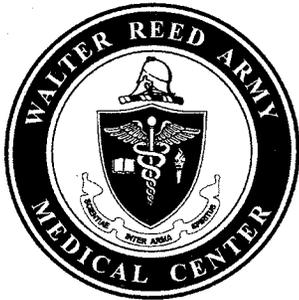
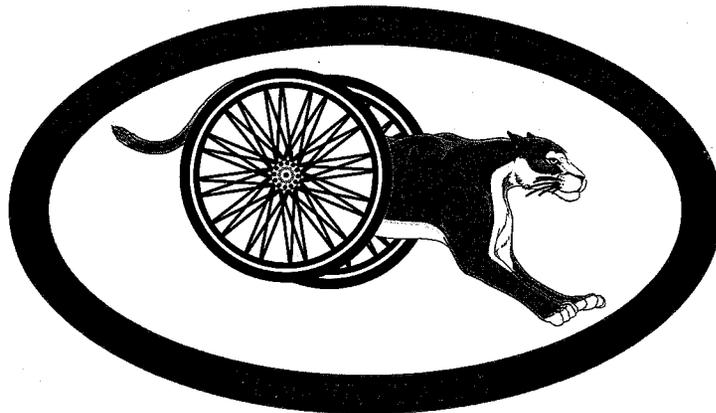


State-of-the-Science Workshop:
Research to Clinical Practice for
People with Upper Limb
Amputation & Prosthetics



Friday, March 30, 2007
Walter Reed Army
Medical Center
Joel Auditorium

8:00am-5:15pm



**State-of-the-Science Workshop: Research to Clinical Practice for
People with Upper Limb Amputation and Prosthetics**

Friday, March 30, 2007

Walter Reed Army Medical Center, Joel Auditorium; Washington, DC

SPONSORED BY THE UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE, DEPARTMENT OF PHYSICAL MEDICINE AND REHABILITATION, CENTER FOR CONTINUING EDUCATION IN THE HEALTH SCIENCES, PHYSICAL MEDICINE AND REHABILITATION AT WALTER REED ARMY MEDICAL CENTER, THE HUMAN ENGINEERING RESEARCH LABORATORIES (A VA RR&D CENTER OF EXCELLENCE), AND THE UNIVERSITY OF PITTSBURGH SCHOOL OF HEALTH AND REHAB SCIENCES, DEPARTMENT OF REHABILITATION SCIENCE AND TECHNOLOGY .

Course Directors:

Rory Cooper, PhD; Distinguished Professor, FISA/PVA Chair, Department of Rehabilitation Science and Technology, University of Pittsburgh; Pittsburgh, PA

LTC Paul Pasquina, MD; Assistant Professor, Department of Neurology, Physical Medicine and Rehabilitation, Uniformed Services University of the Health Sciences; Bethesda, MD

Michael Boninger, MD; Professor of Physical Medicine & Rehabilitation, Associate Dean for Medical Student Research, University of Pittsburgh School of Medicine, Pittsburgh, PA

Overview and Objectives

The overall objective of this course is to provide participants with an overview of current research findings in the area of spinal cord injury. The course will attain this objective by providing education and training in clinical trials, assistive technology, vocational rehabilitation, biomarkers, and basic science.

Who Should Attend

Physicians, therapists, social workers, counselors, rehabilitation engineers, and researchers who work in medical rehabilitation or related areas are encouraged to attend. Patients and their families are welcome.

Continuing Education Credit

The University of Pittsburgh School of Medicine is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The University of Pittsburgh School of Medicine designates this educational activity for a maximum of **7.25 AMA PRA Category 1 CreditsTM**. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Other health care professionals are awarded **0.725** continuing education units (CEU's) which are equal to **7.25** contact hours.

Acknowledgement of Support

as of March 22, 2007

We acknowledge support from the following organizations in support of this conference:

Paralyzed Veterans of America (PVA)

Updated Schedule

March 30, 2007

- 07:30 AM Sign in and late registration
- 08:00 AM **Welcome**
LTC Paul Pasquina, MD
COL Mary S. Lopez, PhD, CPE, OTR/L
- 08:15 AM **Introduction**
CPT (RET) Dawn Halfaker
- 08:30 AM **Revolutionary Prosthetics Program and the APL Approach to Meeting the Program Objectives**
Stuart Harshbarger
- 09:30 AM Break
- 09:50 AM **State of the Art Clinical Practices for Upper Limb Amputee Rehabilitation**
CPT (P) Katie Yancosek, MS, OTR/L, CHT
- 10:45 AM **The Sensory Feedback for Upper Limb Prosthetics**
Doug Weber, PhD
- 11:50 AM Questions/Answers
- 12:00 PM Lunch
- 1:00 PM **Virtual Reality and Robotics for Upper Extremity Rehabilitation**
W. Zev Rymer, M.D., Ph.D.
- 2:00 PM **Upper Limb Rehabilitation Research & Education Programs/Outcomes**
Sandra Hubbard, PhD
- 3:00 PM Break
- 3:15 PM **Direct Brain Interface for Upper Extremity Prosthetics**
Andrew Schwartz, PhD
- 4:15 PM **Closing Remarks**
COL Mary S. Lopez, PhD, CPE, OTR/L
- 5:15 PM Adjournment

Faculty Listing

Course Directors:



Rory Cooper, PhD; Distinguished Professor, FISA/PVA Chair, Department of Rehabilitation Science and Technology, University of Pittsburgh
Director, Human Engineering Research Laboratories
VA Rehabilitation Research and Development Center of Excellence for Wheelchairs and Associated Rehabilitation Engineering
Pittsburgh, PA

Contact Information

Human Engineering Research Laboratories
VA Pittsburgh Healthcare System
7180 Highland Drive, 151R1-H
Pittsburgh, PA 15206
412-365-4850
Fax: 412-365-4858

Brief Biography:

Rory Cooper, PhD, received the B.S. and M.Eng degrees in electrical engineering from California Polytechnic State University, San Luis Obispo in 1985 and 1986, respectively. He received the Ph.D. degree in electrical and computer engineering with a concentration in bioengineering from the University of California at Santa Barbara in 1989. He is the FISA & Paralyzed Veterans of America (PVA) Chair and Distinguished Professor of the Department of Rehabilitation Science and Technology, and professor of Bioengineering and Mechanical Engineering at the University of Pittsburgh. Dr. Cooper is Director and VA Senior Research Career Scientist of the Center for Wheelchairs and Associated Rehabilitation Engineering, a VA Rehabilitation Research and Development Center of Excellence. He is also the Co-Director of the NSF Quality of Life Technology Engineering Research Center, which is a joint effort between the University of Pittsburgh and Carnegie Mellon University.

He serves or has served on the editorial board of several prominent peer-reviewed journals in the fields of rehabilitation and bioengineering. Dr. Cooper has been selected for multiple prestigious awards and has authored or co-authored more than 175 peer-reviewed journal publications. He also has seven patents awarded or pending.



LTC Paul Pasquina, MD

Assistant Professor, Department of Neurology, Physical Medicine and Rehabilitation, Uniformed Services University of the Health Sciences; Bethesda, MD

Director, Residency Training Program & Chief, Physical Medicine & Rehabilitation
Medical Director, Amputee Program, Walter Reed Army Medical Center
Washington, DC

Contact information:

Walter Reed Army Medical Center
Department of Physical Medicine and Rehabilitation
6900 Georgia Avenue, NW
Washington, DC 20307-2003

Brief Biography:

Paul F. Pasquina, M.D. is a Lieutenant Colonel in the United States Army Medical Corps. He is the Chairman of Physical Medicine & Rehabilitation and the Medical Director of the Amputee Program at Walter Reed Army Medical Center. Dr. Pasquina is a graduate of the United States Military Academy at West Point, NY and the Uniformed Services University of the Health Sciences. In addition to being board certified in Physical Medicine & Rehabilitation, he is also board certified in electrodiagnostic medicine and pain medicine. He completed a fellowship in sports medicine and remains interested in all aspects of musculoskeletal medicine especially as it applies to individuals with disability. He serves on the editorial board of the Journal of Rehabilitation Research and Development and was recently elected as a Fellow in the American Institute for Medical Biomedical Engineering (AIMBE) as well as a Secretarial appointee on the Department of Veterans Affairs (VA) Advisory Committee for Prosthetics and Special Disabilities Programs. Dr. Pasquina has authored multiple book chapters, journal articles, and policy papers. He has served as the PM&R Residency Program Director and Medical Advisor to the North Atlantic Regional Medical Command for quality healthcare, and continues to serve as a consultant to the Food and Drug Administrations Orphan Drug Program. He has received multiple military awards, as well as awards for teaching and mentorship.



Michael Boninger, MD

Professor of Physical Medicine & Rehabilitation, Associate Dean for Medical Student Research, University of Pittsburgh School of Medicine
Medical Director, Human Engineering Research Laboratories
VA Rehabilitation Research and Development Center of Excellence for Wheelchairs and Associated Rehabilitation Engineering
Pittsburgh, PA

Contact Information

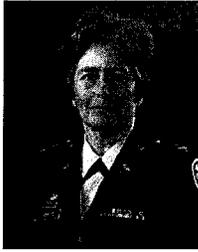
Human Engineering Research Laboratories
VA Pittsburgh Healthcare System
7180 Highland Drive, 151R1-H
Pittsburgh, PA 15206
412-365-4850
Fax: 412-365-4858

Brief Biography:

Michael Boninger, MD, is a Professor and Vice Chair for Research in the Department of Physical Medicine and Rehabilitation and Associate Dean for Medical Student Research in the University of Pittsburgh School of Medicine. He is also a Professor in the Departments of Bioengineering, and Rehabilitation Science and Technology and a physician research in the VA Pittsburgh Healthcare System. Dr. Boninger is the Medical Director of the Human Engineering Research Laboratories (HERL) and the Executive Director of the UPMC Health System's Center for Assistive Technology (CAT). Dr. Boninger received a mechanical engineering degree and Doctorate of Medicine from Ohio State University. Dr. Boninger has authored over 100 peer-reviewed publications and numerous abstracts, proceedings and book chapters.

Dr. Boninger, who holds three patents, is on the editorial board of the Journal of Rehabilitation Research and the Archives of Physical Medicine and Rehabilitation. Dr. Boninger has been an invited speaker on assistive technology, wheelchair biomechanics, spinal cord injury rehabilitation, and secondary prevention of disabilities around the world. In 2003, Dr. Boninger received the VA Stars and Stripes Healthcare Network Annual Award for Research Achievement. In addition, he was elected to the College of Fellows of American Institute for Medical and Biological Engineering (AIMBE), reserved for the top 2% of biomedical engineers.

Guest Faculty:



COL Mary S. Lopez, PhD, CPE, OTR/L

Assistant Corps Chief, Occupational Therapist, Army Medical Specialist Corps
Assistant Professor, Uniformed Services, University of the Health Sciences
Bethesda, MD

Contact information:

(301) 295-2648
mlopez@usuhs.mil

Brief Biography:

Colonel Mary Lopez is an Army Occupational Therapist with over 28 years of active duty service. She is currently the Chief, Occupational Therapist and the Army Medical Specialist Corps Assistant Corps Chief and is assigned to the Uniformed Services University of the Health Sciences as an Assistant Professor in the Department of Preventive Medicine and Biometrics. She previously served as the Manager of the Ergonomics Program at the U.S. Army Center for Health Promotion and Preventive Medicine. COL Lopez obtained her doctorate from Texas A&M University and has been involved in numerous research studies and initiatives focusing on injury prevention, ergonomics, and rehabilitation. She holds positions on several Department of Defense and professional organization technical and advisory committees.



CPT (RET) Dawn Halfaker

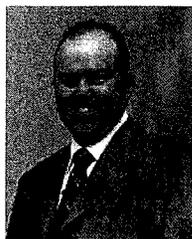
CEO, Halfaker & Associates
Washington, DC

Contact information:

Dawn.Halfaker.ctr@darpa.mil
(202) 236-1450

Brief Biography:

CPT (Ret) Dawn Halfaker is from San Diego, CA. She graduated from USMA in 2001 with a Bachelors Degree in Spanish and was commissioned a Second Lieutenant in the Military Police Corps. Her assignments include: platoon leader, 2nd Military Police Company, 2nd Infantry Division, Camp Casey, South Korea; platoon leader, 179th Military Police Detachment, 3rd Infantry Division, Ft. Stewart, GA and platoon leader, 293rd Military Police Company, 3rd Infantry Division, Hunter Army Airfield. She deployed to Baqubah, Iraq in February 2004 where her platoon occupied and operated an Iraqi Police Station. She received a Purple Heart for wounds sustained in action on 19 June 2004 and was later awarded the Bronze Star for her achievements in Iraq. On 7 June 2005 she was medically retired from active duty and now consults to DARPA's Revolutionizing Prosthetics Program in addition to being the chief executive officer for Halfaker and Associates, a national security consulting firm, she founded in 2006 in Washington, D.C.



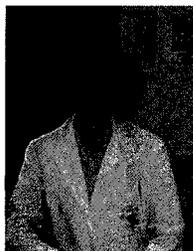
Stuart Harshbarger
Program Director and System Integrator, Revolutionizing Prosthetics 2009
(Laurel, MD)

Contact information:

Stuart D. Harshbarger, Biomedical Business Area
Johns Hopkins University Applied Physics Laboratory
11100 Johns Hopkins Road, MP2 - N - 166
Laurel, MD 20723
443-778-4069

Brief Biography:

Stuart Harshbarger is a Principal Professional Staff member at the Johns Hopkins University Applied Physics Laboratory and is currently the Program Director and System Integrator for the Defense Advanced Research Projects Agency (DARPA) Revolutionizing Prosthetics 2009 Program. Mr. Harshbarger holds a BSEE from West Virginia Institute of Technology (1985), a MSEE from the US Naval Postgraduate School (1990), and an Advanced Certificate in Post Master's Studies in Applied Biomedical Engineering from the Johns Hopkins University Whiting School of Engineering (2004). Mr. Harshbarger's research interests involve transdisciplinary efforts to address trauma prevention, mitigation, and recovery for military and critical civilian personnel exposed to harsh or hazardous environments. The Revolutionizing Prosthetics 2009 Program is an highly aggressive four year program involving over 30 organizations from across the US and Europe with the goal to develop an advanced upper extremity limb system that looks, functions, and is controlled to the extent possible as the natural limb.



CPT(P) Katie Yancosek, MS, OTR/L, CHT
Chief of amputee section in OT Service
State of the Art Clinical Practices for Upper Extremity Rehabilitation
WRAMC
(Bethesda, MD)

Contact Information:

kathleen.yancosek@us.army.mil
Telephone: 202- 236-1450
Fax: 202-782-6374

Brief Biography:

Captain Yancosek graduated from Gannon University in 1997, with a Bachelor's of Science degree in occupational therapy. She was commissioned as a Second Lieutenant in the United States Army, and completed the Army OT Internship at Walter Reed Army Medical Center. She transferred to Fort Carson in Colorado where she was the assistant chief of occupational therapy. In 2003, she completed a Master's of Science degree in occupational therapy at Eastern Kentucky University. Since 2003, she has worked at Walter Reed Army Medical Center where she is currently the chief of the amputee rehabilitation section in the OT Service. She will begin work towards a PhD in Rehab Science at the University of Kentucky this fall.



Doug Weber, PhD
Assistant Professor
Department of Physical Medicine and Rehabilitation
& Department of Bioengineering,
University of Pittsburgh
(Pittsburgh, PA)

Contact Information:

University of Pittsburgh
3471 Fifth Avenue
Pittsburgh, PA 15213
Telephone: (412) 647-4531
Email: djw50@pitt.edu

Brief Biography:

Douglas J. Weber is an Assistant Professor in the Department of Physical Medicine and Rehabilitation at the University of Pittsburgh. He is also a faculty member in the Department of Bioengineering and the Center for the Neural Basis of Cognition. Dr. Weber received a B.S. ('94) in Biomedical Engineering from the Milwaukee School of Engineering and an M.S. ('00) and Ph.D. ('01) in Bioengineering from Arizona State University. He was a postdoctoral fellow ('01-03') and Assistant Professor ('03-'05) in the Centre for Neuroscience at the University of Alberta before joining the University of Pittsburgh. Dr. Weber received predoctoral training fellowships from the National Institutes of Health, the Flinn Foundation, and the ARCS Foundation. He received postdoctoral fellowships from the Alberta Paraplegic Foundation and Alberta Heritage Foundation for Medical Research. Currently, his research is supported by grants from DARPA and Sandia National Laboratories. His primary research area is Neural Engineering, including studies of motor learning and control of walking and reaching with specific emphasis on applications to rehabilitation technologies and practice. Specific research interests include functional electrical stimulation, activity-based neuromotor rehabilitation, neural coding, and neural control of prosthetic devices.



W. Zev Rymer, M.D., Ph.D.
John G. Searle Chair in Rehabilitation Research
Director of Research
Director, Sensory Motor Performance Program
Rehabilitation Institute of Chicago
Professor, Physical Medicine & Rehabilitation, Physiology, and Biomedical
Engineering
Northwestern University

Contact Information:

Rehabilitation Institute of Chicago
345 East Superior Street
Suite 1406
Chicago, IL 60611
Phone 312-238-3919
Fax 312-238-7605

Brief Biography:

Dr. W. Zev Rymer is currently the John G. Searle Professor of Rehabilitation Research at the Rehabilitation Institute of Chicago. He received his undergraduate and medical training from the University of Melbourne in Australia, graduating with honors in Medicine in 1962. After completing residency in Internal Medicine, he returned for Doctoral training in neuroscience and motor control at Monash University in Australia, completing his studies in 1971. He received postdoctoral training at the Laboratory of Neural Control of the National Institutes of Health (1971-1974) and then at Johns Hopkins University Department of Physiology (1974-1976). After two years as an Assistant Professor in Physiology and Neurosurgery at State University of New York at Syracuse, he moved to Northwestern University, joining the Department of Physiology in 1978, with joint appointments in Biomedical Engineering and Neurology. In 1989, he assumed the position of Research Director at the Rehabilitation Institute of Chicago, accepting an endowed chair. He currently holds faculty appointments in the departments of Physical Medicine and Rehabilitation, Physiology, and Biomedical Engineering at Northwestern, with the rank of Professor in each. He is also President of the Rehabilitation Institute Research Corporation. He is the Director of an Infrastructure Network Center (R24) funded by the Center for Medical Rehabilitation Research of the NICHD/NCMRR as well as Director of the Rehabilitation Engineering Research Center for a center entitled "Machines Assisting Recovery from Stroke" (MARS), which began in November 2002.

His research interests include the neural control and biomechanics of movement in human and animal models, and the disturbances of voluntary movement and their origins in neurologically disabled subjects, particularly those suffering from spinal cord injury and stroke. Dr. Rymer is a member of the ASB, the Society for Neuroscience, the ACRM, the AAP, EMBS, the IEEE, and the AIMBE. He has served on the editorial board of several journals, including the *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, *Journal of Neurophysiology*, and the journal *Motor Control*. He has been a member of the NIH Musculoskeletal and Orthopedics Study Section, and chair of the Geriatrics and Rehabilitation study section (GRM). He is a member of the Scientific Advisory Board of the New York State Spinal Cord Injury Program, and of the Craig Nielsen Foundation for spinal cord injury. He is a member of the NCMRR advisory board, and is the liaison to NICHD council. He currently holds grants from the NIH, from NIDRR, and from several foundations. He has published more than 130 peer-reviewed papers in the fields of biomechanics and control of movement.



Sandra Hubbard, PhD, OTR/L, ATP
Occupational Therapy Department
College of Public Health and Health Professions University of Florida
Research Health Scientist
Rehabilitation Outcomes Research Center
North Florida South Georgia Veterans Healthcare System
(Gainesville, FL)

Contact Information:

352-273-6125 phone
352-273-6042 fax
shubbard@phhp.ufl.edu

Brief Biography

Dr. Hubbard is an Assistant Professor in the Occupational Therapy Program and a Health Research Scientist at the Rehabilitation Outcomes Research Center at the North Florida/South Georgia Veterans Healthcare System in Gainesville, Florida. Dr. Hubbard earned her PhD from the University of

Pittsburgh in Rehabilitation Science and Technology. Her research in assistive technology builds upon her 30 years of experience as a clinician in rehabilitation hospital and community-based programs. Presently, Dr. Hubbard has funding to investigate (1) the provision of prosthetic devices to veterans with stroke and (2) the effect of power-assist on the quality of life of manual wheelchair users.



Andrew Schwartz, PhD

Professor, Dept. of Neurobiology, University of Pittsburgh, Joint appointments
Bioengineering McGowan Institute, Robotics Institute at Carnegie Mellon University,
CMBC
(Pittsburgh, PA)

Contact information:
abs21+@pitt.edu

Brief Biography:

Dr. Schwartz received his Ph.D. from the University of Minnesota in 1984 with a thesis entitled "Activity in the Deep Cerebellar Nuclei During Normal and Perturbed Locomotion." He then went on to a postdoctoral fellowship at the Johns Hopkins School of Medicine where he worked with Dr. Apostolos Georgopoulos, who was developing the concept of directional tuning and population-based movement representation in the motor cortex. While there, Schwartz was instrumental in developing the basis for three-dimensional trajectory representation in the motor cortex.

In 1988, Dr. Schwartz began his independent research career at the Barrow Neurological Institute in Phoenix. There, he developed a paradigm to explore the continuous cortical signals generated throughout volitional arm movements. This was done using monkeys trained to draw shapes while recording single-cell activity from their motor cortices. After developing the ability to capture a high fidelity representation of movement intention from the motor cortex, Schwartz teamed up with engineering colleagues at Arizona State University to develop cortical neural prosthetics. The work has progressed to the point that monkeys can now use these recorded signals to control motorized arm prostheses to reach out grasp a piece of food and return it to the mouth.

Schwartz moved from the Barrow Neurological Institute to the Neurosciences Institute in San Diego in 1995 and then to the University of Pittsburgh in 2002. In addition to the prosthetics work, he has continued to utilize the neural trajectory representation to better understand the transformation from intended to actual movement using motor illusions in a virtual reality environment.

Faculty Disclosure

Faculty for this activity have been required to disclose all relationships with any proprietary entity producing health care goods or services, with the exemption of non-profit or government organizations and non-health care related companies.

No significant financial relationships with commercial entities were disclosed by:

LTC Paul Pasquina, MD
Michael Boninger, MD
COL Mary Lopez, PhD
Sandra Hubbard, PhD, OTR/L, ATP
CPT (Ret) Dawn Halfaker
Andrew Schwartz, PhD
Doug Weber, PhD
CPT (P) Katie Yancosek
Stuart Harshbarger

The following information was disclosed:

Rory Cooper, PhD has patent agreements with Three Rivers Holdings, LLC and AT Sciences
Zev Rymer, PhD has interest in Hocoma, Inc.

Disclaimer Statement

The information presented at this CME program represents the views and opinions of the individual presenters, and does not constitute the opinion or endorsement of, or promotion by, the UPMC Center for Continuing Education in the Health Sciences, UPMC / University of Pittsburgh Medical Center or Affiliates and University of Pittsburgh School of Medicine. Reasonable efforts have been taken intending for educational subject matter to be presented in a balanced, unbiased fashion and in compliance with regulatory requirements. However, each program attendee must always use his/her own personal and professional judgment when considering further application of this information, particularly as it may relate to patient diagnostic or treatment decisions including, without limitation, FDA-approved uses and any off-label uses.

Additional Workshop Information

Please watch our website at <http://www.herlpitt.org> for information on upcoming workshops.