



# HERL Quarterly Newsletter

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DECEMBER 2005

## WINTER UPDATE

We have made some important changes regarding the HERL newsletter since our last issue was published in June. First, we have begun publishing our print copies in-house, which resulted in a delay in the release of this issue. We did not release an issue in the fall and combined all news since summer into this Fall/Winter issue. Second, we have begun to pursue distributing the newsletter to more recipients by e-mail rather than mail. Many of our subscribers who receive a print copy or both a print and e-mail copy will begin to only receive the newsletter only by e-mail. HERL would greatly appreciate any subscribers who are currently receiving hard copies of the newsletter but use an e-mail address to notify us of their e-mail address by sending an e-mail to [heinerem@pitt.edu](mailto:heinerem@pitt.edu).

Since we skipped our summer issue, we have a lot of news to report! On May 27, 2005, HERL and Walter Reed Army Medical Center (WRAMC) held our third "State of the Science Workshop," this time focusing on current trends in research and clinical practice for spinal cord injury (SCI). Attended by over 100 researchers, clinicians, engineers, and consumers from around the country the workshop informed participants of up-to-date research findings that are relevant to the clinical treatment of individuals with SCI. The speakers at the workshop were: Graham Creasey, MD (Cleveland VA), William Bauman, MD (VA Bronx), Michael Boninger, MD (HERL Medical Director), Marca Sipski, MD (VA Miami), Margaret Hammond, MD (Chief Consultant to VA for SCI, Seattle), P. Hunter Peckham, PhD (VA Cleveland), Stephen Waxman, MD, PhD (West Haven VA, Yale), Richard Barbara, PhD, MSEd (Pittsburgh), and Rory Cooper, PhD (HERL Director).

In June and July, HERL students and faculty were busy attending the 2006 Rehabilitation and Assistive Technology Society of North America (RESNA) Conference in Atlanta and the National Veterans Wheelchair Games (NVWG) in Minneapolis. HERL had two RESNA student scientific paper competition winners (Yusheng Yang, Jen-

nifer Mercer). For more information about this year's NVWG, please see page 7.

On October 6th, LTC Paul Pasquina, MD, Troy Turner, MBA and CPT David Rozelle from WRAMC came to Pittsburgh to tour the Department of Rehab Science and Technology and HERL.

Dr. Pasquina, who is Chief of Physical Medicine and Rehabilitation Service at WRAMC, gave a lecture entitled,



WRAMC visited Pittsburgh in October (L to R): Mr. Turner, CPT Rozelle, Rory Cooper, LTC Paul Pasquina, MD, Rosemarie Cooper

"Overview of Medical Rehabilitation Programs at Walter Reed Army Medical Center: Opportunities for Collaboration."

Later this fall, we were sad to learn that two friends of HERL within Paralyzed Veterans of America (PVA) who also frequently partici-

parted in our research studies, passed away. On October 25, John Chlebowski, president of the Keystone Chapter of Paralyzed Veterans of America, passed away. John was a close friend of HERL's; many of our faculty and staff knew him personally and he will be sadly missed. Ronald Amador, former California Paralyzed Veterans of America passed away on October 9.

Lastly, on December 12-14, we will be partnering with Carnegie Mellon University (CMU) to participate in the once in a decade event, the Center for Aging Services Technologies (CAST) White House Conference on Aging in Washington, D.C. Universities and companies from across the nation will be demonstrating new ideas and technologies to assist the aging population at this event. CMU and Pitt are showcasing several new "Quality of Life Technologies" to enhance the lives of the elderly, including robotics, video monitoring devices, and exercise technology.

-Christine Heiner

### INSIDE THIS ISSUE:

Current Research	2-3
HERL Publications/ New Grants/Invention Disclosures	4
Current Events/HERL in the Media	5
RST & PM&R News/ Faculty Spotlight	6
HERL Awards Winners	7



HERL doctoral student Rachel Cowan at the HERL display at the RESNA conference

## CURRENT RESEARCH ABSTRACTS

### Kinematic Analysis for Determination of Bioequivalence of a Modified Hybrid III Test Dummy and a Wheelchair User

Michael J. Dvorznak, MS, Rory A. Cooper, PhD, Michael L. Boninger, MD  
Full article published in *Journal of Rehabilitation Research and Development*, Vol. 42, No. 3, pp. 343-352, May/June 2005.

**Purpose of the work:** The goal of this study was to determine if a modified 50<sup>th</sup> percentile male Hybrid III anthropomorphic test dummy (HTD) has a similar dynamic response as a wheelchair user with a spinal cord injury during low speed, low impact scenarios.

**Subjects/Procedures:** A HTD typically used in vehicle crash testing was modified to simulate a person with lower extremity paralysis. The test dummy was placed in a Quickie P100 powered wheelchair. The wheelchair was driven at three speeds and three braking conditions were used to slow the wheelchair to a stop. The trunk motion of the HTD was recorded and compared to the motion of a wheelchair user with T8 paraplegia under the same wheelchair braking conditions. A statistical method known as bioequivalence was implemented to determine if the trunk motions were similar.

**Results:** The results are mixed based on the bioequivalence criterion selected. Average bioequivalence methods would tend to indicate that further



Hybrid II Test Dummy

modifications would be necessary to the test dummy for the accurate assessment of wheelchair user kinematics during tips and falls. Population and individual bioequivalence methods as well as qualitative data would suggest that the test dummy is a suitable surrogate.

#### Relevance to Wheelchair Users:

The ability to move freely throughout society is essential to our social and psychological well-being. An accident involving a power wheelchair can cause injuries leading to secondary disabilities and death. This may also equate to additional hospital and prolonged recovery times and decreased quality of life. It also places additional load on a healthcare system already trying to allocate funds accordingly to its patients. Development of a test dummy with comparable characteristics to a wheelchair user population can be used in studies to reduce the frequency and severity of wheelchair accidents.

—Mike Dvorznak



**If you are between 18 and 70 years of age and use a powered wheelchair with functioning tilt-in-space, recline and/or seat elevation options, we need you for our research study:**

### Effectiveness and Use of Tilt-in-Space and Recline Wheelchairs

The VA R&D Center of Excellence is conducting a research study on the usage pattern of power tilt-in-space, recline, and seat elevation options and the overall effectiveness in a real world environment. If you agree to participate, you will be asked to visit our center once to have a datalogger mounted to your wheelchair. The datalogger is a portable, battery-powered device that can travel with the wheelchair and collect data by itself. Then, you can go about your daily activities as usual for two weeks. At the end of the two weeks, you may be asked to visit the center again or our research associates will meet you at your home to remove the datalogger from your

wheelchair. You will also be asked to complete a questionnaire about your use of the seating options of your wheelchair at the end of the study. Your participation in this study is **strictly voluntary**. All information will be kept **strictly confidential**. You will be reimbursed a small fee for your time.

If you would like to participate or have questions, contact: **Annamarie Kelleher or Emily Teodorski at 1-412-365-4850 or email Annmarie at: ardst12@pitt.edu**

The Principal Investigator of this research study is Michael Boninger, MD

## CURRENT RESEARCH ABSTRACTS

### Pushrim Biomechanics and Injury Prevention in Spinal Cord Injury: Recommendations Based on CULP-SCI Investigations

Michael Boninger, MD, Alicia Koontz, PhD, Sue Ann Sisto, PhD, Trevor Dyson-Hudson, MD, Michael Chang, MD, PhD, Robert Price, MSME, Rory Cooper PhD

Full article published in **Journal of Rehabilitation Research and Development**, Vol. 42, No. 3 (Supplement 1), pp. 9-20, May/June 2005.



**Purpose of the Work:** The purpose of this paper was to draw from a large multi-site trial and a longstanding research program to make specific recommendations related to wheelchair propulsion that may decrease the risk of upper limb injury.

**Subjects and Procedures:**

Over 60 manual wheelchair users with paraplegia have participated in our research studies investigating the association between wheelchair propulsion and upper limb pain and injury. The biomechanical analysis involved the collection of upper body motion and pushrim forces while participants propelled their manual wheelchair on a stationary roller system at a self-selected, slow and moderately fast speed. Individuals also underwent extensive medical tests (shoulder magnetic resonance imaging,

x-rays, wrist nerve conduction studies) to evaluate upper limb repetitive strain injuries.

**Results:** The results have enabled us to formulate practice recommendations for wheelchair propulsion technique and setup that may minimize the risk of developing shoulder and wrist injuries. These recommendations consist of using smooth, long strokes and dipping the hand below pushrim during the non-propulsive phase of the stroke. Individuals should also be aware that weight gain can increase injury risk and using the lightest weight possible wheelchair with a forward-adjusted rear axle can make propulsion easier and less stressful on the upper limbs.

**Clinical Relevance to Manual Wheelchair Users:** Practicing the recommendations could decrease the risk of upper limb pain and injury among individuals with paraplegia which in turn can prolong independent mobility with a manual wheelchair.

*-Michael Boninger*

### Prototype Power Assist Wheelchair that Provides for Obstacle Detection and Avoidance for Those with Visual Impairments

Rich Simpson, Ph.D., Edmund LoPresti, Ph.D., Steve Hayashi, B.S., Songfeng Guo, Ph.D., Dan Ding, Ph.D., William Ammer, B.S., Vinod Sharma, Rory Cooper, Ph.D.

Full article published in **Journal of NeuroEngineering and Rehabilitation**, Vol. 2, No. 30, October 2005.

**Purpose of the Work:** A prototype of the Smart Power Assistance Module (SPAM) has been developed using Yamaha JWII power assist hubs, sonar and infrared rangefinders, and a microprocessor. The prototype limits the user to moving straight forward, straight backward, or turning in place, and increases the resistance of the wheels based on the proximity of obstacles. The result is haptic feedback to the user regarding the environment surrounding the wheelchair.

**Subjects/Procedures:** The prototype has been evaluated on a simple navigation task with four blindfolded able-bodied users and one individual who is blind but not mobility impaired.

**Results:** For all individuals, the prototype reduced the number of collisions on the navigation task. The



SPAM

prototype demonstrates the feasibility of providing navigation assistance to manual wheelchair users, but several shortcomings of the system were identified to be addressed in a second generation prototype.

**Relevance to People with Disabilities:** Almost 10% of all individuals who are legally blind also have a mobility impairment. The majority of these individuals are dependent on others for mobility. The Smart Power Assistance Module (SPAM) for manual wheelchairs is being developed to provide independent mobility for this population.

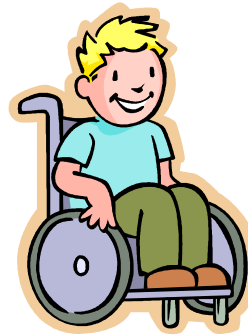
*-Rich Simpson*

## NEW INVENTION DISCLOSURES

HERL recently submitted an invention disclosure to the University of Pittsburgh for a “Lightweight, Adjustable, Modular Pediatric Wheelchair”

HERL recently submitted invention disclosures to both the Department of Veterans Affairs and the University of Pittsburgh for a “Data Logger Safety System”

## NEW GRANTS



“Development of Lightweight, Adjustable, Modular Pediatric Wheelchair” (SBIR Phase II, Three Rivers Holdings). Principle Investigator: Chris Willems (HERL PI: Rory Cooper, Ph.D.) NIDRR. October 10, 2005-September 30, 2006, \$500,000.

## HERL PUBLICATIONS

Dvorznak MJ, Cooper RA, Boninger ML, Kinematic Analysis for Determination of Bioequivalence of a Modified Hybrid III Test Dummy and a Wheelchair User, **Journal of Rehabilitation Research and Development**, Vol. 42, No. 3, pp. 343-352, May/June 2005.

Boninger ML, Koontz AM, Sisto SA, Dyson-Hudson TA, Chang M, Price R, Cooper RA, Pushrim Biomechanics and Injury Prevention in Spinal Cord Injury: Recommendations Based on CULP-SCI Investigations, **Journal of Rehabilitation Research and Development**, Vol. 42, No. 3 (Supplement 1), pp. 9-20, May/June 2005.

Fitzgerald SG, Collins DM, The Working Life of Service Dogs: Companionship, Assistance, and Love, **Rehab and Community Care Medicine**, Vol. 14, No. 3, pp. 18-19, Fall 2005.

Simpson R, LoPresti E, Hayashi S, Guo S, Ding D, Ammer WA, Sharma V, Cooper RA, A Prototype Power Assist Wheelchair that Provides for Obstacle Detection and Avoidance for Those with Visual Impairments, **Journal of NeuroEngineering and Rehabilitation**, Vol. 2, No. 30, October 2005.

Simpson R, [Smart Wheelchairs: A Literature Review](#), **Journal of Rehabilitation Research and Development**, pp. 423-436, Vol. 42, No. 4, July/August 2005.

Koontz AM, Cooper RA, Boninger ML, Yang Y, Impink BG, van der Woude LHV, [A Kinetic Analy-](#)

[sis of Manual Wheelchair Propulsion During Start-Up on Select Indoor and Outdoor Surfaces](#), **Journal of Rehabilitation Research and Development**, pp. 447-458, Vol. 42, No. 4, July/August 2005.

Cohen LJ, Fitzgerald SG, Lane S, Boninger ML, Development of the Seating and Mobility Script Concordance Test for Spinal Cord Injury: Obtaining Content Validity Evidence, **Assistive Technology**, pp. 122-132, Vol. 17.2, Fall 2005.

Cooper RA, Ding D, Simpson R, Fitzgerald SG, Spaeth DM, Guo S, Koontz AM, Cooper RM, Kim J, Boninger ML, Virtual Reality and Computer Enhanced Training Applied to Wheeled Mobility: An Overview of Work in Pittsburgh, **Assistive Technology**, pp. 159-170, Vol. 17.2, Fall 2005.

Crane BA, Holm MB, Hobson D, Cooper RA, Reed MP, Stadelmeier S, Test- Retest Reliability, Internal Item Consistency, and Concurrent Validity of the Wheelchair Seating Discomfort Assessment Tool, **Assistive Technology**, pp. 98-107, Vol. 17.2, Fall 2005.

Frontera WR, Fuhrer MJ, Jette AM, Chan L, Cooper RA, Duncan PW, Kemp JD, Ottenbacher KJ, Peckham PH, Roth EJ, Tate DG, Rehabilitation Medicine Summit: Building Research Capacity, **American Journal of Physical Medicine and Rehabilitation**, pp. 913-917, Vol. 84, No. 12, December 2005.



## Current Events/Announcements

The Department of Veterans Affairs recently announced that athletes competing in the National Veterans Wheelchair Games and National Disabled Winter Sports will now have the opportunity to qualify for the U.S. Paralympic Team and the U.S. Paralympic National Teams. The U.S. Paralympics is a division of the U.S. Olympic Committee and is dedicated to becoming the world leader in promoting excellence in the lives of persons with physical disabilities. The National Veterans Wheelchair Games and the National Disabled Winter Sports Clinic are open to U.S. military veterans with spinal cord injuries, amputations, and other physical disabilities.

For more information on the Paralympics, visit: <http://www.usolympicteam.com/paralympics/>

For more information on the National Veterans Wheelchair Games, visit:

[http://www1.va.gov/vetevent/nvwg/2006/to\\_come.htm](http://www1.va.gov/vetevent/nvwg/2006/to_come.htm)

For more information on the National Disabled Winter Sports Clinic, visit: <http://miracles.dav.org/>



The U.S. Army Wounded Warrior Program (AW2) provides a system of advocacy and assistance to soldiers and their families as they transition from military service to the civilian community. Introduced by the Army, AW2 provides a network of resources for these soldiers, connecting them with services and essential information. For more information, visit <http://www.armyfamiliesonline.org>.

## HERL IN THE MEDIA

**VA Research Currents, May 2005, pp. 3:** Career Milestones: Rory Cooper

**RehabWire, June 2005, pp. :** Research in the New Millennium: UPMC-SCI

**Pitt Chronicle, June 20, 2005, pp. 3:** RST: One of the University's Beacons of Inspiration and Aspiration

**Pitt Chronicle, June 13, 2005, pp. 1:** Department of Rehabilitation Science and Technology to Receive 2005 Chancellor's Affirmative Action Award

**New Pittsburgh Courier, June 15-19, 2005, pp. A-8:** RST Selected for Pitt Affirmative Action Award

**Pittsburgh Tribune-Review, June 20, 2005, pp. B-2:** Pitt Rehab Unit Earns Affirmative Action Award

**University Times, June 23, 2005, pp. 2:** RST Wins Affirmative Action Award

**South Pittsburgh Reporter, June 14, 2005, pp. 1:** Rehabilitation Hospital Opens in UPMC South Side

**Paraplegia News, August 2005, pp. 63-64:** Research Utilization and Dissemination: RESNA Student Scientific Paper Competition

**Paraplegia News, June 2005, pp. 92:** Hall Inductees

**Paraplegia News, June 2005, pp. 78:** Improving Lives Through AT

**Interlocking Concrete Pavement Magazine, August 2005, pp. 16-22:** Study Confirms Wheelchair Compatible Pavers

**New Mobility, September 2005, pp. 36-42:** Shouldering the Load

**New Mobility, September 2005, pp. 43-44:** What's the IQ of SmartWheel?

**The Times of India, November 10, 2005:** An Intelligent Wheelchair for the Indian Terrain

**Journal of the American Medical Association, November 16, 2005, pp. 2413-2416:** Ramping up a Rehabilitation Research Urged as a "Public Health Imperative"

**Sports 'N Spokes, November 2005, p. 64:** Paralympic Award Nominees

**Pittsburgh Business Times, December 2-8, 2005, Page 24:** Pitt's Rory Cooper Works to Match Right Wheelchair with Users Needs



## News from the Department of Rehabilitation Science and Technology

The University of Pittsburgh's Department of Rehabilitation Science and Technology (RST) received two prestigious awards this summer. RST received the 2005 "Leadership Award" from the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA). The award was given "For exemplary leadership in the development and conduct of an academic program in assistive technology."



*The Department of Rehabilitation Science and Technology received two prestigious awards this summer.*

The department also received the 2005 Chancellor's Affirmative Action Award for its work in nurturing opportunity for people with disabilities at the University. Chancellor Nordenberg praised RST for enriching the University and enhancing "the lives of our faculty, staff, and students, as well as the community that we call home" in his award letter.

### News from the Department of Physical Medicine and Rehabilitation

Dr. Arenth, a neuropsychology fellow in PM&R, recently had a paper accepted for publication:

Patricia M. Arenth, John D. Corrigan, and Lyle D. Schmidt, Exploring the use of social comparison by individuals recovering from traumatic brain injury. *Brain Injury*, in press, 2005

*-news contributed Mary Synnott, Dept. Physical Medicine & Rehab, University of Pittsburgh*

## Brad Dicianno, M.D. Joins HERL Investigators

Brad Dicianno joined the Human Engineering Research Labs as a RMSTP fellow under the mentorship of Rory Cooper, PhD and Yoky Matsuoka PhD. He graduated from the University of Pittsburgh School of Medicine after obtaining a B.S. in Evolutionary Biology and a B.A. in the History and Philosophy of Science as an undergraduate there. Dr. Dicianno completed residency in the Dept. of Physical Medicine and Rehabilitation at the University of Pittsburgh Medical Center and was Chief Resident in 2004-2005.



*Dr. Brad Dicianno*

Dr. Dicianno is also a staff physician at the University of Pittsburgh Medical Center where he works in the Spina Bifida Outpatient Clinic and Center for Assistive Technology, evaluating patients with disabilities for assistive technologies such as wheelchairs and addressing the complex assistive technology and rehabilitation needs of individuals with spina bifida.

His research focus is understanding motor control and movement disorders by studying the interfaces between the upper limb and engineering devices such as power wheelchair joysticks.

*-Stephanie French*

## HERL AWARD WINNERS



*Diane Collins, Ph.D.*

HERL investigator **Dr. Diane Collins** joined the editorial board of the journal *Disability and Rehabilitation* in May.

HERL director **Dr. Rory Cooper** was chosen to receive the EP Maxwell J. Schleifer Distinguished Service Award from Exceptional Parent Magazine. He was presented with the

award at the Pittsburgh Pirates Game at PNC park on July 19 for Disability Awareness night and threw the opening pitch.

In July, Dr. Cooper also competed in the 2005 National Veterans Wheelchair Games and received a gold medal in swimming (50 yard backstroke). He also received 3 silver medals in swimming (50 yard breaststroke, 50 yard freestyle, 50 yard backstroke) and a silver medal in the Slalom competition.



*Dr. Cooper was presented with the EP Maxwell J. Schleifer Award at the Pirates Game at PNC park in July.*

Dr. Cooper also received the James J. Peters Award, to honor long-time advocacy for people with disabilities at the 2005 American Paraplegia Society conference in September.

HERL Student **Erica Authier** and Department of mechanical engineering students Andrew Bowman and Jason Sellers were one of the seven winners of the Entrepreneurs' Society BIG IDEA competition for the project, "Wheelchair Mounted Pelvic Restraint." The project was initiated by Principle Investigator Linda van Roosmalen, Ph.D. at the Rehabilitation Engineering Research Center on Transportation Safety. The BIG Idea competition is hosted by Pitt's Institute for Entrepreneurial Excellence at the Joseph M. Katz Graduate School of Business. The winners

were selected for the most innovative ideas to be part of the business plan development process leading to competitive contest entry throughout the country. The winners will work with a dynamic team of industry experts and entrepreneurs to build a strong and competitive business plan and see their "Big Idea" become reality. The team was awarded on November 30 at the Pittsburgh Athletic Association.

**Melanie Modjoros** received the 2006 Association of Academic Physiatrists (AAP) best medical student paper award for her paper, "The Role of Marriage and Children on Social Participation and Depression in Individuals with Spinal Cord Injury" (Modjoros M, Boninger ML, Fitzgerald SG).

**CPT Thane McCann, M.D.** of the Walter Reed Army Medical Center (WRAMC), received the 2006 AAP research paper award for "Correlation of Ultrasound Abnormalities and Shoulder Pain in the Manual Wheelchair User" (McCann T, Boninger ML, Fullerton B, Impink BG, Cooper RA, Pasquina PF). His paper was based on research conducted at the 2005 National Veterans Wheelchair Games by investigators from HERL, WRAMC, and SETON. Melanie and CPT McCann will receive their awards at the AAP annual meeting in March 2006.



*The HERL NVWG research team, L to R: (Back row): Megan Yarnall, Heather Walker, MD, Jen Mercer, Michael Boninger, MD, Amanda Reinsfelder, Shirley Fitzgerald, Ph.D., Rosemarie Cooper, MPT, Brad Impink, CPT Thane McCann, MD (from Walter Reed Army Medical Center), Mike Dvorznak. (Front Row): Annmarie Kelleher, MS, OTR/L, Michelle Tolerico, Rory Cooper, Ph.D., Alicia Koontz, Ph.D., Ding Dan, Ph.D., Brad Fullerton, MD (Director of Physical Medicine and Rehab, SETON – Texas)*

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VA Center Of Excellence For  
Wheelchairs and Associated  
Rehabilitation Engineering

University of Pittsburgh Model  
Center on Spinal Cord Injury

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Michael L. Boninger, M.D.  
*Medical Director*

Shirley G. Fitzgerald, Ph.D.  
*Associate Director of Research,*

Donald M. Spaeth, Ph.D., ATP, RET  
*Associate Director of Engineering*



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**ARE YOU INTERESTED IN WHEELCHAIR RESEARCH?**

The Human Engineering Research Laboratories is recruiting individuals interested in participating in research studies for the **WHEELCHAIR USERS REGISTRY**. If you would like to be notified of Wheelchair related Research Studies for which you may be eligible to participate, contact The Human Engineering Research Laboratories and join the Wheelchair Users Registry. This is an informational resource and notification of a study does not obligate you to participate. You do not need to be located in nor are you required to travel to Pittsburgh in order to participate in research studies. If you are at least 18 years of age, and use a wheelchair or scooter, please contact **Emily** or **Annamarie** for more information.

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