Highlights of the Resident and Fellow Section

EDITORIAL
1  The Neurology Resident and Fellow Section  
Mitchell S.V. Elkind

EDITORIAL TEAM
2  Resident and Fellow Section Editorial Team

EMERGING SUBSPECIALTIES IN NEUROLOGY
4  Emerging subspecialties in neurology: Pain medicine  
Irfan Lalani

CLINICAL REASONING
7  Clinical Reasoning: A 59-year-old woman with acute paraplegia  
S. Prasad, R.S. Price, S.M. Kranick, J.H. Woo, R.W. Hurst, and S. Galetta

RIGHT BRAIN
14  Reading, writing and reflecting: Making a case for narrative medicine in neurology  
Megan Alcauskas and Rita Charon

CHILD NEUROLOGY SECTION
18  Shuddering attacks in infancy  
D. Tibussek, M. Karenfort, E. Mayatepek, and B. Assmann

PEARLS AND OYSTERS
23  Pearls and oy-sters of localization in ophthalmoparesis  
Teresa Buracchio and Janet C. Rucker

INTERNATIONAL ISSUES
30  Neurology education and global health: My rotation in Botswana  
Nabila Dahodwala

EDUCATION RESEARCH AND INITIATIVES
33  Teaching: Residents in the hospital, mentors in the community: The Educational Pipeline Program at Penn  
R.H. Hamilton, K. Hamilton, B. Jackson, and N. Dahodwala

BOOK REVIEWS
Farrah J. Mateen

40  Book Review: The Comprehensive Board Review in Neurology  
Sudha Tallavajhula
We are delighted to announce the first annual Neurology® Resident and Fellow Section Writing Award.

The award is intended to recognize the extraordinary writing abilities of those currently in training in Neurology. Eligible manuscripts will include any submitted to and published in the Neurology® Resident and Fellow Section, whether on-line or in print. Submissions on any topic of interest to trainees and in any subcategory of the section will be eligible. The main criteria for selection will be educational value, novelty, depth of exposition, and clarity of writing. At least one author of the manuscript must be currently in a Neurology residency program or in fellowship training in one of the neurological subspecialties. All authors will be considered equal recipients of the award in order to recognize and encourage collaborative work among trainees. The first award will be announced in early 2009 and will be awarded for a paper published in 2008.

No formal application process is required. All manuscripts submitted to the section will be considered. Manuscripts should be submitted on-line at www.neurology.org. Please direct any questions to kpieper@neurology.org.
Welcome to the Resident and Fellow Section of *Neurology*!

This booklet provides representative examples of some of the finest writing by trainees published in the Resident and Fellow Section.

The Resident and Fellow Section began in January 2004 as an effort both to serve the trainee readership of the journal and to provide an outlet for resident writing. The Section is trainee-run: a team of 10 residents and fellows, each of whom serves for 3 years, has responsibility for writing, reviewing, editing, and publishing articles of interest to trainees. The group also has responsibility for initiating and developing several projects, including podcasts, other electronic communications, a website, and new subsection ideas. Podcasts on resident and fellow articles just began in December of 2007, for example, and E-Pearls, or email “pearls,” will begin soon. Photographs and brief biographies of the Resident and Fellow Section Editorial Team follow this introduction.

The Section has several different subsections, as well, which are well-represented by the articles in this booklet. These include Emerging Subspecialties in Neurology, Clinical Reasoning, Right Brain, Child Neurology, Pearls and Oy-sters, International Issues, Education Research and Initiatives, and Book Reviews. The descriptions of the subsections appear before each sample article.

The Section is strongly supported by *Neurology*’s Editor-in-Chief, Dr. John Noseworthy, the Associate Editors, the journal staff, and its publishers. *Neurology* recognizes that the future of the journal, and the future of the field of Neurology itself, depends on the interest and commitment of its readers and writers. This journal is one of the most important records of our profession, and current trainees are the profession’s most valuable resource. Trainees recognize this, and they have been prolific. During the past 4 years, the submission of papers has increased dramatically. Even more importantly, the breadth of material submitted has expanded, and its quality is even stronger than before. Initially published only on-line, some of the finest trainee writing is now being published in the print journal as well. The section has become one of the most frequently accessed parts of the *Neurology* website.

We anticipate several further developments for the Section in the future, limited only by the imagination of the students, residents, fellows, and others who are interested in neurology education. As the *Neurology* website evolves, for example, it is expected that residents and fellows will be able to find practical information related to educational resources, exams, fellowships and other opportunities available in the Section. Eventually, we hope that by getting residents involved in writing and peer review, the Section will play a role in helping trainees to meet requirements for core competencies related to practice-based learning and improvement, communication skills, and professionalism. And, beginning in 2008, we will offer an annual award for the finest writing to appear in the Section.

We welcome submission of manuscripts for the Resident and Fellow Section, and author instructions can be found at www.neurology.org. Papers submitted for this Section will undergo the same thorough peer review process as all *Neurology* submissions, and it is anticipated they will reflect the same high level of quality. It is further expected that manuscripts published in the Section will carry the same academic weight, whether on-line or in print, as papers published elsewhere in *Neurology*. We also continue to welcome input from our readers, including program directors and other educators, on features that will be most valuable. Questions and comments should be addressed to Mitchell Elkind or Kathy Pieper at kpieper@neurology.org.

We hope you enjoy this special edition of highlights of the Resident and Fellow Section of *Neurology*!

Mitchell Elkind, Resident and Fellow Section Editor

*Disclosures: Dr. Elkind has no disclosures.*
Section Editor
Resident & Fellow Section

Mitchell S.V. Elkind, MD, MS, FAAN

Dr. Elkind graduated from Harvard Medical School in 1992, interned at Brigham and Women’s Hospital, and completed neurology residency at Massachusetts General Hospital. He then obtained a Masters degree in Epidemiology from Columbia University while doing his clinical stroke fellowship. Currently, Dr. Elkind is an Associate Professor of Neurology at Columbia University in the Division of Stroke and Critical Care. His research is focused on inflammatory and infectious biomarkers in stroke risk prediction, as well as acute stroke therapy. Dr. Elkind is a Principal Investigator of 3 NINDS independent investigator awards. These include NeuSTART (Neuroprotection with Statin Therapy for Acute Recovery Trial), a clinical trial evaluating short-term high-dose statin therapy in acute stroke; Levels of Inflammatory Markers in the Treatment of Stroke (LIMITS), a multi-center blood biomarker study among lacunar stroke patients participating in the SPS3 trial; and the Northern Manhattan Study, a prospective cohort study of stroke risk factors. He is the former Neurology Residency Program Director at Columbia University Medical Center, and is a fellow of the American Academy of Neurology and a member of the American Neurological Association and the Stroke Council of the American Heart Association. He has mentored several residents and fellows in neurology and clinical research.

Megan Alcauskas, MD

Megan Alcauskas is the resident editor of Right Brain, the medical humanities segment of the Resident and Fellow Section. Dr. Alcauskas received her BS in Biology from Boston College in 2001 and her MD from Columbia University in 2005. She is currently in her third post-graduate year at Mount Sinai Hospital in New York City.

Rajani Ruth Caesar, MD

Rajani Ruth Caesar is a PGY 3 in the Neurology residency program at UTMB Galveston, Texas. She received her medical degree from Erasmus University in Rotterdam, the Netherlands. After two years researching traumatic brain injury at UTSW in Dallas, Texas, Dr. Caesar did an internship in Toledo, Ohio. There she served as Chief Resident in the Transitional Year program.

Fabio Iwamoto, MD

Fabio Iwamoto received his MD from Universidade Federal do Paraná in Brazil where he also completed a neurology residency under Dr. Lineu Werneck. He then completed a neurology residency at New York Presbyterian Hospital – Weill Cornell Medical Center under Dr. M. Flint Beal. He is currently a fellow in neuro-oncology at Memorial Sloan-Kettering Cancer Center, working with Dr. Lisa DeAngelis and Dr. Jerome Posner.

Shafali Jeste, MD

Shafali Jeste earned her BA in philosophy from Yale University in 1997, and then her MD from Harvard Medical School in 2002. She completed her child neurology residency at Children’s Hospital, Boston, where she served as the Chief Resident in Neurology in 2006. She is now a fellow in Behavioral Neurology at Children’s Hospital, Boston, with funding from the Child Neurology Foundation and Autism Speaks. Her clinical and research interests are in autism, with a focus on the creation of neurologically based endophenotypes. She currently is performing a study using ERPs to define neural markers for autism in the Tuberous Sclerosis Complex.
After completing medical school at The Aga Khan University in Pakistan, Irfan Lalani came to the US for post graduate training in Neurology. This training included a post doctoral fellowship in Neurogenetics at Northwestern University, neurology residency at Baylor College of Medicine and Pain Medicine Fellowship at MD Anderson Cancer Center. He is currently an assistant professor in the Department of Anesthesiology and Pain Medicine at MD Anderson Cancer Center. His clinical interests include the pathophysiology and treatment of neuropathic pain.

Farrah Mateen is a third year resident in adult neurology at the Mayo Clinic in Rochester, MN, and medical ethics fellow at Harvard Medical School. She is originally from Prince Albert, SK, Canada, and completed medical school at the University of Saskatchewan. She is especially interested in international issues related to health, neurological disease in underserved populations, and government policies regarding people with chronic illness. Dr. Mateen is also a member of the American Medical Association’s Public Health Committee and a volunteer writer for patient-focused newsletters.

Shanna Patterson is originally from coastal California, where she completed medical school at UCSD. For the last three years she has relished living in New York City and is currently a second year resident in neurology at Columbia University. Recently she has also enjoyed being an active part of the Neurology Resident and Fellow Section’s editorial team, as well as a member of the Podcast Committee. Her future career interests include the field of epilepsy.

Farrah Mateen, MD

Christopher M. Nolte, MD, MS

Shanna Patterson, MD

Irfan Lalani, MD

Ryan Overman, MD

Sashank Prasad, MD

Christopher Nolte is currently in the Sleep Medicine fellowship at Vanderbilt University after completing his neurology residency at the Mayo Clinic in Jacksonville, FL. He is a graduate of the Palatucci Advocacy Leadership Forum, Chair of the Consortium of Neurology Residents and Fellows, ex-officio member of the Consortium of Neurology Program Directors, member of the Graduate Education Subcommittee, member of the Patient Safety Subcommittee, and has served on the AANnews Subcommittee.

Farrah Mateen is a third year resident in adult neurology at the Mayo Clinic in Rochester, MN, and medical ethics fellow at Harvard Medical School. She is originally from Prince Albert, SK, Canada, and completed medical school at the University of Saskatchewan. She is especially interested in international issues related to health, neurological disease in underserved populations, and government policies regarding people with chronic illness. Dr. Mateen is also a member of the American Medical Association’s Public Health Committee and a volunteer writer for patient-focused newsletters.

Ryan Overman is originally from Anderson, Indiana. He studied chemistry and anthropology at Butler University before attending the Indiana University School of Medicine. He is currently a resident in adult neurology at Indiana University and is serving his senior year as chief resident. His interests include neuromuscular disease and vascular neurology.

Sashank Prasad is completing neurology residency at the Hospital of the University of Pennsylvania. He attended Yale University, where he majored in English, and the University of Pennsylvania School of Medicine. Following residency, he will pursue fellowship training in clinical neuro-ophthalmology and in functional neuro-imaging. His primary research interest is visual perception.
EMERGING SUBSPECIALTIES IN NEUROLOGY

These manuscripts will review the history and development of emerging subspecialties in neurology, including fields such as Pain Medicine, Headache, Neurocritical Care, Interventional Neurology, and others. The focus should be on educating residents with a possible interest in this subspecialty. Those interested in writing these manuscripts should contact the Resident and Fellow Section Editor before submission to inquire about the need for an article on a particular topic.
Emerging subspecialties in neurology: Pain medicine

Irfan Lalani, MD

Traditionally neurologists have been considered masterful diagnosticians. Fellow physicians often rely on neurologists to sort out complex historical and examination data in order to arrive at a diagnosis and plan of action. Our specialty is also known for its expertise in the continuing longitudinal care of patients with serious illnesses that impact social and occupational function. Several neurologic diseases result in chronic pain, e.g., stroke, multiple sclerosis, and radiculopathy. For these reasons, neurologists are well suited to the practice of pain medicine.

One of the first US neurologists to contribute to pain medicine was Silas Weir Mitchell. In *Injuries of Nerves and Their Consequences*, he gave detailed case descriptions of causalgia (complex regional pain syndrome) and phantom limb pain. Subsequently, the concept of multidisciplinary pain management was pioneered by John Bonica, who founded the first interdisciplinary pain clinic in 1947 at Tacoma General Hospital. Currently, the practice of pain medicine involves physicians from multiple specialties including physiatry, psychiatry, anesthesiology, neurosurgery, and neurology.

In a survey of practicing US neurologists, 77.4% of respondents reported that they manage patients with chronic headache, whereas 47.6% cared for patients with chronic spine and limb pain. Other painful conditions that are seen by neurologists include neuropathy, failed back syndromes, radiculopathy, and postherpetic neuralgia. Neuropathic pain syndromes affect more than 3 million Americans and migraine headaches affect 15% of the US population. Despite the large number of patients who neurologists see with pain-related complaints, data suggest that there is considerable room for improvement in pain-related training during residency and beyond.

Galer et al. conducted a survey of practicing neurologists and neurology program directors. Thirty percent of respondents reported that they were adequately trained to diagnose pain-related disorders; only 20% felt adequately trained to treat these conditions. A large majority (89%) stated the need for more pain-related training during residency and 91% wanted more pain education for practicing neurologists. Interestingly, neurology program directors rated pain medicine seventh in importance of eight neurology subspecialties. Only 29% of neurology programs had a pain specialist on faculty and 5% had a mandatory pain clinic rotation, reflecting a current paucity of pain education in neurology residency programs. As a first step to rectify this situation, the American Academy of Neurology published a pain medicine core curriculum for neurology residents in 2001. This document clearly documents educational objectives for residents based on their level of training.

Pain medicine was recognized in 1998 by the American Board of Medical Specialties (ABMS) as a neurologic subspecialty. The first pain medicine certification examination was given by the American Board of Psychiatry and Neurology (ABPN) in 2000. There are currently four approved pain medicine fellowship programs listed on the Accreditation Council on Graduate Medical Education (ACGME) Web site (www.acgme.org), while 18 neurologists were certified in pain medicine in 2005 (www.abpn.org). Other specialties with accredited pain medicine fellowships include anesthesiology (90 programs), physical medicine and rehabilitation (11 programs), and psychiatry (1 program). The ACGME has uniform accreditation criteria for all pain fellowships.
ships. These include training in interventional procedures, behavioral and psychological approaches, pharmacotherapy, and rehabilitation. Several non-neurology based pain fellowships also accept neurology applicants but there remains a need for expanding access for neurologists to multidisciplinary pain fellowships.

Fellowship training in pain management involves the development of skills required to diagnose and treat acute, chronic non-malignant, and cancer-related pain. Expertise is developed in the use of pharmacologic agents including antidepressants, antiepileptic agents, and opioids. The appropriate use and performance of fluoroscopic guided procedures, e.g., zygapophysial joint blocks, selective nerve root blocks, and spinal cord stimulation, should be mastered during pain fellowship training. Training should also integrate behavioral approaches to pain including psychological evaluation and treatment of psychiatric comorbidities. Physical therapy and rehabilitation represent an important adjunct to multidisciplinary pain management. Completion of a comprehensive pain fellowship prepares the neurologist to provide evidence-based, multimodality effective patient care.

There are a variety of career options open to the neurology pain specialist. These include academic practice, private practice, and pharmaceutical/device manufacturing industry. An abundance of research opportunities exist in this nascent field. These include investigating basic molecular mechanisms of pain transduction, functional neuroimaging to evaluate changes in cerebral function related to chronic pain, and outcomes-based research to identify optimal pharmacologic and interventional therapies for acute and chronic pain. The deficiencies in pain-related education and the scarcity of faculty pain specialists will also result in an increased demand for academic pain specialist faculty.

Conventional randomized controlled trials may not be the best tool for assessing chronic pain therapies. Neurologists have been involved in innovative trial designs that better assess the chronic as well as episodic nature of some painful conditions including migraine. Neurology pain specialists may therefore become involved with academic pain trial groups and industry and contribute to the development of novel therapeutic strategies for chronic pain.

Private practice affords the ability to develop physician-patient relationships based on continuity of care. Greater physician autonomy allows for selecting patients according to subspecialty interest and expertise. Other advantages include higher income potential and greater opportunities to develop an interventional-multidisciplinary pain practice.

There are a large number of patients with chronic pain conditions. A tremendous need exists to provide these patients with effective care and reduce their pain-related suffering and disability. The neurology pain specialist has a vital role in this regard. Pain-related education should be emphasized during neurology residency as well as for practicing neurologists. Further work remains to be done to encourage neurologists to specialize in pain medicine.

Acknowledgment
The author thanks Drs. Jerome Kurent, Charles Argoff, Everton Edmondson, and Misha Backonja for their help with this article.

References
Clinical Reasoning is a new initiative of the Resident and Fellow Section of *Neurology*. It focuses on case presentations with the aim of developing clinical reasoning skills among trainees. Appropriate cases for publication would include uncommon presentations of common neurological disorders and also typical presentations of more exotic disorders. The emphasis of the case presentation should be on generating a sound, thorough differential diagnosis; logically arriving at the correct diagnosis; and thoughtfully discussing the teaching-points of the case. Cases discussed in the section should utilize data presented serially in 2-4 segments that could be opened sequentially by the reader, allowing them to challenge themselves by thinking through the differential diagnosis or treatment options at each step. The manuscript should indicate where each break would occur, with specific questions for the reader to consider as they work their way through the case. The final section should provide the experienced clinician’s discussion (or resident author’s literature review). Ideally the individual sections will also include visually presented data, such as radiology, EEG, EMG, or other studies.
Clinical Reasoning: A 59-year-old woman with acute paraplegia

SECTION 1
Case presentation. A 59-year-old woman with a history of hypertension developed acute bilateral lower leg weakness while watching television. She had shifted her weight while sitting on the couch and suddenly felt a sharp pain in her lower back and right leg. When she stood up to walk she noticed that her legs were weak; over the course of 1 hour she became unable to move her legs. She could not urinate voluntarily and had increasing numbness. She was brought to the emergency department for evaluation.

Questions for consideration:
1. What does acute paraplegia localize and what is the differential diagnosis?
2. What features of the history help point toward a more or less likely diagnosis?

SECTION 2
When evaluating a patient with acute bilateral leg weakness, the concern for a possible neurosurgical emergency requires prompt diagnosis and treatment. The initial approach to these cases should address the possible locations for the lesion. An anatomic approach begins with the most central causes. A paraspinal lesion in the brain or spinal cord may cause paraplegia. A spinal cord lesion at any level may cause pain and lower extremity weakness and sensory loss, since the lesion disrupts the ascending and descending tracts that allow the leg to function. When evaluating the patient, it is important to consider the cauda equina, which may be damaged by extrinsic compression or by inflammatory and degenerative processes. Acute demyelinating radiculopathy and myelopathy, such as Guillain-Barré syndrome, must be considered. Peripartum causes of weakness include disorders of the central nervous system. Finally, psychogenic disorders such as conversion reaction must be considered, but only as a diagnosis of exclusion.

The constellation of bilateral leg weakness, radiating back pain, and severe urinary incontinence suggests a lesion within the lower spinal cord or cauda equina. The presence of weakness makes a process involving muscle or axons more concerning than previously thought. The time course points toward the possible etiology. The hyperacute onset of her symptoms is concerning for a compressive or vascular etiology. An inflammatory process of the cord would typically have a more subacute, evolving presentation.

In this patient, examination reveals complete paralysis of the legs proximally and distally, with the exception of 25 left leg strength. Tone was diminished in the legs symmetrically, and normal in the arms. Sensation to light touch, vibration, pinprick, and temperature was absent below the umbilicus on the right and decreased on the left. Joint position sense at the toes was impaired bilaterally. Deep tendon reflexes were absent in the lower extremities and 2+ in the upper extremities. Plantar responses were extensor bilaterally. She had decreased visual field. The remainder of the general and neurologic exam was unremarkable.

Questions for consideration:
1. How does the examination modify the differential and help parcel the workup?
2. What testing would you obtain at this point?
SECTION 3

The pattern of severe lower extremity weakness, sensory loss, hyperreflexia, and extensor planter responses is most consistent with acute myelopathy. The likely location of the lesion is in the lower thoracic cord based on the sensory level at the umbilicus. Diminished sensation of temperature, vibration, and joint position implies involvement of both the anterolateral system and the posterior columns. Since these sensory tracts receive different neural blood supplies, the lesion extends beyond one spinal distribution, which makes an isolated anterior spinal artery infarction less likely. By this reasoning, the most likely etiology is extrinsic spinal cord compression or intramedullary hemorrhage.

Since spinal cord compression may be reversible with prompt neurosurgical intervention, the first step in the evaluation of this patient is an emergent thoracic spine MRI (Figure 1).

Although the MRI was technically limited due to motion degradation, it revealed central cord T2 hyperintensity from T4 to T8 and suggested prominent flow voids within and on the surface of the cord. There was no significant cord expansion or evidence of an extrinsic compressive process. In addition, there was no intramedullary pathologic enhancement with gadolinium contrast.

Laboratory evaluations revealed an elevated white blood cell count of 16.8 cells/μl with 85% neutrophils. Hemoglobin and hematocrit were 9.7 and 29.7, respectively. Platelet count was 331,000. Other chemistry, electrolyte, and coagulation panels were within normal limits.

Question for consideration:
1. How do the MRI findings change the differential diagnosis and guide the diagnostic evaluation?
SECTION 4

Central cord T2 hyperintensity is a nonspecific finding of radiculopathy and is not specific for spinal cord damage. It may be seen in various conditions, such as acute transverse myelitis, spinal cord compression, and multiple sclerosis. The presence of gadolinium enhancement in the central cord region is more specific for acute transverse myelitis, but it is not specific for central cord syndrome.

Differential diagnosis of the differential diagnosis of acute transverse myelitis must take into account the possibility of other conditions, such as spinal cord tumors, infections, and angiography. The presence of gadolinium enhancement in the central cord region is more specific for acute transverse myelitis, but it is not specific for central cord syndrome. The presence of gadolinium enhancement in the central cord region is more specific for acute transverse myelitis, but it is not specific for central cord syndrome. The presence of gadolinium enhancement in the central cord region is more specific for acute transverse myelitis, but it is not specific for central cord syndrome.

Figure 2: Gadolinium-enhanced MR spinal cordography

Questions for consideration:
1. What other imaging studies would you recommend for this patient?
2. What is the diagnosis and prognosis?
SECTION 5
Selective angiograms of the right and left segmental arteries from T6 through L5 were obtained. The left L2 arteriogram demonstrated an intramedullary AVM at the T12-L1 level with arterial feeders arising from the posterior loop of the radiculomedullary artery of Adamkiewicz (Figure 3; see video). The shared origin of the arterial feeders and the anterior spinal artery from the entry of Adamkiewicz was confirmed on multiple oblique views. In addition, multiple dilated venous channels were seen extending to the lower thoracic levels. Venous drainage was into the inferior renal vein at the right L1 level. No dural arteriovenous fistula was identified. The remainder of the segmental arteries appeared normal. No arterial or venous aneurysms were seen.

These findings are consistent with a spinal intramedullary AVM, type 2 (hemangioblastoma).

TREATMENT options were believed to be limited. The patient was not treated with arterial embolization or surgical intervention because the risk for either procedure was considered too significant. Embolization was not performed because the volume of the arterial feeders was too small to target selective embolization of the feeding vessels. Because the L2 radiculomotor artery was shown to feed the anterior spinal artery via the radiculomedullary artery of Adamkiewicz, embolization of this branch would produce further cord infarction. Surgery was not performed because the lesion was inaccessible to its intramedullary location.

The patient remained stable, and after 1 week she was discharged for further rehabilitation. At 2-month follow-up, she had made minimal recovery in her leg strength.

DISCUSSION
The blood supply to the spinal cord is provided by two distinct anterior and posterior spinal arteries (Figure 4). From the anterior and posterior spinal arteries arise small subcortical and penetrating intramedullary arteries. The caliber of the anterior spinal artery narrows in the thoracic cord, resulting in greatly diminished descending blood flow. Blood flow to lower portions of the spinal cord arises from radiculomedullary arteries that reconstitute the anterior spinal artery and radiculomedullary arteries that reconstitute the posterior spinal arteries.

Radiculomedullary and radiculomedullary arteries originate from radiculomedullary arteries. Thirty-one pairs of radiculomedullary arteries pass through the intervertebral foramina to supply each spinal nerve and the dura. These originate from large segmental arteries, which include the ascending cervical, deep cervical, vertebral, intercostal, lumbar, and superior mesenteric arteries. Only 6 to 10 radiculomedullary arteries give rise to radiculomedullary branches, but the exact number and anatomic location is quite variable. Of the radiculomedullary arteries supplying the lumbar cord, the largest is named the artery of Adamkiewicz.

The venous anatomy of the spinal cord includes intramedullary veins that collect into the anterior and posterior subpial veins, which drain into radiculomedullary veins. Anterior and posterior radiculomedullary veins drain into the epidural (or intervertebral) venous plexus. The venous plexus drains into the epidural, abdominal, and interosseous veins. Of note, many venous drainage of the spinal cord does not contain valves, and under pathophysiologic conditions flow may become retrograde.

There are several types of spinal cord vascular malformations, each defined by its anatomic characteristics (Table). These include the spinal arteriovenous fistula (type 1 spinal cord AV fistula), intramedullary arteriovenous malformations (gonadal or type 2 spinal cord AVM), and tumors or type 3 spinal cord AVMs, and direct perimedullary fistulas (type 3 spinal cord AV fistula). Other spinal cord vascular malformations, the discussion of which is beyond the scope of this report, include cavernomas, telangiectasias, and venous angiomata, e.g.
Figure 4. Arterial supply of the spinal cord.

Table Characteristics of the different types of pathologic spinal arterovenous connections

<table>
<thead>
<tr>
<th>AVM type</th>
<th>Type 1: Direct arterial-to-venous shunt</th>
<th>Type 2 and 3: Intramedullary shunts</th>
<th>Type 4: Perimedullary arterovenous fistula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headwaters</td>
<td>Direct arterial-to-venous shunt</td>
<td>Intramedullary shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
<tr>
<td>Aneurysmal shunt</td>
<td>Intramedullary shunt</td>
<td>Intramedullary shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
<tr>
<td>Dividing vessels</td>
<td>Perimedullary shunt</td>
<td>Perimedullary shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
<tr>
<td>Location</td>
<td>Intramedullary shunt</td>
<td>Intramedullary shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
<tr>
<td>Anatomy</td>
<td>Intramedullary shunt</td>
<td>Intramedullary shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
<tr>
<td>Treatment</td>
<td>Direct arterial-to-venous shunt</td>
<td>Direct arterial-to-venous shunt</td>
<td>Direct arterial-to-venous shunt</td>
</tr>
</tbody>
</table>

AVM = arterovenous malformation.
The Resident and Fellow Section is a primarily online feature that serves the resident and fellow readership. Residents and fellows are expected to be the primary authors for most submissions but those highly involved in graduate medical education (e.g. program directors) may also contribute submissions on appropriate topics. Submissions for all article categories should be no more than 2500 words; permission for longer articles will be needed from the editors. The number of references should be ten or less and 1-2 tables or figures can be incorporated. The topic must be mentioned in the cover letter of the submission. Potential article topics include: teaching, ethics, practice, career choices, residency training, editorial, international education, research, historical, opinion, book review, training videos, or teaching NeuroImages. Teaching NeuroImages have the same requirements as NeuroImages but are especially valuable to the trainee audience and will be published in the online Resident and Fellow Section. A number of new categories were added in 2007. Queries and comments should be addressed to Mitchell Elkind, MD, MS, FAAN, or Kathy Pieper at kpieper@neurology.org.
“Right Brain” is a new feature devoted to the relationship between neurology and the medical humanities, with submissions either written by trainees or with a focus on the experience of the trainee. Appropriate submissions include articles, commentaries and reflections on the interaction between neurology and history, literature, ethics, theology, sociology, anthropology, philosophy, poetry, theater, film, fine arts or the media. “Right Brain” also will publish original works of fiction, poetry, and reflection written by residents and fellows relating to the practice of neurology or neurology training.
Right Brain: Reading, writing, and reflecting
Making a case for narrative medicine in neurology

A narrative, at its simplest, is a story. Doctors listen to and tell stories every day. At morning report, on rounds, at case conferences, while taking a patient’s history in clinic and when signing out in the evenings, stories are told, retold, and revised. These narratives are the foundations of clinical practice and the currency of patient-physician and physician-physician relationships.

Neurologists are the custodians of speech and language within the medical community. We study, examine, and characterize speech and language and use diagnostic pathology based on their aberrations. Not only do details and subtle nuances frequently make the diagnosis, but how the patient tells a story, including word choice, sentence structure, and prosody, takes on clinical significance. Neurology is one of the few specialties in which the patient’s history has retained its value despite increasingly sophisticated diagnostic technology.

More can be gained from a patient’s story than dry facts placed in a sequential pattern. Absorbing, interpreting, and responding to a patient’s narrative require a special skill set. These skills, called “narrative competence” by narrative scholars, include those that are practical, such as recognizing a story’s structure and appreciating metaphors and analogies, those that are affective, such as co-investing multiple endings, and those that are emotional, such as feeling empathy and recognizing a story’s mood. By upholding narrative competence, physicians can better understand a patient’s experience and thereby be better equipped to help him or her.

WHAT IS NARRATIVE MEDICINE? Narrative medicine, rather than a specialty, is a framework for clinical practice based on developing and exercising this skill set. It is a way of approaching the clinical encounter that focuses on appreciating and reflecting on the patient’s experience and the patient-physician relationship in order to improve both the building of trust, developing empathy, and fostering a sense of shared responsibility in a patient’s health.

Narrative competence rarely is taught as part of traditional medical school curricula or residency programs. Specific programs in narrative medicine, however, have been implemented in many medical schools and residency programs throughout the world. Courses in narrative medicine typically include two parts: reading of literary texts related to health and disease to gain practice in noticing and interpreting the stories of others and reflective writing about the process and the professional’s individual and shared experience.

LITERATURE IN MEDICINE

...You can’t understand people’s language of reason, one of the heart, you live in a world of abstractions.
—Ezra Pound, The Harrow

Literature and medicine have a remarkable common bond. Apollon was revered as the Greek god of both medicine and poetry. The novel, the case report, and the autobiography were all developed in roughly the same era. Many of the great literary texts, such as Middlemarch by George Eliot, The Plague by Albert Camus, and The Magic Mountain by Thomas Mann, are centered on illness and its vicissitudes. Neurologic illnesses are well-represented in literature, with works including those as diverse as The Iliad by Homer, An Unquiet Mind by Kay Redfield Jamison, and How Green Was My Valley by Richard Wurmbrand. The large number of physicians-writers, including Sir Arthur Conan Doyle, A. A. Milne, and William Carlos Williams, underscores the shared interests and methods of the two disciplines.

The study of literature has been part of medical school curricula since the early 1940s, introduced at a time when medicine was especially focused on nursing patient-centered practice. An informal survey conducted by the Society for
Health and Human Values in 1994 found that approximately 30% of US medical schools taught literature as part of its curriculum. By 1993, the most recent statistics available, 74% of those medical schools taught courses in literature and medicine and in 39% of them, it was a required course. Literature and medicine as a subdiscipline currently sees its own scholarly journals, professional societies, graduate programs, and sources of research funding.

The study of literary texts offers many advantages to students and develops skills that may not be obtainable in any other way. Through literature, a reader enters into another person's experience, which is historically, culturally, and physically different from his or her own. The situations, reactions, emotions, and actions of the characters are often based on a way that would be impossible in reality. Expectations present readers with whole, complex characters, meaningful scenarios, and a profound understanding of the human condition, allowing them to make sense of the story and come to their own conclusions. The partially or wholly fictional nature of most of these works is an advantage as it prevents the distortion of the real world and confuses elements that complicate real life.

By tracing the author's narration of sickness, suffering, and death, the physician can better understand his or her own patient's experience and illness. For example, White's The Daedalus, the Doctor and the Butterfly, describes the helplessness and frustration he feels by being trapped inside his locked-in body while his mind remains active.

Reflected in the glass, I saw the image of a man who seemed to have emerged from a sea of indistinguishable faces. I walked over, his tone intimate, his manner gentle. One eye was several inches farther from the other eye, and the other eye was closer to the edge of a curtain. The man said, "I want to talk to you about Dr. Smith." I nodded and he continued. I stared at the patient's face, but I couldn't see anything. Where was the string or cloth over his eyes? Not only was his face blurred, but his hair was, as well. He was still looking at me.

The book itself, each individual letter of which are transmitted via movements, is a monument to the irrepressibility of the creative spirit, even in the face of catastrophic obstacles. Through great texts, such as this one, physicians become more familiar with the experience of pain and illness in a way that is more personal than could be safely acquired with a real patient.

The act of reading itself is also beneficial. Reading literature builds interpretive, communicative, and empathetic skills. Physicians can put these skills developed in reading literary texts to use while reading other complicated narratives such as medical charts, case studies, and even medical texts.

PERSONAL REFLECTION

"But whatever else people do, or do not do, or the very least they profoundly suffer the more for women who speak, New..."

Daniel Adas

Reflective writing is another method for developing narrative competence. Reflectors take the form of clinical journal writing or critical incident reports where the writer is free to choose a topic of greatest significance to them or else to write personal and personal around a predetermined theme (e.g., a patient's illness or care, illness or illness in a child), or even (e.g., the illness of a relative). Participants are asked to write in different perspectives, voices, styles, and literary formats (e.g., letters, poems, stories). The only fixed rules are that reflections be written in impressions of experiences rather than case reports, that medical language be avoided, and that the reflections be written in a small group environment.

Reflective writing often centers on the patient's experience. Frequently from the patient's perspective, the physician is allowed time and space to narrate on how it feels to be the patient, and how the patient is reacting to what the doctor is experiencing. Writing about a patient in this way reduces the emotional distance between doctor and patient and re-emphasizes that doctor-patient relationship. As vividly and accurately as possible, the physician has the opportunity to express his or her own feelings. The physician can then focus on the patient's story.

Learning is a cycle of action, reflection, interpretation, and reaction. Reflective writers study their own decision-making, feelings, behaviors, inner voices, and gaps in knowledge and skill. Reflecting on one's own presence coincides with the development of insight into one's own educational needs and the ability to become more autonomous. Reflectors use professional and ethical issues that the writer can then think about seriously on his or her own and subsequently gather into viewpoints and judgments of his or her colleagues.

RESEARCH INTO NARRATIVE MEDICINE

The directed outcomes of narrative medicine, such as empathy, personal satisfaction, and relationship-building, are inherently difficult to study, min...
professional lives, any attempt at integrating narrative medicine into their daily must be made to fit within the existing routines, without taking too much extra time for the resident or expending patient care. Possibilities include substituting narrative medicine content for morning reports or noon conferences or on occasion month of asking senior residents to carry junior resident pager for the occasional 2 hours in the afternoon and evenings. Sessions held at night or on weekends may be practiced in some programs or among more senior residents with less call responsibility.

Sessions can take many forms. Residents can be asked to read a single text in advance of a seminar and come ready for a discussion on a predetermined theme, illness, or clinical situation. Another example would be the telling and testing clinical case presentation residents could give a narrative presentation of a patient's case including a discussion of the social, psychological, and personal factors involved in the case, the patient, physician interaction, and any ethical or moral issues that came to light.

Reflective exercises may also be incorporated into available time. Residents may be asked to write freely for as few as 3 or 4 minutes on a theme or event, which they afterward share with a small group. Another exercise is to ask residents to interview each other about a case when they were ill or felt vulnerable. Alternatives talk with the patient's experience about what it felt like to listen to the other's story and the intense about how it felt to share the experience. A facilitator helps to focus the discussion on the content and structure of the writing and the themes and conflicts that emerge. One particular residency program has had success by incorporating these reflective exercises into their program as much as 5% of the year.

CONCLUSION

Neurology training is increasely in the number of knowledge and skill it instills in a short period of time. The main effect of the shortening of residency, however, is the physician's gradual distancing from patients and colleagues. In addition, due to increasing subspecialization, technology, and managed care restrictions, neurology as a field has taken a giant step back from patients in recent years. Connecting with patients and their families, finding fulfillment, in caring for people, rather than caring only managing, or ignoring, is no longer discussed. It is simply describedimportance.

Narrative medicine is not a substitute for current clinical practice, but a way to complement it by reestablishing the centrality of the patient's story in the clinical encounter. Within a neurology residency program, narrative medicine could be a valuable tool in developing empathy, professionalism, and communication skills. Finally, narrative medicine is a way to reconnect with patients, each other, and ourselves. Doctors listen to and tell stories every day. Now it's time to hear them.

REFERENCES

CHILD NEUROLOGY SECTION

A new child neurology section in the Resident and Fellow Section of Neurology will focus on contemporary educational issues in child neurology. The goal of the section is to provide up-to-date reviews on important topics in child neurology that are relevant to all neurologists, both adult and child, particularly those still in their training. Examples include management of acute stroke in children, childhood demyelinating disease, neuroimaging in metabolic disorders, and the neurobiology of autism. Each piece will begin with a patient case, followed by a brief discussion about the differential diagnosis and a detailed discussion about the topic of focus. Submissions are welcome from residents and fellows in either child or adult neurology. Ideally, submissions will include the patient case as well as the discussion, but submission of timely review articles without an accompanying case will also be considered. In this situation, the editors of this section may supply an appropriate patient case.
Clinical Reasoning: Shuddering attacks in infancy

SECTION 1

A 6-month-old boy was brought in by his parents because of a series of paroxysmal shuddering episodes. The parents were able to document one attack on video (video 1 on the Neurology® Web site at www.neurology.org). The attack began with sudden staring, followed by opening of the mouth, noisy stridor, and inspiration, and shuddering movements predominately of his neck and shoulders. This was accompanied by a slight deviation of his eyes, head, and trunk to the right side. The parents reported that these attacks seemed to occur particularly while eating (video 2) and were often preceded by myoclonic jerks of the mouth. The patient was at times but seemed alert. Onset and termination of the events were always abrupt, and the child immediately continued his activities. Duration of the episodes was no longer than 5 to 15 seconds.

We were able to observe more than 20 of these episodes within a period of 48 hours, while he was hospitalized, as are shown in video 3.

Questions to consider:

1. How would you describe these seizures?
2. What is your initial differential diagnosis at this point?
3. What further testing would you recommend?
SECTION 2

The attacks were initially believed to be focal seizures because the shuddering movements were repeatedly preceded by right periorbital myoclonic jerks. Repeated video-EEG recordings were performed, but did not reveal any changes in the EEG other than muscle artifacts.

On the basis of published descriptions of similar fits in infancy, the diagnosis of shuddering attacks was suspected. No further diagnostic workup was undertaken.

On follow-up the frequency of the attacks gradually decreased, and they eventually seemed to have ceased after 3 months. However, at the age of 15 months, the episode reappeared, and another home video was sent to us. At this time the attacks were provoked by an attempt to stick a fork into a piece of bread (video 1). In addition, the mother had observed shuddering attacks provoked by pressing Lego bricks together. This occurred last for less than 1 week and was followed by another symptomless period of 6 months. Again, after that time the parents observed sporadic shuddering attacks that more than one a day which were somewhat milder than the original presentation.

At the age of 24 months, the parents provided another video demonstrating a third relapse (video 1). While playing with his mother, the child is pretending to wash his hair and in the end is asked to shake his head in order to “wet his hair.” However, in a trying to shake his head, he provokes another shuddering attack. Again and again the mother could reproduce this phenomenon. At the last follow-up, aged 26 months, the parents reported shuddering attacks frequency occurring just after coming out of the bath.

Questions to consider:

1. What other information would you like to get at this time?
2. What would you advise the parents?
SECTION 3
Regular neurologic examinations during the first 2 years of life have not revealed any additional abnormalities. In addition, at the age of 2 years the child was scored as being within normal limits on the Bayley Scales and the Mullen Scales of the Bayley Scales of Infant Development, Second Edition (BSID II), a widely used measure of cognitive and motor development in infancy. The BSID II comprises three separate scales: the Mental Scale, the Motor Scale, and the Behavior Rating Scale. Performance is measured through Mental Development Index (MDI) and Psychomotor Development Index (PDI) scores. Index scores have a mean of 100 (± 15). Scores between 85 and 115 are classified as within normal limits.

No family history of essential tremor was reported.

DISCUSSION
Shuddering attacks are benign, non-epileptic events that typically begin in infancy. The clinical events consist of rapid, wavelike movements of the head, shoulders, or occasionally, the trunk. As in our patient, events have been reported as brief, usually lasting less than 15 seconds. Frequency can vary, from up to 60 to over 400 events per day with a great inter- and intra-individual variability. In our patient, attacks seemed to be precipitated not only by feeding or crying but also by other non-epileptic events, including laughter or feeding a baby with a bottle of formula.

Shuddering attacks are not unique to infantile spasms. Infantile spasms are characterized by tonic or clonic contractions of the neck and trunk, often accompanied by a startle response. The clinical features of shuddering attacks are similar to those of infantile spasms, but the electroencephalographic (EEG) findings are different. In infantile spasms, the EEG shows a classic pattern of rhythmic, generalized spikes and waves, known as the “spike and wave” pattern. In our patient, the EEG was normal during the events.

The diagnosis of shuddering attacks is based on the clinical presentation. In cases with unusual clinical presentations, prolonged EEG monitoring is helpful. Other cases in which pediatric spasms are seen in infancy may also reflect seizures, as in our patient, who had no other EEG findings suggestive of seizures. Therefore, EEG is advocated in all patients with shuddering attacks, as well as in those with infantile spasms.

ACKNOWLEDGMENT
The authors thank the patient’s family for their support and encouragement. They also thank the staff of our hospital for their cooperation and assistance.

REFERENCES
General Submission Instructions

The Resident and Fellow Section is a primarily online feature that serves the resident and fellow readership. Residents and fellows are expected to be the primary authors for most submissions but those highly involved in graduate medical education (e.g., program directors) may also contribute submissions on appropriate topics. Submissions for all article categories should be no more than 2500 words; permission for longer articles will be needed from the editors. The number of references should be ten or less and 1-2 tables or figures can be incorporated. The topic must be mentioned in the cover letter of the submission. Potential article topics include: teaching, ethics, practice, career choices, residency training, editorial, international education, research, historical, opinion, book review, training videos, or teaching NeuroImages. Teaching NeuroImages have the same requirements as NeuroImages but are especially valuable to the trainee audience and will be published in the online Resident and Fellow Section. A number of new categories were added in 2007. Queries and comments should be addressed to Mitchell Elkind, MD, MS, FAAN, or Kathy Pieper at kpieper@neurology.org.
“Pearls and Oy-sters” is a new feature of the Resident and Fellow Section of Neurology that will focus on fundamental clinical neurology. Each article should address a specific niche of neurological disease and provide expertise in the form of clinical insights and tips, i.e., “pearls,” as well as advice for avoiding mistakes, or “oy-sters.” The author may choose to address a particular facet of the approach to neurological disease such as localization, elaboration of a differential diagnosis, evaluation, or treatment. The article should concentrate on what may be found in a textbook and/or provide what textbooks cannot, in the form of knowledge rendered from clinical experience. The target audience consists of those in training; however, the subject matter should be of interest to all in the world of clinical neurology.
PEARLS AND OY-STERS OF LOCALIZATION IN OPHTHALMOPARESIS

ABSTRACT

Ocular misalignment and ophthalmoparesis result in the symptom of binocular diplopia. In the evaluation of diplopia, localization of the ocular motility disorder is the main objective. This requires a systematic approach and knowledge of the ocular motor pathways and actions of the extraocular muscles. This article reviews the components of the ocular motor pathway and presents helpful tools for localization and common sources of error in the assessment of ophthalmoparesis. Neurology® 2007;69:E33–E40

Ophthalmoparesis and diplopia. Normal eye movements share the goal of placing an object of visual interest on each fovea simultaneously to allow visualization of a single, stable object. Clear and stable vision is sustained by mechanisms that hold the object on the fovea, such as fixation and the vestibulo-ocular reflex. Absent or inadequate ocular motility (ophthalmoparesis and ophthalmoparesis) often results in ocular misalignment, causing the visual symptom of binocular diplopia. Binocular diplopia occurs when an object of visual interest falls on the fovea in one eye and on an extrafoveal location in the other eye. Binocular diplopia suggests dysfunction of extracocular muscles, the neuromuscular junction, cranial nerves, cranial nerve nuclei or intranuclear and supranuclear connections. Correct localization of the underlying lesion is the first step to accurate diagnosis and requires a systematic approach and knowledge of the ocular motor pathways and actions of the extraocular muscles.

History and examination of diplopia. When obtaining the history and examining the patient, it is important to determine if the diplopia is binocular or monocular. Binocular diplopia resolves with covering either eye and is the result of ocular misalignment. Proper evaluation of binocular diplopia should determine if it is horizontal, vertical, or oblique; worse in a particular direction of gaze, and worse at distance or near. Eye movement examination should include assessment of ocular motility in the four diagnostic positions of gaze, ocular alignment (measured with the corneal light reflex test, cover test, etc., Maddox rod), and constancy or any ocular misalignment. In a constant lesion, the amount of ocular deviation is the same regardless of gaze direction, while in an inconsistent lesion, the amount of deviation varies with changes in gaze direction.

Pearls

- Binocular diplopia resolves with monocular covering of either eye, while monocular diplopia resolves with covering the affected eye.
- Visual blurring that resolves completely with monocular covering of either eye has the same localizing sign as monocular diplopia.
- Vestibular diplopia is non-neurologic in origin and is not caused by ocular misalignment. It is usually due to ocular pathology such as refractive error or intracranial causes such as extracranial.
- Worsening diplopia in a particular gaze direction suggests that motility in that direction is impaired.
- Deviation is a relative medial deviation of the eye, exodeviation is a relative lateral deviation of the eye. Hypertropia is a relative elevation of one eye.
- A tropia is a usually obvious deviation. A diplopia is detectable visually only upon interruption of binocular fusion by covering either eye.

From the Departments of Neurology (E.J.) and Ophthalmology (J.S.), Rush University Medical Center, Chicago, Ill. Disclosures: The authors report no conflicts of interest.
• Horizontal diplopia is caused by impaired abduction or adduction of one or both eyes and vertical diplopia by impaired elevation or depression.

• Diplopia worse at distance accompanies impaired abduction or divergence.

• Diplopia worse at near accompanies impaired adduction or convergence.

• Most neurologic ocular displacements are intermittent.

**Odds and pitfalls**

• Patients with severe monocular visual loss (generally worse than 20/200) will not experience binocular diplopia with ocular misalignment.

• Displacement of "dragging" at the tarsus is a rare cause of binocular diplopia in the absence of an ocular misalignment. It is due to a muscular disease such as an orbital mimic that may wander at rest with subsequent distortion of the muscle. This may displace the fovea resulting in an extrastereoscopic image in one eye and binocular diplopia. It may mimic a heterotropia or a history of muscular diplopia may be clues.

• Generalized ptosis is a rare cause of bilateral ptosis with monocular coverage and is often related to the homonymous hemianopia.

**Extracocular muscles**

Extracocular muscles. Inflammation or infiltration of individual eye muscles may cause binocular diplopia through a restrictive process. Thyroid eye disease, idiopathic orbital inflammation, orbital pseudotumor, and malignant infiltration are the most common orbital diseases of this type. See Table 1 for a list of signs of orbital disease.

**Pearls**

• Inflammation of an extracocular muscle typically results in impaired eye movement in the direction away from the muscle because it restrains muscle movement. This is in contrast to cranial nerve dysfunction, in which weakness of an extracocular muscle from decerebrate process results in impaired muscle in the direction of action of the weak muscle.

• Thyroid eye disease may occur in the absence of symptoms or a previous history of thyroid disease and even with normal thyroid studies.

• Idiopathic is common in extracocular muscle disease.

**Table 2**

<table>
<thead>
<tr>
<th>Signs of extracocular muscle involvement in neurotrophic ophthalmoplegia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Ocular palsies</td>
</tr>
<tr>
<td>Deficits of all fields in eye movements</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

• Chronic progressive external ophtalmoplegia (CPEO) is an extracocular muscle myopathy that may cause painless, progressive ophthalmoplegia and ptosis or bilateral or unilateral.

• Mitochondrial myopathy is the most common cause of CPEO. It may be isolated or part of a syndrome such as Kearns-Sayre.

**Odds and pitfalls**

• External signs of orbital disease may be misleading in some patients.

• Diplopia may be absent if disease process is bilateral and symmetric in CPEO.

**Neuromuscular junction**

Myasthenia gravis (MG) is the most common disease of the neuromuscular junction. It may cause near and ocular muscle weakness. Table 2 lists examination findings suggestive of MG. A positive edrophonium chloride test provides diagnostic support for MG. Edrophonium chloride is a reverse acetylcholinesterase inhibitor that decreases breakdown of acetylcholine in the synapse, which impairs neuromuscular transmission. Up to 10 mg of edrophonium chloride is administered in small increments while the patient's cardiac status is closely monitored. A significant increase in subjective improvement in weakness or ptosis on examination within several minutes after injection of the edrophonium chloride test is considered the edrophonium test result. An edrophonium test and the test for ocular weakness. In the test for ocular weakness, an ice pack is placed over a closed, opaque eye for 2 minutes, followed by observation for improvement. The patients is then instructed to perform voluntary eye movements. If muscular weakness is improved by cold temperatures, the test is positive. Observation for improvement, following a period of 2 minutes, during which the eye is closed and at rest. Standard treatment for MG may be used, or an optimal treatment of ocular MG may be used.

**Pearls**

• The pupillary involvement in MG.

---
Table 2. Ocular findings in ocular MG

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Ocular findings in ocular MG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dryness</td>
<td>Under the upper lid of 50% of patients can be detected by a lid fissure or upper lid lateral margin.</td>
</tr>
<tr>
<td>Lid retraction</td>
<td>Lid retraction causes upper lid deviation and may affect the ocular apex.</td>
</tr>
<tr>
<td>Paralysis</td>
<td>Paralysis of the third cranial nerve is common in ocular MG.</td>
</tr>
<tr>
<td>Enophthalmos</td>
<td>Enophthalmos is present in 30% of patients with ocular MG.</td>
</tr>
</tbody>
</table>

- MG may mimic any papillary-sparing ocular motility disorder.
- Evaluation of eye movements in suspected MG should include maintained upgaze for at least 2 minutes to adequately assess for the appearance or worsening of ptosis or enophthalmos of the elevated eye.
- Tying’s law of equal neural innervation to both eyelids requires for the finding of lid retraction and enhanced prism. Maximal innervation to keep the ptotic lid open results in excess contralateral innervation and may minimize contralateral prism or create an appearance of lid retraction.

**Ocular and pitfalls**

- Limitation: binocular anisocoria blockade of autonomic innervation may mimic the contraction features of MG, but unlike MG it may involve the pupil.
- Miller Fisher syndrome: causes dissociation of ocular motor cranial nerve paresis and may also cause diffuse ophthalmoplegia, mimicking myasthenia. Diagnostic clues include the presence of anti-AChR antibodies, although isolated ophthalmoplegia is reported.
- The finding of lid retraction would prompt consideration of restricting thyroid eye disease, especially if proptosis is present. Thyroid disease occurs with a higher incidence in MG, particularly in the presence of acetylcholine receptor antibodies and in patients with Hashimoto's thyroiditis.

- A positive ophthalmic adrenocortical test is useful in identifying cases such as significant ptosis or a fixed exophthalmic change that may be normalized after treatment.

**Cranial nerves**

Cranial nerves palsy result in ophtalmoplegia in the direction of action of the weak muscle. Lesions may occur anywhere along the course of the cranial nerve and may affect multiple cranial nerves. Cranial nerves may affect cranial nerves three, four, the first and second divisions of the fifth, and the sixth, seventh, and the oculomotor nerve with associated vision loss. The association of vision loss with ophthalmoplegia is critically important in localizing lesions of the orbital apex, including those from systemic disorders, malignant neoplastic infiltration, meningioma, and internal carotid artery aneurysms. Lesions in the cavernous sinus are common lesions in the cavernous sinus. Lesions at the orbital apex include idiopathic orbital pseudotumor and systemic inflammation, infection, immunosuppression, and antiphospholipid syndrome.

**Third nerve (oculomotor nerve)** The third cranial nerves originate in the dorsal midbrain, exits the brachium pontis, vertically, traverses the subarcuate space to reach the cavernous sinus, and crosses the orbit via the superior orbital fissure. Just prior to entry, it divides into a superior branch that innervates the levator palpebrae superioris and the superior rectus, and an inferior branch that innervates the inferior and medial rectus, inferior oblique, and the nasociliary and ciliary muscles.

**Pearls**

- In a complete pupil-sparing third nerve palsy, the eye is deviated down and out with impaired elevation, depression, and adduction. The pupil is dilated and there is ptosis. Posterior communicating artery (PComA) aneurysm is the etiology until proven otherwise. Neuroimaging is indicated in these patients with CT angiography (CTA), MRI, or angiography (MRA/CEMRA), or cerebral angiography if other investigations modality is negative and suspicion is high.
In a complete palsy involving the third nerve, all three cranial nerves are impaired and there is ptosis. This is very unlikely to be caused by a POMM anastomosis. Microvascular ischemia is a common cause. Noninvasive imaging is not absolutely indicated in these patients, although measurement of glucose and serum insulin and blood pressure are indicated. Noninvasive imaging to look for an underlying lesion is absolutely indicated in patients with anterior microvascular third nerve palsy. The spontaneous resolution of the affected eye and vertical diplopia.

The presence or absence of pupillary dysfunction is an important feature in the identification of an incomplete third nerve palsy. Pupillary involvement usually indicates a compressive lesion, while sparing of the pupil is more likely nonsensory. However, noninvasive imaging is generally recommended in these patients, given the morbidity and mortality risk of missing an aneurysm, potentially at the onset. In younger patients, given the increased risk of an intracranial lesion, that group.

Aberrant regeneration after a third nerve palsy is more likely to occur in patients with a partial or complete resolution of the clinical signs. In patients with a third nerve palsy, follow-up should be recommended to evaluate for an underlying POMM aneurysm.

Spontaneous aberrant regeneration without a pre-existing acute third nerve palsy suggests a cavernous sinus meningioma or an internal carotid artery aneurysm.

On-sets and pitfalls

- Primary aberrant regeneration may occur with an unruptured POMM aneurysm.
- When a third nerve palsy follows minor head trauma, noninvasive imaging is indicated to evaluate for an underlying POMM aneurysm.

Fourth nerve involvement is rare, but has been described. The trochlear nerve originates in the diencephalon, passes through the interpeduncular cistern dorsally, decussates within the brainstem, travels dorsally, and emerges at the level of the interpeduncular cistern, and wraps around the midbrain. It can be found within the subarachnoid space, either lateral to the middle cerebral artery, where it is located within the dural sinus wall. The nerve then courses through the superior orbital fissure and innervates the superior oblique muscle contralateral to its nucleus of origin.

Outcomes and pitfalls

- Old photographs of the patient that show a head tilt may suggest long-standing misalignment such as that seen with congenital fourth nerve dysinnervation.
- The trochlear fossa within the brainstem is an uncommon site of pathology, given its short course and dural exit. When it does occur, palsies of the superior oblique are contralateral to the lesion.

Sixth nerve palsy (abducens nerve). The abducens nerve originates in the pons, leaves the brainstem ventrally, and travels in the subarachnoid space, where it ascends near the clivus. It pierces the dura and passes under the petroclinoid ligament in Dorello's canal, then courses through the body of the cavernous sinus.
turbidlike the oculomotor and trochlear nerves housed in the dural sinuses walls, ultimately exerting the superior orbital fissure to innervate the lateral rectus.

**Pearls**

- Abducens dysfunction results in ipsilateral abduction weakness and exotropia.
- Meningiomas may cause an abducens palsy, as may an inflammatory or neoplastic process of the dura.
- The abducens nerves are prone to dysfunction from increased intracranial pressure. Tethering of the nerve in Dandy's canal renders it susceptible to distortion and stretch injury from such alterations in intracranial pressure.\(^2\)
- Microvascular ischemia may cause an abducens, isolated sixth nerve palsy that should spontaneously resolve over 8 to 12 weeks. This process is often painful and may be severe. Pain, however, may be absent and its presence is inconspicuous.

**Ocute ptosis and palsy**

- Common sixth nerve palsy include MG and restrictive medial rectus involvement in thyroid eye disease.
- Additional diagnostic evaluation for other etiologies is required when a presumed microvascular sixth nerve palsy fails to resolve spontaneously.

**Ocular motor nerve nuclei.** Ocular motor nerve nuclei arise in apparent from their corresponding cranial neuropathies.

**Pearls**

- The oculomotor nucleus provides bilateral innervation to the superior, medial, and inferior oblique muscles, and the nasociliary nerve, so that bilateral oculomotor nerve abnormalities result in bilateral pseudostrabismus.
- A trochlear nuclear lesion causes a contralateral superior oblique palsy and a unilateral Horner’s syndrome because of the proximity of the preganglionic sympathetic fibers to the dura around the trochlear nerves.
- An abducens nuclear lesion causes ipsilateral horizontal gaze palsy because the abducens nucleus contains both abducens motor neurons and interneurons that are dependent on input from the contralateral oculomotor nuclei.
- Common etiologies of ocular motor nuclei lesions include demyelination, infection, and Wallerian degeneration.

**Ocular and palsy**

- Rare cases of isolated horizontal gaze palsy exist, but the gaze palsy is more typically accompanied by an ipsilateral facial nerve palsy because the seventh cranial nerve fascicles wrap around the sixth cranial nucleus.
- Due to the functional division of the subnucleus, lesions to the orbital portion of the abducens nucleus are also possible with an oculomotor nucleus lesion.\(^1\)

**Intermaxillary ophthalmoplegia.** Intermaxillary ophthalmoplegia (INO) is caused by a lesion of the MLF, which carries signals from the abducens nucleus to the contralateral medial rectus oculomotor subnucleus. The abducens nerve and MLF coordinates conjugate horizontal eye movements with co-contraction of the ipsilateral lateral rectus and contralateral medial rectus muscles.

**Pearls**

- Causes signs of a unilateral INO include impaired adduction of the ipsilateral eye and abducting nystagmus of the contralateral eye.
- Multiple sclerosis and microvascular brainstem lesions are the most common causes of INO. The two causes may be distinguished by age at presentation, with younger patients likely to have demyelination and older patients ischemia.\(^2\)

**Ocular and palsy**

- Despite ipsilateral adduction weakness with direct motility testing, adduction is often intact with convergence; since vergence signals to the medial rectus motoneurons are absent from the MLF.\(^4\)
- Smooth pursuit may be normal, and INO diagnosed only by the presence of decreased velocity of the abducting eye adduction lag during eccentric testing.\(^9\)
- A “pseudo-INO” may occur in MG.

**Supranuclear**

- Supranuclear eye movement abnormalities result from dysfunctional cerebral, pontine, and brainstem motor connections to the ocular motor nuclei. Basal ganglia in the brainstem provide modulation interneural discharges required to innervate high velocity ocular movements. Basal neurons for horizontal saccades are located in the
pontine paramedian reticular formation (PPRF) and, for vertical saccades, in the midbrain reticular interlacement, medial longitudinal fasciculus (MLF). A PPRF lesion causes slow or absent horizontal saccades, whereas a MLF lesion causes slow or absent vertical saccades. Burst inhibition, required to prevent uncontrolled saccades from degenerative vision, is provided by pontine omnipause neurons.

**References**

INTERNATIONAL ISSUES

More than 85% of the world’s population lives in low and middle income countries, where the burden of neurological disease is the largest. Relatively little is known, however, about patients and practitioners of neurology in most countries. This section aims to explore international issues in neurology education. We welcome manuscripts describing international educational exchanges, personal rotations and experiences in low and middle income countries, and work by neurology trainees from around the globe. Descriptions of notable differences in training between countries are of interest. Inclusion of practical information regarding how interested residents might get involved in international programs would also be of use.
Neurology education and global health
My rotation in Botswana

Nabila Dahodwala, MD

The University of Pennsylvania's Department of Infectious Diseases received an HIV education grant through the President's Emergency Plan for AIDS Relief in 2002. Since then, they have established a permanent clinical and educational program at the main public hospital in Gaborone, Botswana. An attending faculty member resides in Gaborone year-round, and additional infectious disease specialists, fellows, medical residents, and students rotate through the hospital. A team of Penn doctors and students admit patients to the medical ward, care for them through discharge, and often follow them up as outpatients. They have recently invited neurologists to assist in their efforts, and as a fourth-year resident, I spent 5 weeks there in the spring of 2006. To date, three Penn-affiliated and one non-Penn-affiliated neurology residents have participated in the program.

Botswana is a parliamentary republic in southern Africa (figure). Most of the 1.7 million residents are Setswana, whereas the other ethnic groups include Basarwa (bushman), Kalanga, and Cuaneastans. Botswana represents one of the few African countries to have sustained high rates of socioeconomic and infrastructure growth over its 40 years of independence. It provides free healthcare and education to all residents. However, Botswana has one of the highest prevalences of HIV in the world at 24% in adults. Recently, the government has started to cover antiretroviral therapy through its outpatient clinics, but it has been slow to reach all those in need.

Among HIV-infected patients, 10 to 20% initially present with neurologic symptoms, and up to 40% will have neurologic disease during the course of their illness.2 In addition, both HIV-infected and uninfected patients are at risk for non-HIV-related neurologic disease. The Botswana (the people of Botswana) have high...
rates of hypertension, diabetes, heart disease, stroke, cancer, cognitive dysfunction, and epilepsy. However, there are no neurologists in Botswana, nor are there medical schools or neurology residency training programs. This combination has led to little recording and no publications about the basic epidemiology or burden of neurologic disease.

During my rotation, I would review all the cases that were admitted from the previous day with the Botswana and Penn house staff. Routinely through this morning intake, there were 6 to 10 neurologic cases presented: acute onset weakness, progressive weakness, unsteady gait, seizures, headaches, and confusion. I maintained a patient log of the new cases I encountered during my time at the hospital. Of the 98 cases that I recorded, 28 (29%) presented with seizure, 21 (21%) with ischemic stroke, 12 (12%) with neuroophy, 9 (9%) with intracranial hemorhage, 6 (6%) with intracranial masses, and 6 (6%) with myelopathy. I also saw two cases of snake bites, one case of organophosphate poisoning, and two cases of immune reconstitution syndrome. About 75% of these patients were HIV-positive. Diagnoses were based on history and exam, and rarely was quick and reliable blood or CSF testing available. Head CT scans could take up to 1 week to obtain, and there was no EEG, electromyography, or nerve conduction studies, or MRI equipment.

Within the constraints of limited testing, I relied heavily on the history and exam to guide diagnosis and management. My clinical exam skills sharpened, and the scope of my differential diagnoses widened to include tuberculous, parasitic (i.e., malaria) and fungal infections, nutritional deficiencies, complications from traditional medicine, and HIV-related complications. Unfortunately, therapeutic options remained limited; supplies often ran out and neurosurgical services were nonexistent in Gaborone.

The demand for neurologic clinical skills was high. In addition to seeing inpatients, my role expanded to include private patients from outside clinics, outpatient follow-ups, and even the chance family member of a hospital employee. The patients were responsible, respectful, appreciative, and eager to learn. Language proved to be the biggest barrier in obtaining the history and discussing results and plans. Most older patients spoke only Setswana, though a growing number of the younger patients could understand, and often, speak English. Although less than an ideal solution, nurses were called upon to act as translators. Throughout my 5 weeks, I discovered that patient and family education was one of the most valuable services I had to offer.

Because there was such a high demand for education of the house staff, teaching became another integral part of my job. The medical house staff had all completed medical school and had varying degrees of clinical experience. Most expressed discomfort with performing the neurologic exam, interpreting head CT scans, and diagnosing and managing common neurologic diseases. I started with a series of formal lectures focused on basic topics, e.g., review of the neurologic exam and acute stroke management. As my time there progressed, and as I saw more cases, I gave talks on seizure management in HIV positive patients and HIV myelopathy.

On my return to the United States, I flew directly to San Diego, CA, for the 2006 AAN meeting. Surrounded by more than 11,000 neurologists, I was amazed by the cutting-edge research and wealth of resources. We have the extraordinary opportunity to leverage this wealth to change how people with neurologic diseases are cared for globally. First, we can expand our research on the neurologic complications of HIV to include cheaper diagnostic tests and treatments that would be sustainable in the developing world. Second, we can add to the resources in these countries by providing supplies, but especially by providing neurologically trained health care providers. We should develop educational programs to increase knowledge of neurologic diseases. By establishing exchange programs with local providers and cultivating study abroad opportunities, we will be able to provide and improve neurologic care in Botswana and other resource-poor countries.

Residents and fellows who study abroad will be providing essential services to an underserved population and education for local providers. At the same time, they will add to their training by improving clinical and teaching skills and increasing exposure to the neurologic complications of HIV. Bergan and Silberberg comment in their editorial, "Neurovascular system disorders: a global epidemic" that "in many regions, centers of . . . neurologic excellence and expertise are needed, not only to help plan research and prevention strategies appropriate for local needs, but also to educate the primary health care providers who care for most disorders of the nervous system."

Both the AAN and individual training programs should support these efforts. This support should include travel funding and allow for time away from clinical responsibilities at one's home institution. The AAN might even consider establishing international neurology grants for clinical rotations, education, and research abroad. Improving global health and providing equity in care is a daunting task, but we can help meet the challenge.

Acknowledgment
The author thanks Dr. Craig Paliwoda for his invaluable editorial assistance.

References
EDUCATION RESEARCH AND INITIATIVES

As the central mission of Neurology, education is a top priority. This is a section for interventional educational studies, as well as more traditional educational research, such as surveys. This section will examine the way neurologists not only practice, but also the way we teach and approach education. Neurologists have traditionally been respected, perhaps above all other specialties, for their scholarship and teaching. Educational issues will therefore continue to be at the center of the mission of Neurology.
Teaching: Residents in the hospital, mentors in the community

The Educational Pipeline Program at Penn

Row H. Hamilton, MD, MS
Karen Hamilton, PhD
Bayou Jackson, MD
Nabila Daboha, MD

As your physicians embarking on careers, many of us have benefited from exceptional teachers and role models, and we aspire to become equally inspiring mentors. In many institutions, neurology house staff enjoy opportunities to work with outstanding educators of medical students and other physicians in training. Neurology residents and fellows, however, may overlook opportunities outside the walls of their institutions to act as mentors and educators in their local communities. It can be difficult for participants in community outreach during training due to time limitations imposed by the residency or fellowship schedules. A critical first step is to establish meaningful relationships within the community, a process that can be facilitated by collaboration with existing outreach programs. Adopting this strategy, neurology house staff at the University of Pennsylvania have become involved in the ongoing success of the School of Medicine’s Educational Pipeline, a multidisciplinary mentorship program that teaches fundamental principles of medicine and neurology to inner-city high school students in Philadelphia.

The University of Pennsylvania Medical Pipeline Program began in 1998 as part of Project 2005 by 2009, an ambitious program launched by the Association of American Medical Colleges, Division of Community and Minority Programs, with the goal of increasing the number of underrepresented minority medical students. Responding to a growing need for knowledgeable, effective educators and experienced mentors, neurology residents began directing the curriculum of the Pipeline Program in 2005.

METHODS Participants. The Pipeline program has drawn students from three institutions: University of Pennsylvania, Philadelphia, and West York High School’s Pipeline Program. According to 2003-2004 data from the School of Medicine and Program for 40.2% of students in the pipeline and 59.8% of residents in the pipeline, 40.2% are African American, and 59.8% are non-African American residents. This is in line with the diversity of the medical profession, which is expected to increase in diversity.

The Pipeline program is designed to provide a comprehensive education in neurology. The curriculum is designed to complement the students’ educational and professional development. The curriculum is designed to mirror the educational and professional development of the students.

Curriculum. The program covers a range of core topics in neurology, including the anatomy, physiology, and pathology of the nervous system, and the principles of neurology care. The curriculum is designed to provide a comprehensive education in neurology. The curriculum is designed to mirror the educational and professional development of the students.

The Pipeline program is designed to provide a comprehensive education in neurology. The curriculum is designed to mirror the educational and professional development of the students. The curriculum is designed to complement the students’ educational and professional development. The curriculum is designed to mirror the educational and professional development of the students.

For more information, please visit the Pipeline Program website at www.pipeline.upenn.edu.
PARKINSON'S DISEASE, AND NEW CONCEPTS ON ALZHEIMER'S DISEASE.

The 2006 curriculum focused on new advances in neurology and the neurologic manifestations of common medical illnesses such as hypertension, alcoholics, and CNS. The class was divided into four two-week modules. Each module was a hands-on laboratory and CNS-typical presentation or disease.

The objective sessions on neurology focused on specific neurological disorders, such as Parkinson's, Alzheimer's disease, and CNS-typical presentations of disease. The objective sessions on neurology focused on specific neurological disorders, such as Parkinson's, Alzheimer's disease, and CNS-typical presentations of disease.

The medical students used the information provided by the neurology residents and fellows to generate a list of possible diagnoses. These came in contact with the actual presentation of cases in the neurology clinic. The students then used these diagnoses to formulate a list of possible diagnoses for each case.

RESULTS
Since 1998, 313 high school students, 110 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline. A total of 611 high school students, 313 undergraduates, and 265 medical students have participated in the Pipeline.

Feedback from medical school students who participated in the Pipeline has been positive. Of the 110 medical students participants, 108 (98.2%) felt that the program had improved their ability to communicate medical information, and 94 (85.5%) indicated that they had learned to communicate more effectively. Medical school students overwhelmingly (110 of 110) endorsed the Pipeline Program as a positive experience and wrote that they would be interested in participating in the program again.

For the program was similar to the previous year, the 110 high school students interviewed; 95 of them (85%) stated that the program had led to consider careers in medicine. For example, when asked about the impact of the Pipeline on their career goals, A.W. commented, "I'm still working on finding a career... I've got positive attitude to be a neurologist..." Some students' interest in medicine has evolved...
long after completion of the program. Two students from the 2016 Pipeline participated in the National Youth Leadership Forum on Medicine the following summer, and one will be attending a "Mini-Med School" course at Drexel University in the spring of 2017.

**DISCUSSION**

**Strengths of the Pipeline Program.** The Pipeline program provides mentorship and education for students at all levels. High school students are taught by undergraduates, who are guided by medical students, who, in turn, learn from neurology house staff. High school students are exposed to academically successful mentors who are at three different stages of training, and they are able to gain valuable insight into the processes of going to college, entering medical school, and training to become a medical specialist. The success of this mentorship approach is consistent with prior evidence suggesting that programs that employ advanced students—as teachers for high school students—are effective in preparing high school students for medical careers. Studies of medical students have also shown that mentoring programs are effective in preparing high school students for medical careers. The feedback from high school and medical students indicates that they feel the program helps to prepare them for the next stage of their education, and a number of previous Pipeline students report that the program has led them to consider a career in medicine.

The Pipeline program provides neurology residents with the opportunity and means to meaningfully contribute to their community as educators and mentors. By doing so, they improve their teaching skills and increase both the breadth of their knowledge of common neurologic illnesses and their understanding of the impact these conditions have on their community. Participation in the program also contributes to training in several of the core competencies deemed important for neurologists by the Accreditation Council for Graduate Medical Education (ACGME). House staff develop interpersonal and communication skills, which include "providing explanations of psychiatric and neurologic disorders that are clear and geared to the educational level of parent or their family," as well as professional skills.

The structure of the Pipeline Program allows house staff to incorporate the classes into their busy schedules. A number of neurology residents and fellows share the responsibility for teaching the program, and many of the logistical concerns for the program are managed by the medical student coordinator. Because the curriculum is case-based and case-specific, it is catered to the needs of the neurology residents, and because the material is conveyed with the assistance of medical students and medical staff, able to spend additional time outside of class preparing lesson plans and can rely on their pre-existing clinical expertise during didactic sessions. Finally, the high school students are brought to the School of Medicine, it is convenient for neurology residents who work in the administrative offices of the hospital to attend the classes.

**Limitations.** One of the major challenges facing the Pipeline is quantifying its impact on the community. It is important to know what effect the program has on the subsequent academic achievement of its students or on their eventual career choices. Data from similar programs suggest that early mentorship opportunities in biomedical science serve to increase the number of underrepresented individuals in medicine and related fields. The extent to which this holds true for Penn's Pipeline remains to be seen. A second area in which the Pipeline has seen only limited success is in the continuity of mentorship. There is an informal mechanism in place yet for undergraduates, medical students, and neurology house staff to form long-term relationships with high school participants.

**Future directions.** A number of steps are being taken to address the limitations of the program. More outcome data will be collected from future Pipeline st
The Resident and Fellow Section is a primarily online feature that serves the resident and fellow readership. Residents and fellows are expected to be the primary authors for most submissions but those highly involved in graduate medical education (e.g. program directors) may also contribute submissions on appropriate topics. Submissions for all article categories should be no more than 2500 words; permission for longer articles will be needed from the editors. The number of references should be ten or less and 1-2 tables or figures can be incorporated. The topic must be mentioned in the cover letter of the submission. Potential article topics include: teaching, ethics, practice, career choices, residency training, editorial, international education, research, historical, opinion, book review, training videos, or teaching NeuroImages. Teaching NeuroImages have the same requirements as NeuroImages but are especially valuable to the trainee audience and will be published in the online Resident and Fellow Section. A number of new categories were added in 2007. Queries and comments should be addressed to Mitchell Elkind, MD, MS, FAAN, or Kathy Pieper at kpieper@neurology.org.
BOOK REVIEWS

The trainee book review section assesses the usefulness of books developed for use neurology residents and fellows. Reviews will be written primarily by upper-level residents, fellows or program directors that have appropriate perspectives on the potential value of the book at various levels of training.
Book Review

HANDBOOK OF STROKE, 2ND EDITION
by D.O. Waxer, V.L. Fagen, R.D. Brown Jr.,
480 pp., Lippincott Williams & Wilkins, $44.95

To a resident, truly useful books must be reached for as eagerly as a TV as they are at 4 PM, and the Handbook of Stroke serves this role. Concise, carefully detailed chapters are perfect for the conocer-on-call's main stay, and take the necessity loop from providing differential diagnoses to recommending therapeutic goals and plans, disease by disease. Considerably filling into a lab coat pocket, most chapters are less than 10 pages, with topic headings bolded for easy reading and reference.

Partially useful are sections entirely dedicated to prognosis evaluation and management of stroke in special groups (e.g., pregnant women, young adults), knowing that this book will not be collected. A list of appendices illustrating and outlining the facts, scales, and anatomy one should know as a resident.

Although not likely in times, the diagrams complement the text well and capitalize on the fundamental aspects of stroke neurology. Expert discussions on cerebrovascular genetics, depression, and chronic neurological complications of stroke, as well as oft-neglected topics such as speech therapy, may educate health care workers and trainees at various levels and can do so with a quick read. A recommendation for the third edition would be to include a suggested reading list at the end of each section with references by chapter.

The greatest strength of the Handbook is that the book is timely in its reader's progress to a cure with clinically relevant information. There are no detours through the history of stroke or the debate of prevailing orthodoxy encountered disorders.

The text moves gently from assessment, management, and treatment to prevention and rehabilitation. Because the Handbook avoids some of the difficult and complicated end of life issues in stroke, but includes all the elements of management and prevention, one can easily forget while reading that stroke is still a common fatal disease.

Reviewed by Farrell J. Meister, MD
Copyright © 2007 by AAN Enterprises, Inc.
COMPREHENSIVE BOARD REVIEW IN NEUROLOGY

This first edition board review book, edited by Mark K. Berson, M.D., Ph.D., is a concise yet informative resource that seems to have been compiled from a resident's perspective at tackling the boards. The 360-page glossy text is composed of 15 chapters and begins with a well-written neuroanatomy section. Thereafter, several contributors from Canada to Louisiana address individual neuroanatomic categories, such as vascular disorders, epilepsy, oncology, demyelinating disorders, movement disorders, and infections. Pediatric neurology is incorporated in chapters on epilepsy, demyelinating diseases, and neuromuscular and developmental disorders. Attention has also been given to areas such as neuroophthalmology, neuro-otology, and sleep medicine. The section on psychiatry deserves a special mention for its emphasis on psychiatric medication. An exhaustive section on chapters on neurologic manifestations of systemic diseases, an often sidelined area. Many current issues, such as the role of central nervous system in cancer treatment and surgery in epilepsy, have also been introduced.

As with most board review literature, this book adopts an outline format. Named systems, reminiscent of the Resident In Service Training Examination, are printed in bold or in boxes. Positive features include reader-friendly print with space for added notes on every page. Visual learners will appreciate the key images, histopathology slides, boxed high-yield points, and abundant tables. The book does offer the advantage of color pictures, slides, and radiologic images all in one, unlike most other review books published so far.

Comprehensive Board Review in Neurology makes a fine study tool for those who spend considerable time during residency preparing for the boards as well as those pressed for time. For the former, the book provides a good study map, and the reader may be able to assimilate additional information from other texts in the space provided. Some areas to consider in this review are coma, brain death, head injury, clinical neurophysiology, and neurochemistry. Of course, no single book can contain everything needed to pass the boards. For those short on time, this book is concise while at the same time comprehensive. All in all, Comprehensive Board Review in Neurology is a worthwhile consideration in the quest for a single, "street-smart" book for the neurology boards.

Reviewed by Sudha Teja, M.D.
Covefax © 2007 by AAN Enterprises, Inc.
Looking to advance your career?

RESIDENTS AND FELLOWS:
AAN membership gives you free tools and opportunities to network with program directors and fellow residents:

- **Residents and Fellows Luncheon**
  Network with other residents and fellows at this free luncheon

- **Residents and Fellows Career Forum and Reception**
  Learn how to search for a fellowship and about careers in academic/research and private practice; meet program directors

- **Residents and Fellows Consortium**
  Get involved in AAN activities for residents and fellows

- **American Board of Psychiatry and Neurology (ABPN) Resident Informational Session**
  Ask members of the ABPN about the neurology boards

AAN membership also saves you money on the RITE exam, keeps you up-to-date with free publications like *Neurology®* and *Continuum*, and more!

» To learn more about how AAN membership can advance your career, visit [www.aan.com/go/benefits/residents](http://www.aan.com/go/benefits/residents).
Back Cover