INNOVATIONS

Future Solutions Now An NCMRR Update

Summer–Fall 2006

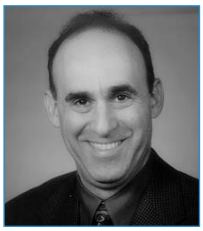
Inside This Issue

Director's Message

The Future of Rehabilitation Research and NCMRR

The NCMRR recently released its 2005 Report to the National Advisory Child Health and Human Development Council. In this report, we summarize accomplishments in NCMRR-supported research over the past five years, present summary information regarding NCMRR funding of rehabilitation research, and highlight challenges and opportunities for rehabilitation research in the future. The National Advisory Board on Medical Rehabilitation Research—the NCMRR's Advisory Board—played a crucial role in the preparation of this report. A series of strategic planning sessions were held with the Board, and its members provided valuable feedback on earlier drafts of the report.

What is not presented in the report, however, is the breadth of discussion regarding the future of rehabilitation research and the fundamental direction of the NCMRR.



Michael Weinrich, M.D., Director, NCMRR

I would like to summarize a few key points discussed by the Board:

1) The NCMRR should build on its success.

Over the past five years, NCMRR funding has doubled and the quality of grant applications has improved markedly. Applications to NCMRR in fiscal year 2005 succeeded at a remarkable rate at a time of very tight funding, and NCMRR funding continued to grow much faster than the growth of the NICHD as a whole. This is evidence that the research capacity in rehabilitation is growing, and that the career development programs, the Medical Rehabilitation Research Infrastructure Network, and other outreach efforts funded by the NCMRR are succeeding.

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Do you have questions for NCMRR staff?

For example, do you need assistance identifying an appropriate funding mechanism for your application? If so, please e-mail us at sheredc@mail.nih.gov. Thanks!

Small Business Innovative Research (SBIR)/Small Business Technology Transfer (STTR) Corner

Featured in each issue of *Innovations*! Visit these links to see a glimpse of what's new in the world of NICHD-funded technology.

- Green, Steve – R44HD043516 – A Modal Reciprocating Pushrim Drive (MRPD) Wheelchair – See *http://www.greentechnologies.com/default.html*

  The MRPD reciprocating pushrim was designed to allow forward, or reverse propulsion through an unlimited number of pushrim stroke cycles without the user letting go of the pushrim. To accomplish this utility, the MRPD utilizes an innovative bi-directional roller clutch designed expressly for this purpose. This roller clutch allows selection of the sense of rotation, either clockwise (CW) or counter CW by the short excursion movement of a small lever.

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Director's Message

The success rate also argues that the culture of review at the National Institutes of Health (NIH) has become friendlier toward rehabilitation research applications. Particularly encouraging is the development of some of our trainees in career development programs into independently funded investigators.

The Board was very supportive of the renewed support and expansion of the Medical Rehabilitation Research Infrastructure Network; members preferred to enhance the number of investigator-initiated grants rather than to increase support more programmatic research, such as more center grants. Thus, the Board suggested that the NCMRR continue to promote investigator-initiated research in rehabilitation and should assist and encourage investigators in all ways possible. The Board further suggested that designated career development programs in rehabilitation be expanded. The new Rehabilitation Research Career Development Program (K12) was created in response to this suggestion. Information and application instructions are available at: *http://grants.nih.gov/grants/guide/rfa-files/RFA-HD-06-010.html*.

2) The NCMRR should promote cutting-edge science.

The Board emphasized that the crucial distinguishing characteristic of rehabilitation interventions is activity, and that rehabilitation science will advance only if we can understand the effects of activity in reshaping the human organism at all levels. The fundamental problem for clinical rehabilitation is to design interventions that optimize recovery and adaptation. Thus, the Board encouraged the NCMRR to focus research on the issue of plasticity—how it occurs, how we can enhance it and shape it. The Board was encouraged with the new expertise represented in the Medical Rehabilitation Research Infrastructure Network that are specifically designated as national resources to help rehabilitation researchers apply contemporary scientific methods. However, the Board also felt that the NCMRR should continue to expand the rehabilitation research capacity in clinical trial design and qualitative research.

There was tremendous excitement as we discussed the opportunities for rehabilitation research in the future, as advances in basic science and engineering make new approaches for rehabilitation interventions available. The Board was particularly excited about prospects for combining activity-driven therapies with manipulations of tissues at the molecular level, application of biomechanical modeling to physical interventions, and development of more sensitive and efficient outcomes measures. The need to improve and validate clinical practice and to provide an evidence base for policy makers was emphasized. The Board also noted the Center's efforts to promote collaborations between basic scientists, clinicians, engineers, and social scientists and felt that these collaborations represented the true interdisciplinary spirit of rehabilitation and that such endeavors were absolutely essential for future progress in the field.

3) The NCMRR should not duplicate the efforts of other agencies.

There was general agreement that the NCMRR was established to develop rehabilitation research capacity in addition to that already developed by other agencies, such as the National Institute on Disability and Rehabilitation Research (NIDRR). Specifically, the Board viewed the NCMRR mission as one of bringing the knowledge and expertise of biomedical sciences to bear on research questions related to rehabilitation and disability. The goals of this research are to develop the knowledge that will help us to prevent or ameliorate disability and to improve the lives of individuals with disabilities.

The Board had little enthusiasm for replication of Model Systems programs. Similarly, the Board suggested that the Centers for Disease Control and Prevention (CDC) was the appropriate agency to continue surveillance and prevention efforts related to disabilities. Access to services continues to be a major problem for individuals with disabilities; however, the Board recognized that the NCMRR neither had the authority nor the resources to provide such services. The Board felt that the NCMRR does have a role in supporting health services research on issues important to rehabilitation, and it encouraged the NCMRR to promote such research. Within the report, the emphases on translational research and bringing research results to the community reflect the Board's suggestions. Development of an evidence base to support clinical practice in rehabilitation was recognized as an essential element in successful translation.

4) The NCMRR must exist within the culture of NIH.

The Board discussed the basic mechanisms and procedures for grant funding at NIH as they relate to the NCMRR. Topics included: separation of program and review so that every application would receive as fair and competent a review as possible; and the philosophy that experts in the field have the best appreciation for scientific problems and the means to solve them, meaning investigator-initiated applications are the best means for developing new scientific knowledge. At the same time, the Board encouraged the NCMRR to work with NIH leadership to bring more consumer input into setting research priorities and into the research process.

Michael Weinrich, M.D., Director, NCMRR

IN THE NEWS

NCMRR-supported research and grantees continue to inspire coverage in the media:

- Ramping Up Rehabilitation Research Urged as a "Public Health Imperative," JAMA, November 16, 2005—Vol. 294, No. 19, p. 2413. (Subscription Required *http://jama.ama-assn.org/cgi/content/full/294/19/2413*)
- Introducing Jesse Sullivan, the World's First "Bionic Man" – (Grant numbers R01HD044798 and R01HD043137, Todd Kuiken, Principal Investigator). For more information, visit:
  - *http://www.ric.org/bionic/*
  - *http://abcnews.go.com/GMA/MedicalMinute/story?id=895590*
  - *http://www.cbsnews.com/stories/2005/09/14/eveningnews/main846531.shtml*
  - *http://www.pbs.org/newshour/bb/science/july-dec03/roboticarms_11-18.html*

Welcome Back!

We hope you had an opportunity to read the first e-update (Innovations Fall-Winter 2005), a new venture for us, initiated in response to requests for periodic updates from the NCMRR. The Center, within the NICHD, views these e-updates as part of its mission to foster the development of scientific knowledge needed to enhance the health, productivity, independence, and quality-of-life of persons with disabilities. This goal is accomplished by supporting research on the functioning of people with disabilities in daily life.

E-updates provide a means of recognizing progress and disseminating information about the many innovations made in the field of medical rehabilitation as a result of NICHD funding. We hope you share in our enthusiasm regarding these developing technologies, the emerging evidence for various treatment options, and a growing portfolio of innovative research.

Carol A. Sheredos, P.T., M.A., NCMRR

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SBIR/STTR Corner

- Koeneman, James – R44HD041805 – Clinical Assessment of a Massed Practice Therapy Device – See *http://www.kineticmuscles.com*

  The Kinetic Muscles Inc., Hand Mentor is an exercise therapy device that actively involves the patient in their rehabilitation. The Mentor encourages a patient to extend their wrist and fingers as much as possible on their own. When maximum self extension is achieved, the Mentor engages a pneumatic actuator and assist the movement of the wrist and fingers to full extension. In addition to recruitment of hand function, the Mentor will actively stretch the hand in an effort to reduce spasticity.

- Axelson, Peter W. – R44HD36944 – A Universal Canoe Seating System – See *http://www.beneficialdesigns.com/rectech/water.html#Top*

  The development of improved canoe seating options will benefit all canoeists, but particularly those with average or limited physical capacity. Existing canoe seats are not designed to provide a secure base of support, a function that the canoeist is expected to provide through muscular effort. The Universal Canoe Seating System reflects a completely new and innovative approach to the provision of canoe seating by providing the canoeist with a stable base of support that does not rely on the individual's muscular effort. A stable base of support provides multiple benefits, including a decrease in the energy required to paddle, increased safety through decreased uncontrolled movements and stable positioning, and improved upper body function. The Universal Canoe Seating System will make the benefits of a stable base of support available to all canoeists, with the benefits being particularly prominent for individuals with disabilities, older adults, young children, and individuals with decreased levels of fitness or muscular coordination.

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Focus on Training

Each issue of Innovations spotlights one of the NCMRR's institutional training grants (T32 or K12).

This issue spotlights the training program at **Northwestern University** in Chicago, Illinois, focusing on the **Pathophysiology and Rehabilitation of Neural Dysfunction**. This T32 grant (T32 HD007418) has been ongoing since 1992, with several competitive renewals. William "Zev" Rymer, M.D., Ph.D., the PI, is president of the Rehabilitation Institute Research Corporation, director of research at the Rehabilitation Institute of Chicago, director of the Sensory Motor Performance Program, and professor in the Department of Physical Medicine and Rehabilitation at Northwestern University. Dr. Rymer earned his medical degree from the Melbourne University Medical School in Melbourne, Australia, and his doctorate in neurophysiology from Monash University in Melbourne, Australia.

All postdoctoral trainees participate actively in research programs with faculty based in one or more of six designated research groups. While the focus is primarily pragmatic, it is expected that areas of common interest and training opportunities will emerge in the areas of computational neurosciences and brain modeling. Dr. Rymer has stated that the program's research is focused on the "…understanding of skeletomotor reflex function in patients with disorders of muscle tone; another research area is physiological effects of spinal cord injury. Using electrophysiological, pharmacological and morphological techniques, (they) are studying the sources of altered motoneuronal responses in spinal segments below a partial or complete spinal cord transection. (Their) objectives are to identify the key transmitters and/or neuromodulators responsible for altered responses and to develop compounds that may counteract these abnormalities in human subjects."

Postdoctoral training programs are tailored to address specific weaknesses and needs, and to highlight required additional course work and other training necessary for completing the training program. For physicians undertaking research training, a clinical mentor and a basic research mentor are identified. The research mentor is selected from the training program faculty roster by the program directors, in consultation with the clinical mentor and the candidate. These mentors identify areas needing strengthening, and help to design the appropriate course work, laboratory exposure, and clinical experience (if necessary).

Predoctoral trainees entering the Northwestern University laboratories are recruited in conjunction with their application to Northwestern University Graduate School. The themes of engineering in rehabilitation and neural engineering are identified as core themes for both the biomedical engineering department (*http://www.bme.northwestern.edu/*), and in the mechanical engineering department (*http://lims.mech.northwestern.edu/research.htm*). These themes have proven to be very appealing to potential graduate students, and about 30 percent to 40 percent of applicants choose these topics as potential thesis areas. The appeal appears to come from the potential for achieving tangible benefits for disabled people.

The Rehabilitation Institute of Chicago has been fortunate to receive support for a novel initiative called the Donnelley Family Disability Ethics Program (sponsored, in part, by the Donnelly Family Foundation). This program seeks to promote thoughtful examination of the moral questions that surround disability. Although the focus of this ethics program is quite broad, several of their presentations are relevant to research, including themes such as: the acquisition of consent for studies on severely disabled adults or children; the role of subject, physician, and researcher in pursuing research on chronic disabling conditions; and concerns about privacy and information sharing. The director has extended an invitation to the members of the Northwestern University Rehabilitation Research Training Program (both predoctoral and postdoctoral trainees) to participate in their weekly activities to learn about ethical issues in medical decision-making in relation to disabled individuals.

Visit the program's Web site for more information at *http://www.bme.northwestern.edu/index.shtml*.

The Neuro-Cognitive Rehabilitation Research Network (NCRRN)

The NCRRN is a collaborative effort of investigators at the Moss Rehabilitation Research Institute and the University of Pennsylvania to provide research infrastructure support and expert consultation to individuals interested in pursuing cognitive rehabilitation research.

The mission of the NCRRN, funded by a grant from the National Institutes of Health (NCMRR/NICHD) is to:

- Synthesize and disseminate the tools necessary to refine promising treatments for cognitive impairment
- Understand their mechanisms of action
- Gather preliminary data about their clinical impact to support larger efficacy trials

For more information, please visit http://www.ncrrn.org/.

Spotlight on Technology

The Effect of Proximal and Distal Training on Stroke Recovery

Principal Investigator: Hermano Igo Krebs (R01HD045343)

This project spotlights the work of the Massachusetts Institute of Technology's mechanical engineering department in collaboration with the Department of Veterans Affairs Medical Center at Baltimore, Maryland.

Stroke is the leading cause of impairment and disability. Although treatment of post-stroke recovery in dedicated rehabilitation units positively influences outcome, no one treatment strategy has demonstrated superiority. This project delivers targeted sensorimotor training for the shoulder and elbow with a planar robotic device, MIT-Manus. In randomized controlled trials, for both inpatients and persons with chronic impairment after stroke, persons treated with the robotic protocol demonstrated reduction in impairment in the exercised limb. The results are in agreement with a prominent theme of current research into recovery from brain injury, which posits that activity-dependent plasticity underlies neuro-recovery. If true, it suggests that significant recovery of motor function may be facilitated by "properly targeted" sensory-motor activity, meaning that with the under-emphasis or absence of sensory and motor stimulation of the central nervous system related either to a particular group of muscles and joints, or to particular tasks, the associated neural systems would be expected to: (1) exhibit little plastic change, or (2) be pre-empted to subserve other functions. These investigators have recently introduced to the clinic a complement to MIT-Manus: a wrist robot. Outcomes of this project will be measured using standard instruments as well as robot-based measures. For more information, visit *http://www.mit.edu/newsoffice/2005/stroke-robot.html*.

Wearable Robots Help With Stroke Rehabilitation

Principal Investigator: Koeneman, James (Contract N01-HD-3-53)

This contract with Arizona State University through the NICHD, in collaboration with the National Institute of Biomedical Imaging and Bioengineering (NIBIB) is for the Robotic Upper Extremity Repetitive Therapy Device (RUPERT), which gives stroke survivors a portable system to retrain their muscles to perform basic tasks such as picking up a cup. For more information about RUPERT, visit *http://www.nibib.nih.gov/publicPage.cfm?pageID=2814* and click on "Enter Flash," then click on the 11th picture down in the left column. Also visit *http://www.nibib.nih.gov/HealthEdu/PubsFeatures/eAdvances/15Dec04*.

Improving the Match of Person and Assistive Cognitive Technology

Principal Investigator: Marcia Scherer (R43HD052310)

The aims of this project are to develop, validate, and commercialize products involving matching of persons with the appropriate assistive technologies for mobility. In spite of the fact that the provision of assistive technology (AT) to people with cognitive disabilities is encouraged in a succession of U.S. statutes, rehabilitation professionals state that they do not have an effective process for matching consumers who have cognitive disabilities with the most appropriate assistive cognitive technologies (ACT) for their use. The lack of AT provision is often associated with a concomitant loss of independence, safety (e.g., emergency preparedness and response), help-seeking, health and participation in education, work, and community life. The goal of this research is to help get more ACT to the consumers who can benefit from them. The project PI is with the Institute for Matching Person and Technology. For more details, visit *http://members.aol.com/impt97/mpt.html*.

Advanced Robotic Device for the Safe Rehabilitation for Stroke and Brain Injury

Principal Investigator: William Townsend (R43HD052327)

The aim of this project is to develop a cost-effective robotic rehabilitation machine that safely improves and accelerates a person's recovery outcome after a stroke or traumatic brain injury by enhancing neural rewiring. The performance of this machine will broaden application of the promising results of recent clinical work at the Rehabilitation Institute of Chicago in trajectory-error amplification and work at Carnegie Mellon University and the University of Pittsburgh in exploiting disturbed perception. Common among these studies is the notion of creating or amplifying a patient's trajectory errors relative to a visual target. It is believed that these techniques motivate the patient to rebuild the neural-muscular structure to function better at reaching and grasping during the crucial few months after the trauma or stroke. Especially in an aging population, the frequency of brain/neural injuries due to stroke or trauma is growing. By immersing a patient in a special robot-generated virtual environment, it may soon be possible to reverse neural stroke or trauma damage somewhat during the critical first few months after injury. For more information, visit *http://www.barrett.com/robot/products/arm/armfefr.htm*.

Investigator Profile

Scott Delp, Ph.D.

Scott Delp is a professor of Bioengineering and Mechanical Engineering at Stanford University, who joined the faculty in 1999. He received his Master of Science and doctorate degrees in mechanical engineering from Stanford. Dr. Delp is also a professor (by courtesy) of orthopedics at Stanford. He is a Fellow of the American Institute of Medical and Biological Engineering, as well as the founding chair of the Department of Bioengineering *(http://bioengineering.stanford.edu/*) and co-director of the Center for Biomedical Computation (*http://simbios.stanford.edu/*) at Stanford.

Professor Delp's work draws on computational mechanics, medical imaging, and neuromuscular biology to improve treatments for neurologic and musculoskeletal diseases. He is best known for the development of highly realistic simulations of the musculoskeletal system. These simulations have been used to study neural control of movement, mechanisms of musculoskeletal diseases, and to design surgeries and medical devices.

Dr. Delp's focus is on experimental and computational approaches to study human movement. He studies the development of biomechanical models to analyze muscle function, study movement abnormalities, design new medical products, and guide surgery. Testing of new computational models of human movement with medical image data and experimental measurements is another area of Dr. Delp's expertise.

The NCMRR has supported Dr. Delp with several grants over the years, including:

- R01HD038962 - Muscle Function After Tendon Transfer Surgery (1999-2004)
- R01HD033929 - Muscle Function in Deformed & Surgically Altered Limbs (1996-2006)
- R01HD046814 - Simulation-Based Treatment Planning for Gait Disorders (2004-2008)

Dr. Delp has also received funding from the National Institute of General Medical Sciences at NIH: P20 GM064782 - PILOT--Image-Based Modeling for Biomechanics (2001-2004).

You may contact Dr. Delp at delp@stanford.edu.

Methodologic challenges to Central Nervous System (CNS) imaging

John Whyte, M.D., Ph.D., gave the following talk at a recent American Academy of Pediatrics meeting on brain imaging studies. The message is that it is easy to design a study that is provocative (correlative) but a lot more difficult to design a study that really provides insight into the underlying rehabilitative and cognitive processes.

Goals of Presentation:

- Review potential applications of fMRI to rehabilitation research
- Identify some of the challenges that rehabilitation research topics present in using this technology
- Point toward some potential solutions
- Describe infrastructure support available for individuals interested in pursuing research in this area

Potential Applications of fMRI:

- Basic Behavioral Neuroscience: What neural networks support what types of cognitive and motor abilities?
- Mechanisms of recovery of function: How is the recovery of an ability manifested in changes in neural network activity?
- Mechanisms of treatment: How do performance and network activity change as a result of treatment and how are these two types of changes interrelated?

What types of recovery processes are most amenable to study with functional imaging?

- Recovery at the ICF levels of body structure and function are most suitable (i.e., "restorative" changes)
- Changes in more macro strategies are harder to interpret with functional imaging unless there are very specific hypotheses regarding the compensatory strategies being used.

This background could be useful the next time you are attempting to develop an fMRI study. Applicants should refer to John's infrastructure group, which is designed to promote research in cognitive rehab: *http://www.ncrrn.org/*

NCMRR Staff in the Limelight

Each issue of *Innovations* focuses on one of the NCMRR's staff and his or her program(s) to help the community learn a little more about NCMRR program staff and about the Center's specific programs. If, after reading about a specific program director or program, you wish to know more, please contact the program director via e-mail or telephone (see end of interview for contact information).

This issue of *Innovations* focuses on the Biological Science and Career Development Program (BSCD) and its program director, Dr. Ralph Nitkin.

Innovations: Where did you receive your education? What were your degrees in, and what were your areas of concentration?

Dr. Nitkin: I got my undergraduate degree from MIT majoring in biology; with a few more graduate courses and a thesis, I was able to add a master's degree. I went west to the University of California at San Diego (UCSD) for my doctoral studies focusing on neurobiology.

Innovations: What influenced your decision to focus on these areas?

Dr. Nitkin: I had an early interest in science and engineering that led me to consider a career in teaching or research. The doctoral program at UCSD had an energetic new group of neuroscientists who got me interested in studies of nerve and muscle cell function. I was attracted to the dynamic nature of these tissues and the opportunities to study them at the cellular and molecular level.

Innovations: When did you first come to the NCMRR?

Dr. Nitkin: I joined the Center in 1999, shifting over from another part of the NIH.

Innovations: What did you do before coming to the NCMRR?

Dr. Nitkin: I initially committed to a career in academic research. I pursued postdoctoral studies at Stanford University and then joined the faculty of Rutgers University. However, in 1990, I shifted careers and became a scientist administrator at the NIH. Initially I worked in the Mental Retardation and Developmental Disabilities Branch of the NICHD and later shifted to the area of medical rehabilitation.

Innovations: What influenced your decision to go into research, particularly rehabilitation research?

Dr. Nitkin: I was fascinated by how nerves and muscles function at the cellular level and recent findings in neuromuscular regeneration. As a scientist administrator, I became interested in broader issues of supporting function and promoting recovery and rehabilitation. Although I came from a basic research background, I have learned a lot from clinical and psychosocial researchers and through my interactions with the rehabilitation community.

Innovations: I know that your program (BSCD) involves funding for projects in the biological sciences. Please tell us about that program.

Dr. Nitkin: Although there is overlap among NCMRR programs, BSCD tends to focus on basic and mechanistic aspects of rehabilitation. This includes research on such topics as tissue plasticity, brain imaging, activity-driven processes, molecular and pharmacological approaches, and the potential role of genetic factors.

Innovations: You are also responsible for the training grants program. Can you provide a brief description of that portion of your program?

Dr. Nitkin: Training and career development have been priorities of the NCMRR since it was established. I think of it as a two-prong approach: supporting rehabilitation clinicians and therapists who become interested in research careers, and attracting experienced researchers from allied fields to research opportunities in medical rehabilitation.

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The NCMRR Advisory Board

The Director of NIH was mandated in 1990 under Public Law 101-613 to establish the National Advisory Board on Medical Rehabilitation Research. The Board advises the Directors of the NIH, the NICHD, and the NCMRR on matters and policies related to the Center's programs.

The Board comprises 12 members representing health and scientific disciplines related to medical rehabilitation and six members representing persons with disabilities. Four new members will begin their tenure in June 2006. The current roster for 2006 is available at *http://www.nichd.nih.gov/about/overview/advisory/nmrrab/roster.cfm.*

Minutes from past Advisory Board meetings are available at *http://www.nichd.nih.gov/about/overview/advisory/nmrrab/index.cfm*.

Multi-center randomized clinical trials network for neurorehabilitation interventions

The World Federation of NeuroRehabilitation (WFNR) (http://www.wfnr.co.uk/) and its national societies aim to promote education and research. One approach to this promotion is to join clinicians together to conduct multi-center randomized clinical trials of simple-to-perform interventions.

The program is supported by the WFNR's Research Committee, chaired by Bruce H. Dobkin, M.D., by the American Society of Neurorehabilitation (ASNR) (http://www.asnr.com/), and by a grant from the NIH with PIs Michael Selzer, M.D., Ph.D., from the University of Pennsylvania, and Dr. Dobkin, at University of California Los Angeles. This project is funded via the new NICHD R24 research infrastructure grants (R24HD50838). For more information on the project, visit http://www.ncmrr.org/Sites/UniversityofPennsylvania/tabid/202/Default.aspx. The NICHD funds will maintain the Web-based interactive data entry system and the statistical and data management group. Funds are not available from the WFNR/ASNR at this time.

By participating in the proposed trials, clinicians and members of the rehabilitation team can acquire experience that may enable them to develop their own center's studies, come to appreciate the scientific rationale for controlled trials, and participate with colleagues around the world. Over time, the NCMRR anticipates that network participants will suggest both commonly used and novel interventions that may be of interest for the network to test. Project researchers believe that the network will enrich experience in patient care and give greater access to experts in the discipline of rehabilitation science and patient care. All trials will adhere to Consolidated Standards of Reporting Trials (CONSORT) criteria and advanced registration. Successfully completed studies will be a priority for peer reviewed publication in the WFNR/ASNR-sponsored journal, Neurorehabilitation and Neural Repair (http://nnr.sagepub.com), with all contributors listed.

All interactions will take place via a dedicated Web site once it is clear that enough sites are interested. The goal is to initiate the first trial in September 2006.

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NCMRR Staff in the Limelight

Innovations: What training grant mechanisms are the most popular?

Dr. Nitkin: The NCMRR funds a handful of departmental training grants to support graduate students or postdoctoral fellows at particular institutions around the United States. We also support mentored career development through individual K awards (K01, K08, K23, and K25) and national K12 networks.

Innovations: Please tell us a little about the training conferences that the NCMRR sponsors.

Dr. Nitkin: In order to help spread the word about research opportunities and NIH funding, the NCMRR participates in workshops at various professional meetings and regional conferences. We also run a biennial training workshop in the Washington, D.C., area that attracts almost 200 researchers at the beginning of their independent careers (*http://www.nichd.nih.gov/about/org/ncmrr/prog_bscd/index.cfm*)

Innovations: Funds are tight within the NIH these days. How are you handling that at the NCMRR, particularly with regard to training grants? What do you tell prospective applicants? How has this changed since you started at the Center, if at all?

Dr. Nitkin: Yes, these are difficult times for biomedical researchers. While we continue to provide support on NIH funding opportunities, peer review, and grantsmanship, we also encourage researchers to be persistent and to diversify their research base. They should consider other federal funding agencies, foundations, and even pharmaceutical and engineering companies that may support rehabilitation research. We also ask that academic departments be patient in supporting new faculty at the beginning of their independent research careers.

Innovations: What can you tell us about the research networks established by the NCMRR?

Dr. Nitkin: The NCMRR supports a national network of institutions to provide research support, workshops, consultations, and collaborative opportunities, particularly in the areas of bioengineering, cognitive rehabilitation, neurorehabilitation, molecular genetics, and muscle function (see *http://www.ncmrr.org/* for more details).

Innovations: Have you seen any changes in the field since you started at the NCMRR?

Dr. Nitkin: Within our research arena, we have a growing cadre of successful clinical and basic researchers. Moreover, the broader research community has taken an increasing interest in issues of tissue plasticity, activity-driven processes, bioengineering and assistive technologies, the role of environmental factors, and functional outcomes. I would like to think that the NCMRR had a small role in these changes.

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New Model of Disability

The NCMRR has been working on a new model of rehabilitation that focuses attention on the possible interventions in the disablement process, rather than trying to define abstractions, and that lists those items that are actually measurable. Thus, rehabilitation interventions become influences, which have the potential to affect the degree of organ system dysfunction or dyscontrol caused by tissue damage, as well as the quality of specific task performance. Other mediating influences act in parallel, and, therefore, the ultimate effects of task-performance deficits on individuals' roles in society are shaped by attitudes and laws at the individual and societal levels. The NCMRR model appears below.

The complexity of multiple interacting influences on task performance and on role performance, especially the influences of the environment and patients' prior education and experience, makes it very difficult to isolate the "active ingredient" of rehabilitation interventions in the clinical setting. Investigators often use surrogate endpoints, such as performance measures on activities of daily living; however, the correlations between these measures and long-term outcomes meaningful to patients and families have not been adequately investigated.

This new model also highlights the importance of individual preferences and values in achieving task and role performance. Even as rehabilitation professionals are eager to avoid "blaming the victim," individual preferences and values clearly play a central role in determining how well individuals will engage in activity-driven therapies, and how well they will surmount the difficulties of performing tasks and participating in roles. Clinicians are well accustomed to the seeming paradox of patients with apparently modest deficits whose lives are devastated, versus those facing seemingly overwhelming obstacles, who, nonetheless, engage in rich and fulfilling lives. More investigations into factors that enhance individual motivation are needed.

Pathophysiology	**Organ Dysfunction**	**Task Performance**	**Roles**
Influences	*Influences*	*Influences*	*Influences*
Genes	Environment	Environment	
Acute Care	Rehabilitation	Rehabilitation	
Anatomy	Education	Attitudes	
Pharmaceuticals	Experience	Preferences and Values	
	Preferences and Values	Socioeconomic Status	
	Technology	Technology	
		Laws and Regulations	
		Family	

The distinction between this model and the World Health Organization (WHO) model is not merely semantic, but reflects a difference in orientation. Rather than focusing on characterizing impairments, functional limitations, disabilities, and societal limitations, the NCMRR model seeks to understand and change the influences that mediate transitions between these levels. The NCMRR model emphasizes rehabilitation as an active process with the goal of improving quality-of-life.

What then, distinguishes rehabilitation interventions from other medical interventions? Rehabilitation interventions are activity-based, requiring the active participation of the patient or client. It is now clear that the nervous system is an exquisitely plastic organ, driven and molded by experience; through the actions of the nervous system, those experiences cause a wide range of actions on nearly all other body systems including cardiovascular, musculoskeletal, and immune systems.

The NCMRR model also highlights the special challenges faced by rehabilitation researchers. For example, organ dysfunction can result from many different pathological processes. Until recently, activity-based therapies often lacked specificity for the particular deficits experienced by patients. Although rehabilitation disciplines articulated a very clear philosophy of individualized treatments for patients, few empirical principles existed to guide the process.

From the NCMRR Report to the NACHHD Council, January 2006

The NCMRR invites suggestions and comments on this proposed New Rehabilitation Model. Please visit *http://www.nichd.nih.gov/publications/pubs_details.cfm?from=&pubs_id=5049* for the NCMRR Report to the NICHD Council, which includes this Model in its entirety.

A Message to Our Grantees

Dear grantees:

The NCMRR, along with the rest of the NIH, is under an increasing obligation to report the results and the significance of the research we support. The audience for these reports typically includes the congress, the executive branch of government, professional and advocacy organizations, and the general public.

You can help present the strongest demonstration of the quality and importance of this research (very considerably) by including critical information in your annual progress reports. Please also be sure to follow the instructions for the annual progress report for PHS 2590 (*http://grants1.nih.gov/grants/funding/2590/2590.htm#updates*).

The information outlined below can serve as a template for the progress report summary (page 5).

For research grants, please include:

- Brief descriptions of major research findings in the past year
- Research or public health significance of your findings to date
- Other investigators, if any, using your methods or findings
- Publications resulting from this grant
- If your work includes human subjects, an accurate tally of subjects entered, as well as projected and targeted enrollments; please include gender and ethnic distributions
- Major research problems encountered, including recruitment issues, and your approach to solving them

For SBIR/STTR grants, please include:

- If your work includes human subjects, an accurate tally of subjects entered, as well as projected and targeted enrollments; please include gender and ethnic distributions
- Publications resulting from this grant
- Products resulting from this grant
- Progress towards a commercial product
- Numbers of known users of the product

For career development awards, please include:

- If your work includes human subjects, an accurate tally of subjects entered, as well as projected and targeted enrollments; please include gender and ethnic distributions
- Publications resulting from this grant
- Your current career status/address
- Grant applications submitted
- Grant applications funded

For training grants, please include:

- Current status/address of trainees in the program
- Publications by trainees
- Career status/address of past trainees
- Grant applications submitted by (present and past) trainees
- Grant applications by trainees (present and past) funded

Following these instructions and suggestions should facilitate the continued support of your grant. Please contact your program official if you have any questions about this or the grant renewal process.

Conference Calendar

- **January 9 10, 2006:** *Rehabilitation Research Agenda: Improving Functional Mobility for Patients with Musculoskeletal Impairments*
  Conference information is available at:
  http://icdr.us/musculoskeletal/.

There are no remaining NCMRR-sponsored conferences planned for fiscal year 2006.

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SBIR/STTR Corner

- Bonniger, Ronald M. – R44HD039962 – Development of an Ergonomic Manual Wheelchair Pushrim – See *http://www.3rivers.com/naturalfitintro2.php*

  Wheelchair users push on their handrims an average of 2500 times a day (17,500 times a week, and 75,000 a month). Yet, despite the fact that the handrim is the primary point of active interface between a manual wheelchair user and his or her wheelchair, in more than 50 years there has been little innovation and little change in the basic round design of the handrim. The prototypes produced under Specific Aim #1 (with size and coating variations) are directly in line with the central focus of this research and development effort: To drive a paradigm shift away from standard wheelchair handrims that ignore the importance of ergonomics and the potential for the development of secondary injury to the upper-extremities, and that ignore differences in upper-extremity function (paraplegia vs. tetraplegia). This continued R&D effort will help spearhead efforts to supplant this "one-size-fits all" standard, and instead drive toward a paradigm that encourages the production of wheelchair handrims that address differences in upper-extremity function and differences between men, women, and children, and that are designed to minimize the risk of secondary injury to the upper-extremities.

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NCMRR Staff in the Limelight

Innovations: What do you do in your spare time (if you have any!)?

Dr. Nitkin: In order to "practice what I preach," I participate in sports and recreational activities. I occasionally get involved with home projects and repairs.

Innovations: Thank you so much for taking the time to share these thoughts with us. Is there anything else you would like to share with our constituents?

Dr. Nitkin: We hope for increased opportunities to support biological and psychosocial research that improves function and enhances participation. We look to the rehabilitation community to keep us connected to the issues that matter for people with disabilities.

Dr. Nitkin's Contact Information:
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Director
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E-mail: rn21e@nih.gov

NCMRR Mission

The mission of the NCMRR is to foster the development of scientific knowledge needed to enhance the health, productivity, independence, and quality of life of persons with disabilities. This goal is accomplished by supporting research on the functioning of people with disabilities in daily life.

The research initiatives and opportunities recommended in the Research Plan (154 KB) for the NCMRR are discussed in terms of seven cross-cutting areas in which increased research effort is needed. Those areas are:

- Improving functional mobility;
- Promoting behavioral adaptation to functional losses;
- Assessing the efficacy and outcomes to medical rehabilitation therapies and practices;
- Developing improved assistive technology;
- Understanding whole body system responses to physical impairments and functional changes;
- Developing more precise methods of measuring impairments, disabilities, and societal and functional limitations; and
- Training research scientists in the field of rehabilitation.

To fulfill this plan, the NCMRR is very interested in receiving applications for funding from investigators, and its support of rehabilitation research is limited only by the number of quality applications received.

To encourage new investigators, the NCMRR offers various training grant mechanisms available to support individuals in all stages of their careers. Information regarding specific training grants is available at http://www.nichd.nih.gov/funding/position/individual_institutional.cfm or by contacting Dr. Ralph Nitkin at rn21e@nih.gov.

In the next *Innovations:*

- *Who's Who on the NCMRR Advisory Board*
- *Profile of NCMRR Staff Member*
- *NCMRR Infrastructure Development Sites*

And more...