



Welcome!

This e-update is in response to several requests from our Advisory Board and constituents for a periodic update from the National Center for Medical Rehabilitation Research (NCMRR), within the National Institute of Child Health and Human Development (NICHD). It is intended as 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 that you share our excitement over 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*

Director's Message

The NCMRR Advisory Board suggested that we develop this electronic update to improve communications with the NCMRR's constituents—consumers, advocates, and investigators. In that spirit, we invite your suggestions on ways that we can improve these updates, and on items that you would like to see featured in future updates. Please feel free to e-mail us with your comments and suggestions.

The number of rehabilitation grant applications to the NICHD continues to rise, and rise proportionately faster than appropriations for the NICHD, resulting in tighter pay lines for investigator-initiated applications, and reduced resources for targeted initiatives. This dynamic is not expected to change in the foreseeable future. Despite this

fact, I am pleased to report that applicants to the NCMRR are continuing to succeed under these challenging conditions.



*Michael Weinrich, M.D.,
Director, NCMRR*

The total number of funded applications and funds committed to NCMRR-sponsored research has also continued to rise. The NCMRR has issued a solicitation and will fund the second generation of Rehabilitation Research Network Centers, as well as the Medical Rehabilitation Scientist Development Program. We have also taken the lead in developing a trans-NIH program announcement on *Research Partnerships to Improve Functional Outcomes* (PAR-04-077) to encourage collaborative research on problems in rehabilitation.

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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.

- ❖ Axelson, Peter – R44HD29983 – Back Support Shaping System – See <http://www.beneficialdesigns.com/wcseating/wcseating-techdev.html#backsupport>
- ❖ Axelson, Peter – R43HD36533 – FlexRim Low Impact Wheelchair Pushrim – See <http://www.beneficialdesigns.com/wcseating/wcseating-techdev.html#flexrim>
- ❖ Dean, Robert – R44HD36154 – Smart Variable Geometry Socket – See <http://www.simbex.com/ACS.html>
- ❖ Kraus, Lewis E. – R44HD33310 – MathPad™ Plus – See <http://www.infouse.com/mathpadplus>

Director's Message

The NCMRR continues to participate in planning and funding conferences to develop and promote an agenda for rehabilitation research. Our collaborations with other agencies are especially noteworthy, including:

- ❖ *The White House/Department of Veterans' Affairs (VA) Conference on Emerging Technologies* (co-sponsored with the VA and the Office of Science and Technology Policy);
- ❖ *Translating Defense and Civilian Technologies for Pediatric Critical Care and Rehabilitation* (co-sponsored with the Departments of Energy and Defense);
- ❖ *Increasing the Quantity and Quality of Multiple Sclerosis Rehabilitation Research* (co-sponsored with the National Multiple Sclerosis Society); and
- ❖ *Workshop to Develop a Research Agenda on Appropriate Settings for Rehabilitation* (co-sponsored with the Center for Medicare and Medicaid Services).

Together with its Advisory Board, the NCMRR will be drafting a new strategic plan for the next five years. At the December 2004 meeting, the Advisory Board broke into three work groups that recommended the following research priorities:

- ❖ The first group recommended support of research in: biological basis of rehabilitation (including influence of gender, genetics, and ethnicity); artificial intelligence, robotics, and telemedicine; neural-prosthetic interfaces; advanced assistive technologies; clinical trials to promote novel rehab interventions; osseointegration and nanotechnology to build devices that integrate with dysfunctional tissue; and research on outcomes and quality-of-life measures.
 - ◆ The group also supported the use of: three-year center-planning grants; national training K12 grant program for rehabilitation engineers; workshops focused on new and emerging technologies; more R24 infrastructure grants; and collaborative clinical trials to determine optimal intensity, duration, and content of rehabilitative therapies, as well as the optimal target populations.
- ❖ The second group focused on: plasticity, adaptation, and accommodation; translational research; medical intervention to sustain life; epidemiology prior to rehabilitation; and needs assessment, with a focus on the person and quality of life.
 - ◆ Priorities include: translating emerging knowledge from basic sciences into implementation; technology, research, and development that leads to evidence-based interventions and accommodations; qualitative



and quantitative evaluation of therapeutic interventions (e.g., duration and frequency); and improving the practice of rehabilitation medicine.

- ◆ The group also noted opportunities in stem-cell technology and outcomes research (e.g., defining positive health and wellness). Members encouraged collaborations with other NIH Institutes on common topics (e.g., stroke, cancer) to extend outcomes through rehabilitation and participation. It recommended the continued support of investigator-initiated research and encouraged the NCMRR to evaluate the success of ongoing programs and research initiatives.
- ❖ The third group felt that rehabilitation research was grounded in studies of: adaptation and plasticity at the level of cells, organs and systems; approaches that go beyond healing and reversal of injury; and studies of retraining reflex functions.
 - ◆ Research goals include: reconciling outcomes between bench science and clinical studies; examining quality of life and impact on families; secondary effects of impairment/ disabilities (e.g., weaning spinal cord injury patients, positive psychosocial impact, breaking out of the spiral of cumulative illness and disability); and long-term management of chronic disabilities and conditions (including pressure sores, effects of long-term drug/narcotic use, inactivity, and obesity).
 - ◆ The group recommended conferences on universal design for learning, family and support systems, contrasting the medical model with the social/minority model, and outcome measures.

We invite suggestions and comments on these proposed research areas. Please check our Web site at <http://www.nichd.nih.gov/about/ncmrr/ncmrr.htm> for the forthcoming draft report to the NICHD Council. We invite your comments and suggestions on this draft.

Michael Weinrich, M.D., Director, NCMRR

IN THE NEWS

NCMRR-supported research and grantees have had a newsworthy year:

- ❖ EEG-Based Brain-Computer Interface
NCMRR Grantee: Jonathan Wolpaw
Project: R01HD030146
 - ◆ Chip reads mind of paralyzed man, *The Guardian*, March 31, 2005
<http://society.guardian.co.uk/health/story/0,7890,1448366,00.html>
 - ◆ Mind control, *Nature Reviews/Neuroscience*, February 2005
http://www.nature.com/hnrnljournal/v6/n2/full/hnrn1610_fs.html
 - ◆ Brain-Computer Interface Adds a New Dimension, *Science*, Vol 306, Issue 5703, 1878-1879, 10 December 2004
<http://www.sciencemag.org/cgi/content/full/306/5703/1878a>
- ❖ The EXCITE Trial
NCMRR Grantee: Steven Wolf
Project: R01HD037606
Constraint-induced therapy (CIT) involves teaching stroke patients to regain use of their impaired arms by limiting use of the unaffected arms.
<http://www.rehabmed.emory.edu/labs/wolf/home.html>
- ❖ ESPN.com: Inside the Helmet, November 2004
NCMRR Grantee: Rick Greenwald
Project: R44HD04074
<http://www.simbex.com/news/Articles/HITS/2004/11/10-ESPN.pdf>
- ❖ Clinical trial of nerve-muscle grafts in transhumeral amputees for improved prosthesis control
NCMRR Grantee: Todd Kuiken
Project: R01HD044798
 - ◆ Reconnecting, *A News Hour with Jim Lehrer*, November 18, 2003
http://www.pbs.org/newshow/lbbscience/july-dec03/roboticarms_11-18.html
 - ◆ Brain waves drive man's bionic arm, *CNN*, September 25, 2003
<http://www.cnn.com/2003/HEALTH/09/25/bionic.arm/>
 - ◆ Double Amputee Gets Thought-Controlled Arm, *Betterhumans*, October 8, 2003
<http://www.betterhumans.com/News/2985/Default.aspx>

- ❖ Flexing It: Kinetic Muscles Rewrites Injured Brains, *The Business Journal*, November 2004
NCMRR Grantee: James Koeneman
Project: R43HD041805
http://www.bizjournals.com/laccount/sign_in?uri=/phoenix/stories/2004/11/22/focus3.html
(Journal Registration Required)
- ❖ Logic Controlled Electromechanical Free-Knee Orthosis, *Medical Edge* from the Mayo Clinic, July 2003
NCMRR Grantee: Kenton R. Kaufman
Project: R01HD031476
<http://medicaledge.org/2003july.html#1>

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NCMRR Director Gives Plenary Talk at Institute of Electrical and Electronics Engineers (IEEE) in March 2005

Engineering New Approaches to Rehabilitation

By Michael Weinrich, M.D.

The population in the industrialized world is aging rapidly. Modest growth in national economies coupled with rapidly increasing expenditures for medical goods and services have strained the health care budgets for most of the industrialized world. This means that there will be an increased emphasis on maintaining a productive, older work force, and that there will be an advantage for health systems that can develop strategies to reduce disabilities, maintain individuals' function and control costs. While there is increased competition for resources from other disciplines, neuro-rehabilitation has a new set of tools that can begin to create the kind of scientific excitement and major clinical advances that we have seen in other fields. These include functional imaging, gene therapies, tissue engineering, biomechanical modeling, to name just a few. We also are seeing a new generation of investigators and clinicians emerging that are taking on the challenge of developing effective treatments for stroke, brain injury and spinal cord injury. Science is rapidly moving away from the "cottage industry" of the individual investigator working in an isolated laboratory to the collaborative, multidisciplinary model of "big science." To survive, neurorehabilitation must maintain the pace of scientific and clinical innovation while also retaining the essential elements of successful clinical interaction.

IN THE NEWS

Workshop at Walter Reed Army Medical Center

On January 14, 2005, the Human Engineering Research Laboratories (HERL) at the University of Pittsburgh, in collaboration with Physical Medicine and Rehabilitation at Walter Reed Army Medical Center in Bethesda, Maryland, presented a workshop entitled *State-of-Science Workshop: Wheelchair Research and Clinical Practice—Featuring Wheelchair Skills Training*. The workshop was free to all military, Department of Defense, NIH, and VA personnel and families. For more information, visit <http://www.herlpitt.org/home.html>.

Conference Calendar

May 2005: *Increasing the Quality and Quantity of Multiple Sclerosis Rehabilitation Research*, New York City, New York.

May 16-17, 2005: *Research Opportunities: Translating Defense and Civilian Technologies for Pediatric Critical Care and Rehabilitation*, Rockville, Maryland; sponsor/co-sponsor(s): NICHD/NCMRR, NIH Office of Rare Diseases, Department of Energy, Defense Advanced Research Projects Agency; for information, contact Dr. Carol Nicholson at nicholca@mail.nih.gov, or call 301-435-6843.

June 9-10, 2005: *Workshop on the Biology of Manual Therapies*, Bethesda, Maryland; co-sponsored by: NICHD/NCMRR, National Center for Complementary and Alternative Medicine, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institute of Neurological Disorders and Stroke, and the Canadian Institutes of Health Research; visit <http://nccam.nih.gov/news/upcomingmeetings/manual-conference.htm> for more information.

December 5-6, 2005: *NCMRR Biennial Training Workshop*, Rockville, Maryland; visit http://www.nichd.nih.gov/about/ncmrr/training_workshop.htm for information, slides, background materials, and information on previous meetings.

January 9-10, 2006: *Rehabilitation Research Agenda: Improving Functional Mobility for Patients with Musculoskeletal Impairments*; visit <http://www.nichd.nih.gov/about/ncmrr/workshops.htm> for more information.

Focus on Training

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

This issue focuses on the Medical Rehabilitation Research Training Program at the University of Michigan. This T32 grant (T32 HD007422) has been ongoing, with several competitive renewals, since 1991. Theodore (Ted) Cole was the founding Principal Investigator. The current principal investigator is Denise Tate, Ph.D., professor, Department of Physical Medicine and Rehabilitation. Dr. Tate earned her Ph.D. in rehabilitation psychology from Michigan State University.

The University of Michigan Medical Rehabilitation Research Training Program (U-M MRRTTP) was one of the first T32 programs funded by NCMRR with three grant cycles: 1992-1997; 1997-2001; and 2001-2006. The program emphasizes an interdisciplinary approach to research and is designed to prepare fellows for careers in growing biological and health care fields.

Research training is offered in three core areas:

- ❖ Motor performance and function;
- ❖ Recovery and treatment of brain and spinal cord injury (SCI); and
- ❖ Health and wellness.

This program received an NICHD MENTOR award, which goes to the Institute's most productive training programs. Visit the Program Web site for more information at <http://www.med.umich.edu/pmr/arrtp/mrrt.htm>.



Do you have any questions for NCMRR staff?

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



Spotlight on Technology

Innovative Body-Powered Voluntary-Closing Prehensor

Principal Investigator: Bradley D. Veatch
(R44HD039046)

This project is currently gearing up for a commercialization effort. It is a good example of a successful research effort funded under PA 02-071, *Innovative Technologies for Enhancing Function for Individuals with Disabilities*. This Phase II SBIR project focuses upon optimizing a body-powered voluntary-closing prehensor offering variable mechanical advantage and passive holding-assist. For more information and to view videos of this innovation in action, go to <http://www.adatech.com/goto/LESA> or to http://www.adatech.com/goto/LESA_in_Motion.

Magic Wheels: Two-Speed Manual Wheelchair Wheel

Principal Investigator: Steve Meginniss
(R43HD35793)

Wheels for manual wheelchairs are essentially unchanged since invented more than 150 years ago. Traditional non-g geared wheels have limited ability in varying terrain (e.g., hill climbing, hill descending, rough/uneven surfaces) and high-driving loads can cause repetitive stress injuries of shoulder, arm, and hand. These problems are amplified for patients with limited upper body capability.

The Magic Wheels product was designed from the ground up expressly to meet the needs of long-term wheelchair users. The unique design not only meets almost all the design criteria, but also includes two important, but unanticipated additional features: hill holding with override, and finger-tip assistive braking. Magic Wheels two-speed wheels have also been designed to allow after-market retrofitting in the field. To view video clips of Magic Wheels in action, visit <http://lchas.host-noc.com/~magicwheel/gallery/video.htm>.

For additional information on Magic Wheels, visit <http://www.magicwheels.net>.



Magic Wheels' new 2-speed geared manual wheelchair wheel. See www.magicwheels.net for details.

Development of the Game-Cycle Exercise System

Principal Investigator: Rory A. Cooper
(R41HD39535)

The GameCycle exercise system is an interface between an arm ergometer and a computer game that was designed to provide motivation for individuals who use wheelchairs to exercise on a regular basis. Exercise is important to the physical health and well-being of all people and helps in the prevention of cardiovascular disease, high blood pressure, obesity, and diabetes. It is especially important for persons with disabilities, who tend to have lower activity levels in general. For a presentation on the GameCycle, visit http://www.herlpitt.org/Presentations/RESNA2002/GAMECYCLE_EXERCISE_SYSTEM.ppt



Photo Courtesy of <http://www.herlpitt.org>

The NCMRR Advisory Board

The director of NIH was mandated in P.L. 101-613 to establish the National Advisory Board on Medical Rehabilitation Research. The Board advises the directors of NIH, NICHD, and NCMRR on matters and policies relating to the Center's programs.

The Board comprises 12 members representing health and scientific disciplines related to medical rehabilitation and 6 members representing persons with disabilities. Please visit http://www.nichd.nih.gov/about/ncmrr/ncmrr_roster.htm for the current roster for 2005.

Minutes from past Advisory Board meetings are available at <http://www.nichd.nih.gov/about/ncmrr/board.htm>.

Investigator Profile

Amy Bastian, Ph.D., P.T.



Dr. Bastian is a physical therapist who is known for her work with movement disorders, particularly looking at the role of the cerebellum. One of her major projects, *Mechanisms and Rehabilitation of Cerebellar Ataxia* (HD040289), funded through January 2006, focuses on cerebellar function in dynamically adjusting the relative motion of multiple joints and limbs to make movement smooth and accurate.

“We know that cerebellar circuits must process complex temporal and kinetic relationships between body segments predictively to avoid inaccuracies caused by long feedback delays,” Dr. Bastian said. “Cerebellar control processes must also be continually calibrated via adaptive mechanisms in order to be useful in a constantly changing environment.”

Although rehabilitation is the major treatment for most cerebellar conditions, there is minimal evidence to demonstrate the efficacy of existing rehabilitation techniques and mechanisms. Dr. Bastian has proposed to test:

- ❖ If there are maneuvers that can improve movement performance of people with cerebellar damage;
- ❖ If adaptive capacity can be enhanced in people with cerebellar damage; and
- ❖ If adaptive capacity predicts outcome (i.e., learning).

Dr. Bastian also hypothesizes that, to improve movement performance and adaptation capacity, it may be possible to enhance residual cerebellar function and/or tap into extra-cerebellar mechanisms, and that adaptive ability will correlate with learning capacity in this population, allowing researchers to predict who will best respond to rehabilitation.

“As we perform these studies, we will evaluate different theories of cerebellar function (e.g., dynamics control, timing) by determining which aspects of movement performance and adaptation are most compromised in cerebellar patients. Thus, this work will test motor control theories, while at the same time evaluating new strategies for rehabilitation.”

Dr. Bastian received her B.S. in physical therapy from the University of Oklahoma, and her Ph.D. in movement science from Washington University in Missouri. She was on the faculty of Washington University from 1997-2001. In 2001, she moved to Baltimore, Maryland, where she is an associate professor in the Neurology & Developmental Medicine Department at the Johns Hopkins School of Medicine. She is also the director of the Motion Analysis Laboratory at Kennedy Krieger Institute.

Dr. Bastian is the 1999 recipient of the American Physical Therapy Association - Eugene Michels New Investigator Award. You can contact her at bastian@kennedykrieger.org.

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, there are various training grant mechanisms available to support individuals in different stages of their careers. Information regarding specific training grants is available at <http://www.nichd.nih.gov/training/training.htm> or by contacting Dr. Ralph Nitkin at rn21e@nih.gov.

In the next *Innovations*:

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- ❖ [Profile of NCMRR Staff Member](#)
- ❖ [News to Use from the NCMRR](#)

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