punctures in children.
4. Perform a shunt tap.
5. Perform a twist drill or burr hole for subdural, parenchymal, or ventricular access or as part of a craniotomy.
6. Perform a craniotomy or craniectomy for evacuation of subdural or epidural lesion.
7. Perform a craniectomy as part of skull biopsy.
8. Perform craniotomy for elevation of depressed skull fracture.
9. Place a ventriculoperitoneal, jugular, or pleural shunt.
10. Revise a ventriculoperitoneal, jugular, or pleural shunt.
11. Perform a cranioplasty with artificial material or homologous material.
12. Perform a laminectomy in a patient with normal spinal anatomy.
13. Position a patient for intracranial or intraspinal surgery.
14. Demonstrate an ability to open and close cranial and spinal wounds to include dural opening and repair.
15. Complete a sagittal synostectomy.

Middle Level:

1. Close an open spinal or cranial neural tube defect.
2. Repair an intracranial encephalocele.
3. Perform the opening for a complex craniofacial repair.
4. Perform the exposure for supratentorial and infratentorial lesions (excluding pineal, suprasellar and intraventricular locations).
5. Perform the exposure for spinal exploration in a patient with abnormal spinal anatomy or reoperation.
6. Evacuate an intraparenchymal hematoma.

7. Accomplish endoscopic third ventriculostomy in uncomplicated settings.
8. Apply and utilize frameless or framed stereotactic modalities for lesion location and shunt placement.
9. Accomplish repair of a Chiari malformation.
10. Accomplish an uncomplicated detethering procedure.
11. Perform a cranial vault expansion.
12. Perform placement of baclofen type pumps.
13. Perform spinal fusion without instrumentation.
14. Apply a vagal nerve stimulator.

Senior Level:

1. Perform exposure for suprasellar, pineal and intraventricular lesion (including orbito-frontal, transcallosal and supracerebellar).
2. Remove uncomplicated posterior fossa and supratentorial lesions.
3. Repair complex tethered cords (e.g. lipomyelomeningocele, retethering, and diastematomyelia).
4. Accomplish exposure for intradural spinal neoplasms.
5. Utilize an endoscope to communicate trapped CSF spaces.
6. Remove intracranial vascular malformation less than 3 cm in size and in non-eloquent brain.
7. Perform placement of grids for seizure monitoring.
8. Perform rhizotomy for spasticity.
9. Perform temporal lobectomy in an uncomplicated patient.
10. Perform stereotactic biopsy of supratentorial lesion.
11. Perform spinal fusion utilizing instrumentation.
12. Accomplish endoscopic third ventriculostomy in uncomplicated settings.
13. Assist with complex craniofacial surgery.
14. Assist with a vascular procedure for moyamoya disease.

SURGERY OF THE PERIPHERAL NERVOUS SYSTEM

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology, and presentation of peripheral nerve diseases. Demonstrate the ability to formulate and implement a diagnostic and treatment plan for diseases of the peripheral nerves that are amenable to surgical intervention.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Define the peripheral nervous system versus the central nervous system.
2. Discuss the major structural elements of a peripheral nerve:
    a. epineurium
    b. perineurium
    c. endoneurium
    d. axon
    e. fascicle

   f. Schwann cell
   g. connective tissue
   h. motor end plate i. sensory receptor
3. Discuss the blood supply of the peripheral nerves.
4. Discuss the blood-nerve barrier.
5. Define axonal transport and differentiate fast from slow.
6. Describe an action potential including the flow of ions.
7. Describe the various nerve fibers in terms of size.
8. Discuss the significance of fiber size in terms of function (e.g., c-fiber - nociceptive).
9. Discuss the various forms of action potential propagation.
10. Discuss the pathophysiological response to various injuries by a nerve:
   a. compression
   b. ischemia
   c. metabolic
   d. concussive
   e. stretch
11. Define and discuss apoptosis.
12. Define Wallerian degeneration.
13. Discuss nerve regeneration:
   a. sprouting
   b. nerve growth factors
   c. rate of growth
   d. remyelination
14. Define neuroma:
   a. axonal tangle
   b. mechano-sensitivity c. neuroma-in-continuity
15. Define and discuss the pathophysiology and clinical significance of the Tinel's sign.
16. Describe the symptoms and signs of typical nerve injuries:
   a. entrapment syndromes
   b. stretch injuries
   c. laceration injuries
   d. concussive injuries e. injection injuries
17. Distinguish upper versus lower motor neuron symptoms and signs in nerve injury:
   a. anatomical definition
   b. degree of atrophy
   c. distribution of weakness
   d. reflex changes
   e. potential for recovery
18. Describe the classification of nerve injury:
   a. Seddon classification
   b. Sunderland classification
19. List the major peripheral nerves of body. Describe the motor and sensory innervation of each.
20. Draw the major components of the brachial plexus.
21. Describe the rating scales for motor power.
22. Describe the various sensory modalities and how to examine each.

23. Describe the symptoms and signs of common nerve entrapments:
    a. carpal tunnel
    b. ulnar entrapment at the elbow
    c. lateral femoral cutaneous nerve
    d. peroneal at fibular head
24. Define EMG and NCV.
25. Describe the changes in EMG and NCV in nerve entrapment.
26. Describe the nonoperative and operative treatment of entrapment syndromes.
27. Define:
    a. coaptation
    b. neurorrhaphy
    c. neurotization
    d. nerve transfer

Middle Level:

1. Define the autonomic nervous system:
    a. differentiate sympathetic and parasympathetic
    b. discuss anatomic distribution
    c. identify the various neurotransmitters
    d. discuss Horner's syndrome
2. Compare and contrast a peripheral nerve to a cranial nerve:
    a. histology
    b. response to injury
    c. root entry zone
3. Describe nerve regeneration in terms of:
    a. specificity
    b. pruning of sprouts
    c. end to side sprouting
4. Draw the complete brachial plexus.
5. Discuss the lumbar plexus.
6. Discuss stretch injury, missile injury and avulsion injury:
    a. definition
    b. typical etiology
    c. physical findings
    d. electrical findings
    e. nonoperative management
    f. indications for surgery
    g. intraoperative findings
    h. potential for recovery
7. Describe the anatomical location of the common entrapment sites. List the various bands and arcades that produce entrapment.
8. Provide a differential diagnosis for common entrapment syndromes:
    a. differentiate radiculopathies from entrapments
    b. discuss repetitive strain disorder
9. Discuss uncommon entrapment neuropathies:
    a. Guyon's canal
    b. suprascapular entrapment

c. radial tunnel/PIN
d. median nerve in forearm/AIN
e. tarsal tunnel (anterior and posterior)
f. pyriformis syndrome

10. Explain the use of EMG/NCV in the management of peripheral nerve disorders:
    a. physiology
    b. typical findings in neuropathy
    c. typical findings in nerve injury
    d. typical findings in nerve regeneration
11. Discuss the common metabolic/inherited neuropathies.
12. Discuss burn and electrical injury effects on nerves.
13. Classify peripheral nerve tumors.
14. Discuss the pathophysiology of NF1 and NF2.
15. Discuss the timing of peripheral nerve surgery:
    a. laceration injury
    b. blunt injury
    c. missile injury
    d. iatrogenic injury
    e. surgical injury
    f. injection injury
16. Discuss outcome priorities in brachial plexus surgery:
    a. motor versus sensory
    b. functional outcome- elbow flexion, shoulder abduction, etc.
17. Discuss tension at the nerve repair site.
18. Discuss nerve repair techniques:
    a. direct coaptation
    b. nerve graft
    c. nerve transfer
    d. donor (graft) nerves
    e. epineurial repair
    f. fascicular repair
19. Describe intra-operative nerve evaluation:
    a. visual
    b. palpation
    c. internal neurolysis
    d. nerve conduction
    e. biopsy

Senior Level:

1. Discuss with the aid of diagrams the anatomy of the peripheral nervous system:
    a. common sites of entrapments
    b. the brachial and lumbar plexus
    c. innervation of the bladder
2. Discuss the use of nerve grafting:
    a. types of fixation (suture/glue)
    b. types of grafts (nerve, vein, artificial)

c. end to side
3. Discuss entrapment syndromes:
   a. thoracic outlet
   b. double crush syndrome
   c. repetitive strain
4. Discuss ulnar nerve decompression:
   a. in situ decompression
   b. transposition (subcutaneous/intramuscular/submuscular)
   c. medial epicondylectomy
5. Differentiate brachial plexus injury from brachial plexitis.
6. Formulate a management plan for:
   a. birth brachial plexus injury
   b. acute nerve injury (stretch/compression/laceration/injection)
   c. chronic nerve injury
   d. failed nerve decompression
   e. painful nerve/neuroma
7. Describe the management of nerve tumors:
   a. imaging techniques, including MR neurography
   b. indications for surgery in NF1
   c. operative and adjuvant treatment for malignant peripheral nerve sheath tumors
   d. use of monitoring during tumor surgery
   e. fascicular dissection
8. Describe adjuvant therapies in nerve injury:
   a. muscle and tendon transfers
   b. prosthesis
   c. joint fusion

COMPETENCY-BASED PERFORMANCE OBJECTIVES:

Junior Level:

1. Obtain a history and perform a motor and sensory examination of the peripheral nervous system.
2. Based on history and physical, anatomically localize the lesion.
3. Obtain appropriate ancillary tests:
   a. EMG/NCV
   b. metabolic screens
   c. imaging studies
4. Formulate a differential diagnosis for common entrapments.
5. Position and prep for common entrapment releases.
6. Perform a diagnostic nerve and muscle biopsy.
7. Obtain sural nerve for grafting.

Middle Level:

1. Perform pre- and postoperative care of the patient with a peripheral nerve injury.
2. Evaluate a child with birth palsy.

3. Position a patient for nerve surgery:
    a. all entrapment sites
    b. brachial plexus surgery
4. Perform a neurolysis/decompression.
5. Expose the brachial plexus.
6. Manage the pain associated with nerve injury:
    a. use of medications
    b. use of rehabilitation c.
    use of stimulation

Senior Level:

1. Perform a consultation concerning a nerve injury.
2. Discuss the risks versus benefits of a surgical repair of a given nerve injury.
3. Determine the parameters confirming anticipated nerve regeneration:
    a. anticipated advancing Tinel's sign
    b. order of muscle re-innervation
4. Perform a nerve decompression:
    a. carpal tunnel
    b. ulnar nerve at elbow
    c. peroneal nerve
5. Perform a nerve repair:
    a. neurolysis
    b. internal neurolysis
    c. intraoperative nerve conductions
    d. placement and suture of nerve graft
6. Excise a nerve sheath tumor.
7. Expose a brachial plexus injury:
    a. determine possible repairs including nerve transfers
    b. expose the spinal accessory nerve
    c. expose the intercostal nerves

SPINAL SURGERY

UNIT OBJECTIVES

Demonstrate an understanding of the anatomy, physiology, pathophysiology, and presentation of disorders of the spine, its connecting ligaments, the spinal cord, the cauda equina, and the spinal roots. Demonstrate the ability to formulate and implement a diagnostic and treatment plan for diseases of the spine, its connecting ligaments, the spinal cord, the cauda equina, and the spinal roots that are amenable to surgical intervention.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Review the anatomy of the craniocervical junction, cervical, thoracic, and lumbar spine,

sacrum, and pelvis.
2. Interpret plain and dynamic radiographs, bone scans, myelograms, computerized tomographic (CT) scans, and magnetic resonance (MR) scans of patients with spinal disorders.
3. Review the signs, symptoms, and pathophysiology of common syndromes of degenerative spinal disorders: radiculopathy, myelopathy, instability, and neurogenic claudication.
4. Identify the common syndromes of spinal cord injury, including complete transverse injury, anterior cord injury, Brown-Sequard injury, central cord injury, cruciate paralysis, syringomyelia, conus syndrome, and sacral sparing. Describe the pathophysiology of spinal cord injury.
5. Describe the cauda equina syndrome.
6. Recite the differential diagnosis of cervical, thoracic, and lumbar pain.
7. Discuss the indications for cervical, thoracic, and lumbar discectomy.
8. Identify non-surgical spinal cord syndromes including amyotrophic lateral sclerosis, demyelinating conditions, and combined systems disease.
9. Review the initial management of spine and spinal cord injured patients including immobilization, traction, reduction, appropriate radiographic studies, and medical management.
10. Classify fractures, dislocations, and ligament injuries of the craniocervical region, subaxial cervical spine, thoracic, thoracolumbar junction, lumbar, and sacral spine. Describe the mechanism of injury and classify the injuries as stable or unstable. Review the indications for surgical management. 11. Discuss briefly the concept of grading schemes for spinal cord injury and myelopathy.

Middle Level:

1. Review the biomechanics of the craniocervical junction, cervical spine, and thoracolumbar and lumbar spine.
2. Review the biomechanics of common internal spinal fixators.
3. Review the definition of spinal instability based upon the principles of Punjabi and White and other authors.
4. Recognize the radiographic signs of degenerative neoplastic, traumatic, and congenital spinal instability.
5. Review the indications for, and uses, and relative effectiveness of common spinal orthoses. Discuss the degree of segmental and regional immobilization these orthoses provide.
6. Review the indications for, and physiology of, intraoperative spinal cord monitoring. Describe the technical aspects of intraoperative spinal cord monitoring.
7. Compare and contrast indications for anterior and posterior approaches to the cervical spine for the treatment of herniated cervical discs, spondylosis, and instability.
8. Discuss the role of corpectomy in the management of cervical disorders.
9. Compare and contrast the indications for anterior cervical discectomy with and without anterior interbody fusion.
10. Discuss the indications and techniques for anterior and posterior cervical spinal internal fixators.
11. Explain the biology of bone healing and options for bone grafting in spinal surgery.
12. Review the diagnosis and management of primary spinal tumors, spinal cord tumors, and spinal metastatic disease including indications for dorsal decompression, ventral decompression, and radiotherapy.

13. Discuss the management principles for gunshot and other penetrating wounds to the spine.
14. Review the signs, symptoms, and management options in the treatment of the adult tethered cord syndrome and syringomyelia.
15. Review management principles for spontaneous and postoperative spinal infections.
16. Review the management principles for intraoperative and postoperative cerebrospinal fluid leaks. 17. Discuss the surgical management of intradural congenital, neoplastic, and vascular lesions.

Senior Level:

1. Describe indications for the use of angiography and endovascular procedures in the management of spinal disorders.
2. Discuss the management of cervical degenerative disease secondary to rheumatoid arthritis. Describe factors which make it different from the management of non-rheumatoid disease.
3. Compare and contrast the treatment options for cervical spondylotic myelopathy and ossification of the posterior longitudinal ligament, including multilevel anterior cervical corpectomy and fusion, laminectomy, laminectomy and fusion, laminoplasty, and nonoperative therapies.
4. Discuss the indications for posterior cervical spinal internal fixators.
5. Compare and contrast the transthoracic, transpedicular, costotransverse, and lateral extracavitary approaches to a herniated thoracic disc, thoracic tumor, or thoracic spinal injury.
6. Discuss the indications for lumbar fusion for congenital disorders, iatrogenic disease, and degenerative disease, ranking indications from least to most controversial.
7. Compare and contrast the indications for anterior or posterior lumbar interbody fusion and intertransverse fusion for lumbar disease.
8. Discuss internal fixation options for posterior lumbar interbody fusion and intertransverse fusion.
9. Summarize the most common types of spinal tumors in the following categories:
    a. intradural/intramedullary
    b. intradural/extramedullary
    c. extradural/extramedullary.
10. Discuss nonoperative and operative treatment options for fractures and dislocations affecting the atlas and axis.
11. Compare and contrast the indications for nonoperative treatment, anterior approaches, and posterior operative approaches for the treatment of fractures and dislocations of the subaxial cervical spine.
12. Describe the indications for anterior, posterior, and posterolateral procedures in the management of thoracolumbar tumor, trauma, or infection.
13. Compare and contrast the indications for anterior and posterior spinal fixators in the management of thoracolumbar tumor, trauma, or infection.
14. Discuss reconstruction options for vertebral body defects after corpectomy for tumor, trauma, or infection.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Perform a complete history and physical examination on patients with spinal disorders.
2. Interpret plain x-rays, dynamic x-rays, myelograms, CT scans and MR scans of patients with spinal disorders.
3. Prepare patients for spinal surgery, including proper positioning, protection to pressure points, and placement of indicated arterial and central venous catheters, indwelling urinary catheters and anti-embolism devices.
4. Perform lumbar punctures and placement of lumbar drains.
5. Demonstrate the ability to place and manage cranial traction devices for reduction and immobilization of the unstable cervical spine.
6. Demonstrate the ability to place and manage a halo vest, including indications for placement and criteria for removal.
7. Demonstrate the ability to properly place the Mayfield head holder and other headrests.
8. Demonstrate the ability to harvest autologous bone graft from the calvarium, rib, fibula, and anterior or posterior iliac crest.
9. Perform dorsal exposure of the spinous processes, laminae, and facets of the cervical, thoracic, and lumbar spine.
10. Demonstrate the ability to close dorsal, ventral, and lateral spinal incisions.
11. Demonstrate proper postoperative wound care.
12. Demonstrate appropriate postoperative management of patients who have undergone spinal procedures.
13. Demonstrate the ability to perform, with supervision, a lumbar decompressive laminectomy for spinal stenosis.
14. Demonstrate the ability to excise, with supervision, a herniated lumbar disc.
15. Demonstrate the appropiate use of the operating microscope.

Middle Level:

1. Demonstrate the ability to prepare structural allografts for use in spinal surgery.
2. Determine the need for postoperative inpatient or outpatient rehabilitation in patients with spinal disorders.
3. Demonstrate the ability to perform a ventral exposure of the cervical spine followed by anterior cervical discectomy.
4. Demonstrate the ability to perform an anterior cervical interbody arthrodesis.
5. Demonstrate the ability to place anterior cervical instrumentation.
6. Demonstrate the ability to perform posterior cervical decompressive laminectomy.
7. Demonstrate the ability to perform posterior cervical foraminotomy with or without discectomy.
8. Demonstrate the ability to perform medial and lateral approaches to a far lateral lumbar disc herniation.
9. Demonstrate appropriate surgical technique in the management of recurrent lumbar disc herniations and recurrent lumbar stenosis.
10. Demonstrate the ability to perform posterior lumbar arthrodesis with or without the use of interbody instrumentation.
11. Demonstrate exposure of the cervical lateral masses, thoracic and lumbar transverse processes, and the sacral ala.
12. Demonstrate the ability to perform posterior/intertransverse arthrodesis in the cervical, thoracic and lumbar regions.
13. Demonstrate the ability to perform a laminectomy with or without transpedicular

decompression for tumor, infection, or trauma.

14. Demonstrate techniques for spinous process arthrodesis of the subaxial cervical spine for fracture or dislocation.
15. Demonstrate the ability to manage postoperative complications of spinal surgery including:
    a. hematoma
    b. infection
    c. spinal fluid leak
    d. new neurologic deficit
16. Demonstrate the ability to perform a tethered cord release.

Senior Level:

1. Demonstrate the ability to function independently in all phases of management of patients with spinal disorders.
2. Demonstrate the ability to perform occipital-cervical arthrodesis.
3. Demonstrate the ability to properly place sublaminar wires, lateral mass screws, lower cervical/upper thoracic pedicle screws, C2 pars interarticularis screws, and C1 -2 transarticular screws for the management of cervical spine disorders.
4. Demonstrate the ability to perform, with assistance if necessary, transoral odontoidectomy.
5. Demonstrate common techniques for performing C1 -2 arthrodesis.
6. Demonstrate the ability to perform anterior cervical corpectomy followed by arthrodesis.
7. Demonstrate the ability to perform, with assistance if necessary, transthoracic, thoracoabdominal, retroperitoneal, and transabdominal approaches to the thoracic and lumbar spine.
8. Demonstrate the ability to perform costotransverse and lateral extracavitary approaches to the thoracolumbar spine.
9. Demonstrate the ability to excise a herniated thoracic disc by use of the above-mentioned approaches.
10. Demonstrate the ability to perform vertebral corpectomy of the thoracolumbar spine for tumor, infection, or trauma, utilizing the above-mentioned approaches.
11. Demonstrate the ability to perform anterior arthrodesis of the thoracolumbar spine.
12. Demonstrate the proper placement of transpedicular screws in the thoracic and lumbar spine.
13. Demonstrate the proper placement of laminar, transverse process, and pedicle hooks in the thoracic and lumbar spine.
14. Demonstrate the ability to resect intradural spinal neoplasms.
15. Demonstrate the ability to perform methylmethacrylate vertebroplasty.
16. Demonstrate techniques of open reduction of fractures and dislocations of the cervical, thoracic, and lumbar spine.
17. Demonstrate the ability to surgically manage arachnoid cysts and spinal cord syrinx.
18. Demonstrate the ability to perform intradural procedures for congenital, neoplastic, and vascular lesions.

STEREOTACTIC AND FUNCTIONAL NEUROSURGERY

UNIT OBJECTIVES

Define neurosurgical stereotactic procedures and recognize their proper application. Describe the appropriate anatomy, physiology, and presentation of patients that are candidates for stereotactic procedures.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Junior Level:

1. Discuss the considerations of stereotactic frame placement in regard to target localization and purpose of procedure (biopsy, craniotomy, functional, radiosurgery).
2. Describe the direct and indirect basal ganglion-thalamocortical motor pathways.
3. Define and distinguish each of the following entities:
    a. tremor
    b. rigidity
    c. dystonia
    d. chorea
    e. athetosis
4. Describe the pathophysiology of Parkinson's disease and cerebellar tremor.
5. Explain the primary symptoms treated by ventro-lateral (VL) thalamotomy pallidotomy.
6. Discuss the advantages and disadvantages of stereotactic biopsy compared to open biopsy procedures.
7. Discuss the differential diagnosis of a newly discovered ring-enhancing intracranial mass.
8. Discuss the differential diagnosis of a newly discovered non-enhancing intracranial mass.
9. Define different seizure types (partial, partial-complex, generalized, etc).
10. Define medically intractable epilepsy.
11. Describe the anatomy of the mesial temporal lobe.
12. Define brachytherapy.
13. Define conventional care for patients with high-grade gliomas.
14. Review the limitations of conventional care for patients with high-grade gliomas.
15. Describe the anatomy of the trigeminal nuclei, root, ganglion and divisions.
16. Define typical trigeminal neuralgia, atypical trigeminal neuralgia, and trigeminal neuropathy.
17. Explain the potential causes for trigeminal neuralgia.
18. Define stereotactic radiosurgery.
19. Explain the differences between radiosurgery and radiation therapy.
20. List the potential indications for radiosurgery.
21. List the reported complications of radiosurgery.
22. Compare advantages and disadvantages of frame-based or frameless stereotactic craniotomies to nonstereotactic craniotomies.

Middle Level:

1. Describe factors guiding the choice of neuroimaging (CT, MRI, angiography) for stereotactic procedures.
2. Explain the rationale for various MRI sequences used for tumor localization and functional procedures.
3. Discuss the benefits and limitations of frame-based stereotactic procedures.
4. Discuss patient selection for VL thalamotomy and pallidotomy.
5. Discuss the advantages and disadvantages of ablative procedures.
6. List the potential complications of VL thalamotomy, pallidotomy, and bilateral thalamotomies or pallidotomies.

7. Discuss technical considerations to minimize the potential for an intracranial hemorrhage after a stereotactic biopsy.
8. Discuss technical considerations to minimize the potential for a non-diagnostic stereotactic biopsy.
9. Describe the appropriate trajectories to biopsy a lesion in the pineal region, midbrain, pons, and medulla.
10. Compare the advantages and disadvantages of radiosurgery and surgical resection for tumors and vascular malformations.

Senior Level:

1. Identify the microelectrode recordings of the thalamus and globus pallidus.
2. Identify the primary indications for medial thalamotomy and cingulotomy.
3. Describe the evaluation of a patient with medically intractable epilepsy.
4. Discuss the indications for placement of depth electrodes.
5. Describe the surgical treatment of epilepsy in detail.
6. Discuss the theoretical advantages of brachytherapy over external beam radiation therapy.
7. Describe the most common complications of brachytherapy and their treatment.
8. Explain the effect of patient selection on the reported results of brachytherapy for high-grade gliomas.
9. Describe the methods used to localize and percutaneously penetrate the foramen ovale.
10. List the potential advantages and disadvantages for the following trigeminal rhizotomy procedures:
    a. glycerol
    b. radiofrequency
    c. balloon compression
11. Discuss the dose-volume relationships for radiation-related complications after radiosurgery.
12. Discuss potential sources of inaccuracy for stereotactic procedures.
13. Discuss advantages and disadvantages of deep brain stimulation compared to ablative techniques.

COMPETENCY-BASED KNOWLEDGE OBJECTIVES:

Middle Level:

1. Perform simple radiosurgery dose-planning.

Senior Level:

1. Perform complex radiosurgery dose-planning.
2. Perform stereotactic craniotomies.

APPENDIX B

Program Requirements for Residency Education in Neurological Surgery

Program Requirements for Residency Education in Neurological Surgery
ACGME common program requirements as of 7/7/05 appear in **bold.**

Preface
The program requirements set forth here are to be considered common to all specialties, and are complete only when supplemented, where indicated and individually, by each specialty.

I. Introduction

A. Definition of Discipline

Neurological surgery is a discipline of medicine and that specialty of surgery which provides the operative and nonoperative management (ie, prevention, diagnosis, evaluation, treatment, critical care, and rehabilitation) of disorders of the central, peripheral, and autonomic nervous systems, including their supporting structures and vascular supply; the evaluation and treatment of pathological processes that modify the function or activity of the nervous system, including the hypophysis: and the operative and nonoperative management of pain. As such, neurological surgery encompasses the surgical, nonsurgical and stereotactic radiosurgical treatment of adult and pediatric patients with disorders of the nervous system: disorders of the brain, meninges, skull, including skull base, and their blood supply, including the surgical and endovascular treatment of disorders of the intracranial and extracranial vasculature supplying the brain and spinal cord; disorders of the pituitary gland; disorders of the spinal cord, meninges, and vertebral column, including those that may require treatment by fusion, instrumentation, or endovascular techniques; and disorders of the cranial and spinal nerves throughout their distribution.

B. Duration and Scope of Education

1 The training program in neurological surgery must include a minimum of 1 year of training in Accreditation Council for Graduate Medical Education (ACGME) accredited program in general surgery or at least 1 year of a program accredited for the acquisition of fundamental clinical skills as defined below. This training should be completed prior to the third year of neurological surgery training.

2. The neurosurgery program director is responsible for the design, implementation, and oversight of a PGY-1 year that will prepare residents for education in neurological surgery.

a) This year must include resident participation in clinical and didactic activities that will give them the opportunity to:

(1) Develop the knowledge, attitudes and skills needed to formulate principles and assess, plan, and initiate treatment of patients with surgical and medical problems.

(2) Be involved in the care of patients with surgical and medical emergencies, multiple organ system trauma, and nervous system injuries and diseases.

(3) Gain experience in the care of critically ill surgical and medical patients

(4) Participate in the pre-, intra-, and post-operative care of surgical patients

(5) Develop basic surgical skills

b) In order to meet the goals of the PGY-1 Year there must be:

(1) At least 6 months of structured educational experience in surgery, as approved by the neurosurgery program director. The program director should consider training in adult and pediatric operative surgery, surgical critical care, and emergency/multisystem trauma care.

(2) 3 months of training in an ACGME accredited neurology training program preferably included in the PGY 1-year.

(3) No more than 3 months of neurological surgery.

3. The neurological surgery training program is 60 months in duration, in addition to the year of acquisition of fundamental clinical skills, and must provide 36 months of clinical neurological surgery at the sponsoring institution or one of its approved participating institutions.

4. The remaining period of time, not devoted to clinical neurology and neurosurgery, should be spent in the study of the basic sciences, neuroradiology, neuropathology, or other appropriate subject matter related to the neurosciences as agreed on by individual residents and the program director. [*Note:* The program director should consult the American Board of Neurological Surgery for certification requirements concerning any training conducted outside the approved institutions of the program.]

5. A block of training of 3 months minimum in an ACGME-accredited neurology training program must be arranged for all residents, unless they have previously had a minimum of 1 year of formal residency training in an accredited neurology training program. This training may be taken during the year of fundamental clinical skills.

6. The program must provide the residents with experience in direct and progressively responsible patient management as they advance through training.

7. There must be a 12-month period of time as chief resident on the clinical service of neurological surgery in the sponsoring institution or its approved participating institutions.

a) The chief resident must have major or primary responsibility for patient management with faculty supervision.

b) The chief resident should also have administrative responsibility as designated by the program director. The specific portion of the clinical training that constitutes the 12 months of chief residency must be specifically designated as the chief residency experience and must be identified at the time of program review.

8. Prior to entry into the program, each resident must be notified in writing of the length of training. The prescribed length of training for a particular resident may not be changed without

mutual agreement during his or her program unless there is a break in his or her training or the resident requires remedial training. Any training added to the accredited residency must be based on a clear educational rationale and must not interfere with the education and training of the residents enrolled in the program.

II. Institutions

A. Sponsoring Institution

One sponsoring institution must assume ultimate responsibility for the program, as described in the Institutional Requirements, and this responsibility extends to resident assignments at all participating institutions.

The sponsoring institution for an educational program in neurological surgery must be in a single geographic location. Appropriate institutions include medical schools, and hospitals. The institution must demonstrate commitment to the program in terms of financial and academic support, including timely appointment of a permanent department or division chairperson of Neurological Surgery.

B. Participating Institutions

1. **Assignment to an institution must be based on a clear educational rationale, integral to the program curriculum, with clearly-stated activities and objectives. When multiple participating institutions are used, there should be assurance of the continuity of the educational experience.**

2. **Assignment to a participating institution requires a letter of agreement with the sponsoring institution. Such a letter of agreement should:**

   a) identify the faculty who will assume both educational and supervisory responsibilities for residents;

   b) specify their responsibilities for teaching, supervision, and formal evaluation of residents, as specified later in this document;

   c) specify the duration and content of the educational experience; and

   d) state the policies and procedures that will govern resident education during the assignment.

3. An integrated institution must function as a single neurological surgery service with the sponsoring institution The program director must demonstrate to the RRC that the clinical service operates as a single unit in the assignment of residents and their faculty supervisors, the formulation of call schedules, and the convening of teaching conferences and related educational activities.

4. A participating institution functions as a separate neurological surgical service with a local training director under the direction of the program director and should be sufficiently close to the sponsoring institution to ensure peer interaction and regular

attendance at joint conferences and other activities. Appropriate exceptions may be considered for special resource hospitals (e.g. pediatrics, trauma).

III. Program Personnel and Resources

A. Chairman

When a change in chairmanship occurs within an accredited neurological surgery training program, the program must be site-visited within 2 years.

B. Program Director

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. In the event of a change of either program director or department chair, the program director should promptly notify the executive director of the Residency Review Committee (RRC) through the Web Accreditation Data System of the Accreditation Council for Graduate Medical Education (ACGME).

2. The program director, together with the faculty is responsible for the general administration of the program, and for the establishment and maintenance of a stable educational environment. Adequate lengths of appointment for both the program director and faculty are essential to maintaining such an appropriate continuity of leadership.

Administrative activities include those related to the recruitment, selection, instruction, supervision, counseling, evaluation, and advancement of residents (in accordance with institutional and departmental policies and procedures) and the maintenance of records related to program accreditation,

3. Qualifications of the program director are as follows:

a) The program director must possess the requisite specialty expertise, as well as documented educational and administrative abilities and experience to conduct the program.

b) The program director must be certified in the specialty by the American Board of Neurological Surgery, **or possess qualifications judged to be acceptable by the RRC.**

c) The program director must be appointed in good standing and based at the primary teaching site.

d) The program director shall be licensed to practice medicine in the state where the institution that sponsors the program is located. (Certain federal programs are exempted.)

4. Responsibilities of the program director are as follows:

a) The program director must oversee and organize the activities of the educational program in all institutions that participate in the program. This includes selecting and supervising the faculty and other program personnel at each participating institution, appointing a local site director, and monitoring appropriate resident supervision at all participating institutions.

b) The program director is responsible for preparing an accurate statistical and narrative description of the program as requested by the RRC, as well as updating annually both program and resident records through the ACGME's Accreditation Data System.

c) The program director must ensure the implementation of fair policies, grievance procedures, and due process, as established by the sponsoring institution and in compliance with the Institutional Requirements.

d) The program director must seek the prior approval of the RRC for any changes in the program that may significantly alter the educational experience of the residents. Such changes, for example, include:

(1) the addition or deletion of a participating institution

(2) a change in the format of the educational program

(3) a change in the approved resident complement for those specialties that approve resident complement.

(4) the addition or deletion of any institutional rotation

On review of a proposal for any such major change in a program, the RRC may determine that a site visit is necessary.

e) The program director is responsible for the annual collection, compilation, and retention of the number and types of neurological surgery operative procedures performed in all institutions and facilities utilized in the clinical education of residents. This information must be provided in the format specified by the RRC.

f) Annually, the program director must ensure the compilation of a comprehensive and accurate record of the number and type of operative procedures performed by each resident completing the program. This record must include all of the procedures in which the neurological surgery resident was either resident surgeon or assistant and must be signed by both the resident and the program director as a statement of its accuracy. This information must be provided in the format specified by the RRC.

g) The program director must monitor resident stress, including mental or emotional conditions inhibiting performance or learning and drug- or alcohol-related dysfunction. Program directors and teaching staff should be sensitive to the need for timely provision of confidential counseling and psychological support services to residents. Training situations that consistently produce undesirable stress on residents must be evaluated and modified.

C. Faculty

1. **At each participating institution, there must be a sufficient number of faculty with documented qualifications to instruct and supervise adequately all residents in the program.**

2. **The faculty, furthermore, must devote sufficient time to the educational program to fulfill their supervisory and teaching responsibilities. They must demonstrate a strong interest in the education of residents and must support the goals and objectives of the educational program of which they are a member.**

   a) Neurological surgery faculty participation in undergraduate medical education is desirable.

   b) There should be a minimum faculty of three neurological surgeons at the primary teaching site.

   c) Training directors at Participating Institutions

      (1) The training director shall be a qualified neurological surgeon appointed by and responsible to the program director in each geographically separate institution. This individual must be responsible for the education of the residents and also will supervise the educational activities of other neurological surgeons relating to resident education in that institution. Appropriate exceptions may be considered for special resource hospitals.

      (2) These appointments will generally be for a 1-year period and can be renewable to ensure continuity of leadership.

      (3) The training director in neurological surgery at each participating institution must have major clinical responsibilities at that institution.

3. Qualifications of the physician faculty are as follows:

   a) The physician faculty must possess the requisite specialty expertise and Competence in clinical care and teaching abilities, as well as documented educational and administrative abilities and experience in their field, and an in-depth understanding of basic mechanisms of normal and abnormal states and the application of current knowledge to practice.

   b) The physician faculty who are neurological surgeons **must be certified in the specialty by,** or be in the certification process of, **the American Board of** Neurological Surgery **or possess qualifications judged to be acceptable by the RRC.**

   c) The physician faculty must be appointed in good standing to the staff of an institution participating in the program.

4. The responsibility for establishing and maintaining an environment of inquiry and

scholarship rests with the faculty, and an active research component must be included in each program. While not all members of a teaching staff must be investigators, the staff as a whole must demonstrate broad involvement in scholarly activity. ***Scholarship*** **is defined as the following:**

a) the scholarship of *discovery,* as evidenced by peer-reviewed funding or by publication of original research in a peer-reviewed journal;

b) the scholarship of *dissemination,* as evidenced by review articles or chapters in textbooks; c) the scholarship of *application,* as evidenced by the publication or presentation of, for example, case reports or clinical series at local, regional, or national professional and scientific society meetings.

Complementary to the above scholarship is the regular participation of the teaching staff in clinical discussions, rounds, journal clubs, and research conferences in a manner that promotes a spirit of inquiry and scholarship (e.g., the offering of guidance and technical support for residents involved in research such as research design and statistical analysis; and the provision of support for residents' participation, as appropriate, in scholarly activities.

5. Qualifications of the nonphysician faculty are as follows:

a) Nonphysician faculty must be appropriately qualified in their field.

b) Nonphysician faculty must possess appropriate institutional appointments.

D. Other Program Personnel

Additional necessary professional, technical, and clerical personnel must be provided to support the program.

E. Resources

The program must ensure that adequate resources (e.g., sufficient laboratory space and equipment, computer and statistical consultation services) are available.

1. Inpatient facilities

a) Inpatient facilities available for training programs in neurological surgery should be geographically identifiable and have an adequate number of beds, support personnel, and proper equipment to ensure quality education and excellence in patient care.

b) The presence of a neurological surgery operating room with microsurgical capabilities and an intensive care unit specifically for the care of neurological surgery patients is desirable to a training program, as are other units for specialized neurological surgery care.

c) Similarly, neurological surgery beds should be on a unit designated for the care of neurosurgery patients.

2. Outpatient Facilities

Residents must have available appropriate outpatient facilities, clinic, and office space for training purposes in the regular preoperative evaluation and postoperative follow-up for cases for which the resident has responsibility.

3. Research Facilities

a) There should be space and support personnel for research identifiable in the neurological surgery division or department, and some activity should be ongoing in this area.

b) Clinical and/or basic research opportunities should be available to the neurological surgery resident with appropriate faculty supervision.

4. Library

a) Residents must have ready access to a major medical library.

b) Library services should include the electronic retrieval of information from medical databases.

c) There must be access to an on-site library or to a collection of appropriate texts and journals in each institution participating in a residency program. On-site libraries and/or collections of texts and journals must be readily available during nights and weekends.

IV. Resident Appointments

A. Eligibility Criteria

The program must comply with the criteria for resident eligibility as specified in the Institutional Requirements.

B. Number of Residents

The RRC will approve the number of residents based upon established written criteria that include the adequacy of resources for resident education (e.g., the quality and volume of patients and related clinical material available for education), faculty-resident ratio, institutional funding, and the quality of faculty teaching.

1. One of the measures of a training program is the quality of residents chosen and the ability of the program to ensure a steady increase in the resident's knowledge and skills.

2. The RRC will review the selection process of residents and seek evidence that the program evaluates the progression of the residents during training.

3. Where there is demonstrated excellence in providing educational experience for the residents, as determined by the RRC, a program may be authorized to enroll more than one resident per year. The ability to do so does not depend on any multiplication of the

minimum requirements as established by the Program Requirements for Residency Education in Neurological Surgery. In determining the size of a resident complement, the RRC will consider the following:

a) Presence of a faculty of national stature in neurological surgery

b) Quality of the educational program

c) Quality of clinical care

d) Total number and distribution of cases

e) Quality of clinical and basic research

f) Quality of residents trained by the program, including numbers of residents starting and finishing the program, number of graduates who take written and oral examinations of the American Board of Neurological Surgery, and the number of graduates passing these written and oral examinations

g) Facilities

4. The number of residents at each year of training in a given program, except as provided below, shall not exceed the number approved by the most recent accreditation review of that program. A new resident may be appointed to fill a vacancy providing there is no adverse impact on the existing resident staff. The program must provide the RRC with an explanation for the excess complement and its plan for resolution to normal complement.

C. Resident Transfers

To determine the appropriate level of education for residents who are transferring from another residency program, the program director must receive written verification of previous educational experiences and a statement regarding the performance evaluation of the transferring resident prior to their acceptance into the program. A program director is required to provide verification of residency education for residents who may leave the program prior to completion of their education.

D. Appointment of Fellows and Other Students

1. **The appointment of fellows and other specialty residents or students must not dilute or detract from the educational opportunities available to regularly appointed residents.**

2. Programs must notify the RRC when they sponsor or participate in any clinical fellowship taking place within institutions participating in the program. This notification must occur before the commencement of such training and at each subsequent review of the program. Documentation must be provided describing the fellowship's relationship to and impact on the residency.

3. If fellows so appointed will, in the judgment of the RRC, detract from the education of the

regularly appointed residents, the accreditation status of the program may be dversely affected.

V. Program Curriculum

A. Program Design

1. Format

The program design and sequencing of educational experiences will be approved by the RRC as part of the review process.

2. Goals and Objectives

The program must possess a written statement that outlines its educational goals with respect to the knowledge, skills, and other attributes of residents for each major assignment and for each level of the program. This statement must be distributed to residents and faculty, and must be reviewed with residents prior to their assignments. All educational components of a residency program should be related to program goals.

3. Educational experience in neuroradiology, including endovascular surgical neuroradiology, and neuropathology must be an integral part of the training program designed for the education of the neurological surgery residents. Such experience should be under the direction of qualified neuroradiologists and preferably endovascular neurosurgeons, and neuropathologists.

4. The program must provide opportunities for experience and instruction in the basic neurosciences 5. Resident participation in undergraduate medical education is desirable.

5. Resident participation in undergraduate medical education is desirable.

6. Related Disciplines

   a) Recognizing the nature of the specialty of neurological surgery, it is unlikely that a program can mount an adequate educational experience for neurological surgery residents without approved training programs in related fields. Clinically oriented training programs in the sponsoring institution of the neurological surgery program should include accredited training programs in neurology, general surgery, internal medicine, pediatrics, and radiology.

   b) There should be clinical resources for the education of neurological surgery residents in anesthesiology, critical care, emergency medicine, endocrinology, ophthalmology, orthopedics, otolaryngology, pathology, and psychiatry. A lack of such resources will adversely affect the accreditation status of the neurological surgery program.

B. Specialty Curriculum

The program must possess a well-organized and effective curriculum, both didactic and clinical. The curriculum must also provide residents with progressive responsibility for patient management.

C. Residents Scholarly Activities

Each program must provide an opportunity for residents to participate in research or other scholarly activities, and residents must participate actively in such scholarly activities.

D. ACGME Competencies

The residency program must require its residents to obtain competence in the six areas listed below to the level expected of a new practitioner. Toward this end, **programs must define the specific knowledge, skills, behaviors, and attitudes required, and provide educational experiences as needed in order for their residents to demonstrate the following:**

1. ***Patient care*** **that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health** with specific reference to neurosurgical conditions. At a minimum residents are expected to:

    a) Gather and understand essential patient information in a timely manner.

    b) Generate an appropriate differential diagnosis.

    c) Implement an effective plan of management.

    d) Prioritize and stabilize multiple patients simultaneously.

    e) Competently perform neurosurgical operative procedures.

    f) Manage Complications

    g) Analyze Outcomes

    h) Counsel and educate patients and families.

    i) Provide health care services aimed at preventing health problems and maintaining health.

    j) Work with health care professionals to provide patient-focused care.

2. ***Medical Knowledge:*** Residents must demonstrate knowledge **about established and evolving biomedical, clinical, and cognate sciences,** with specific reference to basic and clinical neurosciences, **as well as the application of this knowledge to patient care.** Among other things, residents are expected to:

    a) Generate a differential diagnosis and properly sequence critical actions for patient are, including management complications, morbidity and mortality.

    b) Synthesize and properly utilize acquired patient data.

    c) Identify neurosurgical emergencies.

    d) Know how to access current medical information

e) Understand how to treat neurosurgical conditions.

f) Incorporate evidence-based principles.

3. *Practice-based learning and improvement* that involves the investigation and evaluation of care for their patients, the appraisal and assimilation of scientific evidence, and improvements in patient care. At a minimum, residents are expected to:

a) Analyze and assess their practice experience and perform practice-based improvement.

b) Locate, appraise and utilize scientific evidence related to their patients' health problems.

c) Apply knowledge of study design and statistical methods to critically appraise the medical literature.

d) Utilize information technology to enhance their education and improve patient care. e) Facilitate the learning of students and other health care professionals.

4. Residents must be able to demonstrate ***interpersonal and communication skills* that result in the effective exchange of information and collaboration with patients, their families, and other health professionals.** At a minimum, residents are expected to:

a) Develop an effective therapeutic relationship with patients and their families, with respect for diversity and cultural, ethnic, spiritual, emotional, and age-specific differences.

b) Demonstrate effective participation in and leadership of the health care team.

c) Develop effective written communication skills.

d) Maintain relevant and legible medical records

e) Effectively communicate with out-of hospital personnel as well as non-medical personnel.

f) Involve patients in medical decisions

g) Strengthen listening and non-verbal communication skills.

5. *Professionalism,* as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to patients of diverse backgrounds. At a minimum, residents are expected to:

a) Treat patients/family/staff/paraprofessional personnel with respect.

b) Demonstrate sensitivity to patient's pain, emotional state, and gender/ethnicity issues.

c) Discuss death honestly, sensitively, patiently, and compassionately.

d) Exemplify integrity

e) Accept responsibility/accountability

f) Demonstrate reliability

g) Maintain calm, even temperament

h) Exhibit self-awareness and knowledge of limits.

i) Respond to the comments of other team members, patients, families, and peers openly and responsibly.

6. *Systems-based practice,* as manifested by actions that 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. At a minimum, residents are expected to:

a) Understand, access, appropriately utilize, and evaluate the effectiveness of the resources, providers, and systems necessary to provide optimal neurosurgical care.

b) Understand different medical practice models and delivery systems and how to best utilize them to care for the individual patient.

c) Practice cost-effective health care and resource allocation that does not compromise quality of care.

d) Advocate, coordinate, and facilitate patient care.

e) Understand principles of and advance practices for patient safety at the institutional and individual level.

E. Clinical Components

A current, well-organized, written plan for rotation of residents among the various services and institutions involved must be maintained and must be available to the residents and faculty.

1. Patient Requirements

There shall be sufficient patients admitted each year to ensure that the resident articipates in the care of patients suffering from the full spectrum of neurosurgical diseases.

2. This participation must include substantial experience in the management (including critical care) and surgical care of adult and pediatric patients and should include the full spectrum of neurosurgical disorders.

a) A program must demonstrate to the satisfaction of the RRC that it has both the volume of patients under neurological care and the breadth and depth of academic support to ensure that it has the capability of providing excellent neurological surgery training to residents.

b) The former must be substantiated in part by a compilation of annual institutional operative data and resident operative data (including that from residents rotating on the service from other programs) provided in a fashion prescribed by the RRC.

c) The profile of clinical experience reported to the RRC must be limited to that utilized in the resident's educational program. It also is understood that the educational requirements of the resident must be considered at all times, and assignment to a clinical service that limits or precludes educational opportunities will be adversely considered in evaluation of the program.

d) Within the total clinical facilities available to the training program, there should be a minimum of 500 major neurological surgery procedures per year per finishing resident. It must be understood that achievement of this minimum number of clinical procedures will not ensure accreditation of a training program.

e) The presence within a given training program of this neurological surgery workload and the distribution of the surgical experience are equally important. For instance, the cases should be appropriately distributed among cranial, extracranial, spinal, and peripheral nerve surgical procedures and should represent a well-balanced spectrum of neurological surgery in both adults and children. This spectrum should include craniotomies for trauma, neoplasms, aneurysms, and vascular malformations; extracranial carotid artery surgery; transsphenoidal and stereotaxic surgery (including radiosurgery); pain management; and spinal procedures of a sufficient number and variety using modern techniques.

f) No affiliated hospital in the training program should be a component of a training program unless there are a minimum of 100 major neurological surgery procedures per year distributed appropriately among the spectrum of cases as described in paragraph e, above. An exception may be made if a hospital offers special clinical resources, e.g., stereotaxic surgery, trauma, or pediatric neurological surgery, that significantly augment the resources of the training program.

3. Residents must have opportunities to evaluate patients referred for elective surgery in an outpatient environment. Under appropriate supervision, this experience should include obtaining a complete history, conducting an examination, ordering (if necessary) and interpreting diagnostic studies, and arriving independently at a diagnosis and plan of management. Consonant with their skills and level of experience, residents should be actively involved in preoperative decision making and subsequent operative procedures under the supervision of the attending physician who has ultimate responsibility for the patient. Residents should similarly be actively involved in postsurgical care and follow-up evaluation of their patients to develop skills in assessing postoperative recovery, recognizing and treating complications, communicating with referring physicians, and developing the physician-patient relationship. Preoperative interview and examination of patients already scheduled for a surgical procedure will not satisfy these requirements.

F. Didactic Components

There must be a well-coordinated schedule of teaching conferences, rounds, and other educational activities in which both the neurological surgery faculty and the residents participate. Conferences must be coordinated among institutions in a training program to facilitate attendance by a majority of staff and residents. A conference attendance record for both residents and faculty must be maintained.

G. Other Required Educational Components

Graduate medical education must take place in an environment of inquiry and scholarship in which residents participate in the development of new knowledge, learn to evaluate research findings, and develop habits of inquiry as a continuing professional responsibility.

VI. Resident Duty Hours and the Working Environment

Providing residents with a sound didactic and clinical education must be carefully planned and balanced with concerns for patient safety and resident well-being. Each program must ensure that the learning objectives of the program are not compromised by excessive reliance on residents to fulfill service obligations. Didactic and clinical education must have priority in the allotment of residents' time and energy. Duty hour assignments must recognize that faculty and residents collectively have responsibility for the safety and welfare of patients.

A. Supervision of Residents

1. **All patient care must be supervised by qualified faculty** through explicit written descriptions of supervisory lines of responsibility for the care of patients. Such guidelines must be communicated to all members of the program staff. **The program director must ensure, direct, and document adequate supervision of residents at all times. Residents must be provided with rapid, reliable systems for communicating with supervising faculty.**

2. **Faculty schedules must be structured to provide residents with continuous supervision and consultation.**

3. **Faculty and residents must be educated to recognize the signs of fatigue, and adopt and apply policies to prevent and counteract its potential negative effects.**

4. Attending physicians or supervising residents with appropriate experience for the severity and complexity of the patient's condition must be available at all times on site. The responsibility or independence given to residents in patient care should depend on their knowledge, their technical skill, their experience, the complexity of the patient's illness, and the risk of the operative procedures.

a) Progressive Responsibility

Resident participation in and responsibility for operative procedures embracing the entire neurosurgical spectrum should increase progressively throughout the training period.

b) Continuity of Care

Graduate training in neurological surgery requires a commitment to continuity of patient care, as practiced by qualified neurological surgeons. This continuity of care must take precedence-without regard to the time of day, day of the week, number of hours already worked, or on-call schedules. At the same time, patients have a right to expect a healthy, alert, responsible, and responsive physician dedicated to delivering effective

and appropriate care.

B. Duty Hours

1. **Duty hours are defined as all clinical and academic activities related to the residency program; i.e., patient care (both inpatient and outpatient), administrative duties relative to patient care, the provision for transfer of patient care, time spent in-house during call activities, and scheduled activities such as conferences. Duty hours do *not* include reading and preparation time spent away from the duty site.**

2. **Duty hours must be limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities.**

3. **Residents must be provided with 1 day in 7 free from all educational and clinical responsibilities, averaged over a 4-week period, inclusive of call. *One day* is defined as 1 continuous 24-hour period free from all clinical, educational, and administrative duties.**

4. **Adequate time for rest and personal activities must be provided. This should consist of a 10- hour time period provided between all daily duty periods and after in-house call.**

5. The program director must establish an environment that is optimal for both resident education and patient care, while ensuring that undue stress and fatigue among residents are avoided. It is his or her responsibility to ensure assignment of appropriate in-hospital duty hours so that residents are not required to perform excessively difficult or prolonged duties regularly.

6. During duty hours residents must be provided with adequate sleeping, lounge, and food facilities. Support services must be such that the resident does not spend an inordinate amount of time in non-educational activities that can be discharged properly by other personnel.

C. On-call Activities

The objective of on-call activities is to provide residents 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 residents are required to be immediately available in the assigned institution.

1. **In-house call must occur no more frequently than every third night, averaged over a 4-week period.**

2. **Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Residents may remain on duty for up to 6 additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care.**

3. **No new patients may be accepted after 24 hours of continuous duty.**

4. ***At-home call* (or *pager call)* is defined as a call taken from outside the assigned**

institution.

a) The frequency of at-home call is not subject to the every-third- night limitation. At-home call, however, must not be so frequent as to preclude rest and reasonable personal time for each resident. Residents taking at-home call must be provided with 1 day in 7 completely free from all educational and clinical responsibilities, averaged over a 4-week period.

b) When residents are called into the hospital from home, the hours residents spend in-house are counted toward the 80-hour limit.

c) The program director and the faculty must monitor the demands of at-home call in their programs, and make scheduling adjustments as necessary to mitigate excessive service demands and/or fatigue.

D. Moonlighting

1. **Because residency education is a full-time endeavor, the program director must ensure that moonlighting does not interfere with the ability of the resident to achieve the goals and objectives of the educational program.**

2. **The program director must comply with the sponsoring institution's written policies and procedures regarding moonlighting, in compliance with the ACGME Institutional Requirements.**

3. **Any hours a resident works for compensation at the sponsoring institution or any of the sponsor's primary clinical sites must be considered part of the 80-hour weekly limit on duty hours. This refers to the practice of *internal moonlighting.***

E. Oversight

1. **Each program must have written policies and procedures consistent with the Institutional and Program Requirements for resident duty hours and the working environment. These policies must be distributed to the residents and the faculty. Duty hours must be monitored with a frequency sufficient to ensure an appropriate balance between education and service.**

2. **Back-up support systems must be provided when patient care responsibilities are unusually difficult or prolonged, or if unexpected circumstances create resident fatigue sufficient to jeopardize patient care.**

a) Duty Hours Exceptions

An RRC may grant exceptions for up to 10% of the 80-hour limit to individual programs based on a sound educational rationale. Prior permission of the institution's GMEC, however, is required.

VII. Evaluation

A. Resident

1. Formative Evaluation

The faculty must evaluate in a timely manner the residents whom they supervise. In addition, the residency program must demonstrate that it has an effective mechanism for assessing resident performance throughout the program, and for utilizing the results to improve resident performance.

a) Assessment should include the use of methods that produce an accurate ssessment of residents' competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.

b) Assessment should include the regular and timely performance feedback to residents that includes at least semiannual written evaluations. Such evaluations are to be communicated to each resident in a timely manner, and maintained in a record that is accessible to each resident.

c) Assessment should include the use of assessment results, including evaluation by faculty, patients, peers, self, and other professional staff, to achieve progressive improvements in residents' competence and performance.

2. Final Evaluation

The program director must provide a final evaluation for each resident who completes the program. This evaluation must include a review of the resident's performance during the final period of education, and should verify that the resident has demonstrated sufficient professional ability to practice competently and independently. The final evaluation must be part of the resident's permanent record maintained by the institution.

B. Faculty

The performance of the faculty must be evaluated by the program no less frequently than at the midpoint of the accreditation cycle, and again prior to the next site visit. The evaluations should include a review of their teaching abilities, commitment to the educational program, clinical knowledge, and scholarly activities. This evaluation must include annual written confidential evaluations by residents.

C. Program

The educational effectiveness of a program must be evaluated at least annually in a systematic manner.

1. Representative program personnel (i.e., at least the program director, representative faculty, and one resident) must be organized to review program goals and objectives, and the effectiveness with which they are achieved. This group must conduct a formal documented meeting at least annually for this purpose. In the evaluation process, the

group must take into consideration written comments from the faculty, the most recent report of the GMEC of the sponsoring institution, and the residents' confidential written evaluations. If deficiencies are found, the group should prepare an explicit plan of action, which should be approved by the faculty and documented in the minutes of the meeting.

The teaching staff review of program effectiveness must evaluate the following:

a) the utilization of the resources available to the program,

b) the contribution of each institution participating in the program,

c) the financial and administrative support of the program,

d) the volume and variety of patients available to the program for educational purposes,

e) the performance of members of the teaching staff, and

f) the quality of supervision of residents.

2. The program should use resident performance and outcome assessment in its evaluation of the educational effectiveness of the residency program. Performance of program graduates on the certification examination should be used as one measure of evaluating program effectiveness. The program should maintain a process for using assessment results together with other program evaluation results to improve the residency program.

VIII. Experimentation and Innovation

Since responsible innovation and experimentation are essential to improving professional education, experimental projects along sound educational principles are encouraged. Requests for experimentation or innovative projects that may deviate from the program requirements must be approved in advance by the RRC, and must include the educational rationale and method of evaluation. The sponsoring institution and program are jointly responsible for the quality of education offered to residents for the duration of such a project.

IX. Certification

A. Certification Requirements

Residents who plan to seek certification by the American Board of Neurological Surgery **should communicate with the office of the board regarding the full requirements for certification.** The current address of this office is published in each edition of the *Graduate Medical Education Directory.* Requests regarding evaluation of educational programs in neurological surgery and all related program inquiries should be addressed to the Executive Director of the Residency Review Committee for Neurological Surgery, 515 N State St/Ste 2000, Chicago, IL 60610.

B. Performance on Examination

One measure of the quality of a program is the participation in and performance of its graduates on the examinations of the American Board of Neurological Surgery. The number of residents completing training and taking and passing the certification examinations will be part of the RRC's evaluation of the program. All residents must pass the ABNS primary examination before completing the program.

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