

# AMERICAN ACADEMY OF NEUROLOGY NEURAL REPAIR AND REHABILITATION FELLOWSHIP CORE CURRICULUM

## Introduction

Neurorehabilitation is the process of restoration of function for persons with disorders of the nervous system. This process involves multiple disciplines and the application of strategies aimed at reducing impairments, disabilities and handicaps, and ultimately enhancing quality of life for persons with neurological disorders. Rehabilitation involves restoration of functioning or facilitation of compensatory or adaptive functioning. The practice of rehabilitation involves a team process, highly dependent on the interaction of multiple treatment agents and factors. The patient is the ultimate target of treatment, but at the same time serves as a member of the team along with his or her family and other members of their social network.

Neurologists have become increasingly involved in the practice of rehabilitation as rehabilitation has developed as a medical discipline and the array of treatments for neurological disorders has expanded. Neurorehabilitation has evolved as a subspecialty of neurology. Increasing numbers of neurologists have included or even centered rehabilitation in their clinical or research activities. The growth of this subspecialty led to the formation of the Rehabilitation Section ([now Neural Repair and Rehabilitation Section](#)) of the American Academy of Neurology in the mid-1980s and subsequently, the American Society of Neurorehabilitation (ASNR) in 1991.

Neurologists bring a unique perspective to the rehabilitation team with expertise in diseases of the nervous system, including pathophysiology, diagnosis, prognosis and medical treatment. The melding of an understanding of the principles of disease with the process of rehabilitation would seem to be the most effective and efficient way to plan and guide rehabilitation for persons with neurological disorders. The blind application of rehabilitation, largely based on empirical intuition, has been one of the weaknesses of the area. Neurologists can help recognize when rehabilitation efforts might be futile or when treatable complications may impede the rehabilitative path, adding the understanding of pathophysiology, natural history, and the processes of neurological recovery to the rehabilitation mix. Moreover, neurologists can bring a critical approach to set up the research questions and protocols to answer how specific rehabilitative treatments or overall rehabilitative systems interact with or improve the process of recovery. In recent years, neurologists have recognized that optimal recovery from neural injuries will require not only adaptive strategies, but also repair of the injured nervous system. Thus they have promoted research on the fundamental mechanisms of nervous system plasticity and repair.

Neurologists involved in rehabilitation have been active in the training, credentialing and continuing education process as the subspecialty has developed. The effort began with the Section of Rehabilitation of the AAN which spawned the formation of the American Society of Neurorehabilitation

(ASNR). The ASNRs goals have included the development of guidelines for neurorehabilitation fellowship training, an examination and system of certification for practitioners of neurorehabilitation, and a system of recertification assuring adequate continuing education credits, specific to rehabilitation. The ASNR has also sponsored frequent continuing education and training programs, including an annual conference, to further this effort.

The Core Curriculum outlined in this document is largely based on training and assessment guidelines that had been developed by the ASNR and have been in practice since 1995. This core curriculum addresses general neurorehabilitation fellowship training. Some neurorehabilitation training also occurs in other specialty fellowships such as multiple sclerosis, spinal cord disease, clinical neuromuscular disease and geriatric neurology fellowships.

## **Goals and Objectives**

- To develop guidelines that provide adequate training and experience in the management of the common neurological problems that produce functional disabilities and handicaps requiring rehabilitation and to provide the opportunity to acquire knowledge in other special topics related to neurologic rehabilitation.
  - Trainees should become proficient in the management of rehabilitation issues for patients with stroke, brain injury, spinal cord injury and multiple sclerosis.
  - To consider additional training in rehabilitation management of patients with chronic pain, neuromuscular disease, multiple systems disorders, degenerative disorders and aging, and pediatric neurological rehabilitation.
  - To encourage training in neuro-urology, sexuality, formal disability evaluations, orthotics, wheelchairs and adaptive equipment, speech and swallowing disorders, neural prostheses, management of medical problems complicating rehabilitation, pharmacologic treatments in rehabilitation, rehabilitation of cognitive and behavioral problems, outcome assessment and measurement, new and emerging technologies (e.g. robotics), and economic aspects of rehabilitation.
  - To learn about the fundamentals of neurologic recovery, regeneration and plasticity, and the interaction with rehabilitation interventions, learning and environmental influences.
  - To gain experience working with an interdisciplinary rehabilitation team.
  - To understand psychological and social issues faced by patients and families involved in rehabilitation.
  - To have the opportunity to participate in a basic science or clinical neurorehabilitation research project.
- To assure that uniform knowledge base is available for future practitioners of neurorehabilitation.
- To provide assurance that participation in a fellowship will result in the acquisition of knowledge to allows fellows to be confident and competent in practicing neurorehabilitation.
- To encourage fellowships to adopt a curriculum that will allow fellows to successfully complete the ASNR certification examination.
- To provide a curriculum for new and existing training programs.

## **Content of Subjects to be Taught**

### **Basic mechanisms of recovery from neural injury**

- Behavioral adaptation
- Exercise-induced muscular and systemic changes
- Physiological plasticity in the nervous system (LTP, denervation supersensitivity, *etc.*)
- Anatomical plasticity (collateral sprouting, dendritic pruning, *etc.*)
- Regeneration

### **Neurorehabilitation for Specific Diseases**

For each of the following disorders that commonly lead to disability, trainees will master the fundamentals of:

- Epidemiology
- Pathophysiology
- Diagnosis and differential diagnosis
- Natural history and prognosis (functional outcomes)
- Neuromedical complications
- Rehabilitation interventions - inpatient, outpatient, long-term
- Special problems
- Psychosocial issues
- Prevention and other pharmacological treatment
- Cerebrovascular disease and stroke (including specific stroke syndromes)
- Brain injury
- Spinal cord injury and dysfunction
- Neuromuscular disease
- Multiple systems disorders
- Degenerative disorders and aging
- Pediatric neurorehabilitative disorders

### **Neurorehabilitation for Symptoms**

- Aphasia and Cognitive Deficits
  - Speech therapy
  - Cognitive rehabilitation
- Chronic pain
  - Mechanisms of pain - central and peripheral
  - Management - pharmacologic, pain modalities, special procedures, surgical treatments, psychological management
- Spasticity
  - Pharmacotherapy
  - Blocks
  - Casting and splinting
- Neurogenic bladder
- Dysphagia

Sexual dysfunction

### **Relevant Issues in Related Specialties**

Orthopedics  
Neurosurgery

### **Rehabilitative Methodologies**

Outcome measurement and assessment scales  
Interdisciplinary management and social barriers  
Physical and occupational therapy  
Orthotics  
Wheelchairs and adaptive equipment  
Restorative neuropharmacology  
Vocational rehabilitation  
Augmentative communication and environmental control technologies  
Emerging and investigational technologies (e.g., robotics, stem cell transplants)

### **Administration and Economic Aspects of Rehabilitation**

#### **Prerequisites for the Trainee**

Fellowship candidates should be board eligible or board certified in neurology or by a recognized specialty board.

#### **Personnel Needed for the Training and Qualifications of the Trainers**

There should be sufficient number of training personnel and faculty to provide a well-rounded clinical experience in neurorehabilitation. There should be at least 2 physicians with a high level of expertise in neurorehabilitation. Non-physician clinical staff of various rehabilitation disciplines, such as physical, occupational, and speech therapy, rehabilitation nursing, therapeutic recreation, psychology and neuropsychology, should be available. A program director must be identified. This individual must have completed a fellowship in neurorehabilitation, or have had a minimum of two years clinical experience in neurorehabilitation.

#### **Facilities Needed for the Training**

Trainees should see both inpatients and outpatients in a facility that provides rehabilitation services. Facilities might include: free-standing rehabilitation hospitals; rehabilitation units in acute hospitals; subacute or transitional care units; skilled nursing rehabilitation facilities.

#### **Setup and Methods for the Training**

The training program must have a sufficient volume of both inpatients and outpatients with a variety of neurorehabilitation problems in order to allow a broad-based clinical experience. Fellows will provide rehabilitation care to a minimum of 50 patients with faculty supervision. Fellows should evaluate and follow patients through the inpatient rehabilitation process. They should learn and become proficient in neurologic rehabilitation evaluation and documentation that adds the rehabilitation perspective to the

traditional neurological evaluation and communicates information that can be used by the rehabilitation team. They should have the opportunity to interact with the rehabilitation team through formal team conferences and other venues. They should have the opportunity to evaluate and follow outpatients with rehabilitation needs through a regular clinic. Fellows should be directly supervised in their clinical work by faculty with significant background and experience in aspects of neurorehabilitation. There should be opportunity for clinical teaching rounds and didactic teaching sessions. Fellows will receive a reference and reading list based on the American Society of Neurorehabilitation Certification Examination Suggested Reading List. In addition, faculty will provide trainees with suggested readings and articles. Trainees will have access to major journals and texts on rehabilitation topics. Fellows should also have the opportunity to participate in research projects in neurorehabilitation under the supervision of a faculty member.

### **Timetable for Training**

Programs must be at least one year in duration, with one or more additional years available to fellows with research or academic career interests. A minimum of six months of inpatient rehabilitation experience should be provided.

### **Evaluation of the Trainee**

Faculty will supervise and provide both formal and informal feedback to trainees on expectations and performance. At the completion of the training fellowship, fellows will be expected to sit for an examination designed to evaluate knowledge and proficiency in basic science and clinical topics in rehabilitation. The examination will be based on the Certification Examination presently given by the American Society of Neurorehabilitation.

### **Evaluation of the Training Process**

Fellowship directors will be responsible for assuring that training programs comply with training guidelines and the core curriculum. The ASNR and Neural Repair and Rehabilitation Section of the AAN will develop a questionnaire to be completed by fellowship directors every 2 years to determine compliance with training guidelines.

An evaluation questionnaire will be developed for fellows to fill out at the completion of their training program as a critical review of their training experience.

Fellowship faculty will evaluate the results of trainees' performance on the certification examination for the purpose of improving the training program in areas of apparent weakness.

### **Mechanisms for Feedback**

Fellows will meet with faculty periodically to discuss progress and evaluate both the performance of the fellow and the fellow's training experience. The Neural Repair and Rehabilitation Section of the AAN and ASNR will provide fellowship directors with structured evaluation forms, one for faculty evaluation of a fellow's performance and one for the fellow's evaluation of the fellowship. Written evaluation should be performed at least once, about half way through the fellowship, and once at the end of the fellowship.

The fellowship directors should also seek feedback from former fellows who have completed the program and entered practice.

The ASNR and Neural Repair and Rehabilitation Section of the AAN will periodically survey fellowship directors regarding the evaluation process, the numbers of fellows completing the programs, successful completion of the certifying examination and the nature of the positions obtained after fellowship training.

### **Methods for Constantly Upgrading Knowledge - Required CME**

Following successful completion of the certification examination, recertification will be required according to the present recertification guidelines of the ASNR. Recertification will be required every 6 years. Recertification requirements include: 1. Completion of at least 80 hours of CME credits in rehabilitation and / or the diagnosis and management of chronic neurological conditions, including the attendance of at least two meetings sponsored by the ASNR, during the previous 6 year period. (A maximum of 20 hours will be allowed in diagnostic procedures such as EMG and EEG.)

Category 1 CME credits in neurorehabilitation are available from a number of sources including: 1. AAN annual meeting – courses and seminars sponsored by the Neural Repair and Rehabilitation Section; Scientific Sessions in neurorehabilitation; 2. Annual ASNR meeting; 3. ASNR / AAN sponsored neurorehabilitation courses; 4. Meetings and courses offered by other organizations; 5. Publications and Correspondence courses that offer post-reading quizzes for CME credit; 6. Accredited grand rounds presentations on rehabilitation or chronic neurologic management topics.

## References / Resources

### **Cerebrovascular disease**

Ozer MN, Materson, Caplan LR. (eds.) Management of Persons with Stroke. St. Louis: Mosby, 1994

### **Cognitive Rehabilitation**

Sohlberg M, Mateer, C. Cognitive Rehabilitation, Guilford Press, 2001

### **Chronic pain**

Wall PD, Melzack R, et al. (eds.) Textbook of Pain (3<sup>rd</sup> Edition). Edinburgh: Churchill Livingstone, 1994.

### **Degenerative disorders and aging**

Katzman RK, Terry RD, Bick. Alzheimer's Disease. (eds.) New York: Raven Press, 1994.

### **Multiple systems disorders**

Shapiro RT. Symptom Management in Multiple Sclerosis (2<sup>nd</sup> Edition). New York: Demos Publications, 1994.

Burks JS. Interdisciplinary Rehabilitation of MS and Neuromuscular Disease. Philadelphia: J.B. Lippincott Company, 1985.

### **Orthotics and Prosthetics**

Aisen M. Orthotics in Neurologic Rehabilitation. New York: Demos Publications, 1992.

Chapin J, Moxon K. Neural Prostheses for Restoration of Sensory and Motor Function, CRC Press, 2001

### **Pediatric neurorehabilitation**

Molnar GE. Rehabilitation Medicine Library. Baltimore: Williams & Wilkens, 1992.

### **PT, OT, speech therapy**

Trombly CA. Occupational Therapy for Physical Dysfunction. Baltimore: Williams & Wilkens, 1995.

O'Sullivan SB, Schmitz TJ. Physical rehabilitation: assessment and treatment. Philadelphia: F.A. Davis, 1994.

Caplan D. Language: Structure, Processing and Disorders. Cambridge: MIT Press, 1992.

Umphred D. Neurological Rehabilitation (2<sup>nd</sup> Edition). St Louis: Mosby Company, 1990.

### **Regenerative, recovery, neural plasticity**

Spear NE, Spear LP, Woodruff ML. Neurobehavioral Plasticity: Learning, Development and Response to Brain Insults. Northvale: Lawrence Erlbaum Associated, 1995.

Kidd G, Lawes N, Musa I. Understanding Neuromuscular Plasticity: A Basis for Clinical Rehabilitation. London: Edward Arnold, 1992.

Gonzales EG, Myers SJ, Edelstein JE, Lieberman JS (eds.) Downey and Darling's Physiological Basis of Rehabilitation Medicine (3<sup>rd</sup> Edition), 2000.

FJ Seil, editor. Neural Plasticity and Regeneration, Elsevier, 2000

M Tuszynski, J Kordower, CNS Regeneration, Academic Press, 1999

### **Rehabilitative orthopedics and neurosurgery**

Nickel V, Bolte M. Orthopedic Rehabilitation (2<sup>nd</sup> Edition). Edinburgh: Churchill Livingstone, 1992.

### **Spinal cord injury**

Contemporary Management of Spinal Cord Injury. Parkridge: American Association of Neurological Surgeons, 1995.

Kalb RG & Strittmatter SM(eds.) Neurobiology of Spinal Cord Injury. Totowa, New Jersey, Humana Press, 2000

### **Traumatic Brain Injury**

Rosenthal M, et al. Rehabilitation of the Adult and Child with Traumatic Brain Injury (3<sup>rd</sup> Edition). Philadelphia: F.A. Davis, 1999.

### **General**

DeLisa JA, Gans B (eds.) Rehabilitation Medicine Principles and Practices. Philadelphia: J.B. Lippincott Company, 3<sup>rd</sup> edition 1998.

BH Dobkin, The Clinical Science of Neurologic Rehabilitation, Oxford University Press, 2003

Good DC, Couch JR. Handbook of Neurorehabilitation. New York: Marcel Dekker, 1994.

Greenwood R, Barnes M. Handbook of Neurological Rehabilitation, Psychology Press, 2003

Illis LS. Neurological Rehabilitation (2<sup>nd</sup> Edition). Oxford: Blackwell Scientific, 1994.

Lazar RB. Principles of Neurologic Rehabilitation. New York: McGraw Hill, 1998.

Mills VM, Cassidy JW, Katz DI. Neurologic Rehabilitation: A Guide To Diagnosis, Prognosis and Treatment Planning. Massachusetts: Blackwell Scientific, 1997.

Ozer M (ed.) Management of Persons with Chronic Neurological Illness. Boston: Butterworth-Heinemann, 2000.

Stuss DT, Winocur G, Robertson IH(eds.) Cognitive Neurorehabilitation. London UK: Cambridge University Press, 1999.