Capabilities
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ICORR 2005

IEEE 9th International Conference on Rehabilitation Robotics
Frontiers of the Human-Machine Interface
June 28 - July 1, 2005
Chicago, Illinois

By Richard F. *ff*. Weir, Ph.D.

In June of this year the Rehabilitation Institute of Chicago and the Department of Physical Medicine and Rehabilitation at Northwestern University were hosts [Dr. Jim Patton (chair) and I (co-chair)] of a very successful international conference on Rehabilitation Robotics (ICORR 2005). The conference was held at Northwestern Memorial Hospital's (NMH), Feinberg Pavilion Conference Center. There were 323 official attendees from 22 different countries and the scientific component involved 190 submitted papers with 511 contributing authors from 25 different countries.

ICORR 2005 highlighted the most recent advances in the basic sciences of rehabilitation robotics and focused on a number of themes:

- Assistive Robotics
- Therapeutic Robotics
- Brain-machine Interfaces for Rehabilitation
- Robotics in Prosthetics and Orthotics
- Hardware and Control Developments for Rehabilitation
- Evaluation Methods and Clinical Experience
- Biorobotics and Biomimetics
- Basic Science and Sensory/Motor Control Learning

ICORR 2005 received formal sponsorship from a most distinguished engineering organization, the Institute of Electrical and Electronics Engineers (IEEE). In a first for the IEEE, ICORR 2005 was formally sponsored by the IEEE Robotics and Automation Society (RAS), and also jointly co-sponsored by the IEEE Engineering and Medicine and Biology Society (EMBS). Additionally, ICORR 2005 received financial support from The Whitaker Foundation, the Rehabilitation Institute of Chicago (RIC), the National Institute of Biomedical Imaging & Bioengineering (NIBIB), the National Institute of Neurological Disorders & Stroke (NINDS), and the National Institute of Child Health & Human Development (NICHD).

The International Conference on Rehabilitation Robotics (ICORR) is not a society, but rather a series of conferences directed by an International Steering Committee. Although its roots can be traced back to a workshop held in Cambridge in 1989, the first official ICORR conference dates back to 1990 when

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the University of Delaware hosted it. In 1992, it was decided that a biennial forum would be adopted. Conferences alternate back and forth across the globe using a pattern of presiding in America, Asia, America, Europe, America, Asia, and so on. Recent conferences have spanned the globe from California to Korea.

The concepts of looking at advanced robotics and mechatronic devices to assist people with moderate to severe motor impairments have been at the core of the ICORR conferences and this remains as true today as it was when the conferences first started. Although ICORR always has had a relatively small research domain reflecting the difficulty of the technical problems and the niche nature of the 'customers,' it was the realization that there were several groups working in this field without a common forum that spurred the creation of this conference series.

ICORR has become a truly international event and it is thanks to the many sponsors over the years that we can report both the widening of scope of the conference to include recent advances in therapeutic applications of robotics as well as commercial results in the area of assistive robotics. These technologies are still in a very nascent form and it is only the small to medium-sized enterprise organizations that are able to push forward the commercial success of our results. Given the large amount of research that still is needed, it is important to bring together this community of people from both the academic and commercial sectors.

Highlights of this year's conference were the keynote speeches by Dr. Andrew Schwartz of the University of Pittsburgh, on brain-machine interfaces; by Dr. Paolo Dario on the work of the Scuola Superiore Sant'Anna in Pisa, Italy; and by Dr. John Hollerbach of University of Utah, on virtual reality systems. Another highlight was the targeted reinnervation approach developed by Dr. Todd Kuiken to allow individuals with high-level amputations more subconscious control of their electric arm prostheses. Dr. Kuiken had a patient at ICORR demonstrate his control on a new six motor arm made of components integrated together for this project.

There was also a brain-machine interface system called BrainGate that allows the human brain to control a computer mouse. A surgeon implants a chip into the motor cortex of the brain and the chip detects tiny electrical signals generated when the user imagines moving the computer cursor. The goal is to allow individuals with high-level quadriplegia to control a computer.

Other highlights were the Lokomat walking system, a robotic system used to retrain people with spinal cord injury how to walk. Another device, the KineAssist from Chicago PT, was formally unveiled at ICORR and received a lot of attention. Physical Therapists use this robot aide to prevent patients from falling by following along behind the patient, allowing the therapist to focus on training the patient to balance and walk properly.

Other devices shown at ICORR were Robot Assistants that help people in wheelchairs pick up objects and arm guides that counterbalance the effect of gravity for people with weakness.

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All in all, the meeting was viewed as a success by most attendees. ICORR 2005 allowed many researchers and commercial systems providers to meet, interact and advance the state of technology for persons with severe disabilities. For more interesting details about ICORR 2005, visit www.ncsu.edu/IEEE-RAS/RAS/ICORREthicsRTsept9.htm .

ICORR Visits Open House at NURERC

On June 30, 2005, approximately 100 ICORR participants visited an Open House at Northwestern University's Rehabilitation Engineering Research Program and Prosthetics Research Laboratory on the fourteenth floor of the Rehabilitation Institute of Chicago.

Steven A. Gard, Ph.D., Director, organized five educational stations to offer an overview of research projects being conducted at NURERC. Knowledgeable specialists provided in-depth information at each station. Craig Heckathorne, M.S., manned the Upper-Limb Prosthetics Development Station; Stefania Fatone, Ph.D., Rebecca Stine, M.S. and Brian Ruhe, M.S. demonstrated the VA Chicago Motion Analysis Research Laboratory; Andrew Hansen, Ph.D. and Steven Steer, Research Engineer, explained Prosthetic Foot Development; Joshua Rolock, Ph.D. and Kerice Tucker, Research Engineer, explained the Squirt-Shape system of fabrication; and George Bertos, M.S. demonstrated his unique "Wheeled Walker."

We were delighted to welcome ICORR participants to our lab and demonstrate the scope of our work. Visitors responded positively to the human application of robotics in our laboratory. We hope that NURERC's Open House helped forge new interest and understanding about ways to combine robotics with research engineering in the field of prosthetics and orthotics.

Shown above are some of the prosthetic feet displayed at NURERC's recent Open House for ICORR participants

Liang-Wey Chang, Ph.D. Returns to NURERC

Liang-Wey Chang, Ph.D., Associate Professor at the Institute of Biomedical Engineering at National Taiwan University, spent two months at NURERC where he continued his work at the Prosthetics Research Laboratory and in RIC's P&O clinical services. Dr. Chang's current research topics include analysis and design of swivel walkers, spasticity in stroke patients with AFO, and clinical study of stroke patients with quadriceps weaknesses in KAFO with four-bar orthotic knees.

Dr. Chang was awarded a Ph.D. in Mechanical Engineering from Purdue University (1984) and held faculty positions in US universities until 1992 when he returned to Taiwan and established a national infrastructure for the development of prosthetics and orthotics. From 1998 to 2002, Dr. Chang completed his orthotics education at Northwestern University and an orthotics residency at the University of Virginia. In Winter 2005, he completed his prosthetics education at Northwestern University and is an ABC board-eligible orthotist who plans to complete his prosthetics residency training at RIC over the course of four summers.

In 2000, Dr. Chang was appointed Deputy Director of the National Rehabilitation Engineering Research Center (NRERC) in Taipei. Under his guidance, Taiwan's NRERC provides patient care throughout Taiwan. Dr. Chang envisions that Taiwan NRERC will become an academy of rehabilitation services, research and education.

The National Science Council in Taiwan and other governmental agencies fund Taiwan NRERC's research, including rehabilitation engineering in P&O, assistive technologies and devices. The Taiwan NRERC offers P&O education and a Master level Orthotics program. Since 1999, the program has accepted students from the Institute of Biomedical Engineering at National Taiwan University and plans to offer a Master level P&O program from autumn 2005.

The faculty, programs and facilities at Taiwan NRERC continue to develop. The faculty consists of Dr. Chang and an orthotics practitioner (Ms. Janet Ishida, an ABC CPO); and three research orthotists (Mr. Vincent Chen, Mr. Ching-Yuan Wu and Mr. Lun-Ho Yuan) who completed their training in orthotics and obtained Master degrees in Biomedical Engineering from National Taiwan University. Taiwan NRERC is affiliated with eastern Taiwan (Mennonite Christian Hospital, Hwa-Lian), one satellite office in central Taiwan (Changhua Christian Hospital, Chang-Hua) and is developing another satellite office in southern Taiwan (Kaohsiung Veterans General Hospital, Kaohsiung).

Dr. Chang appreciates the professionals at NURERC, NUPRL and NUPOC for their unselfish contributions to the development of P&O in Taiwan. Dr. Chang believes that the Taiwan NRERC will continue to flourish, thanks to support and encouragement from RIC and NURERC professionals.

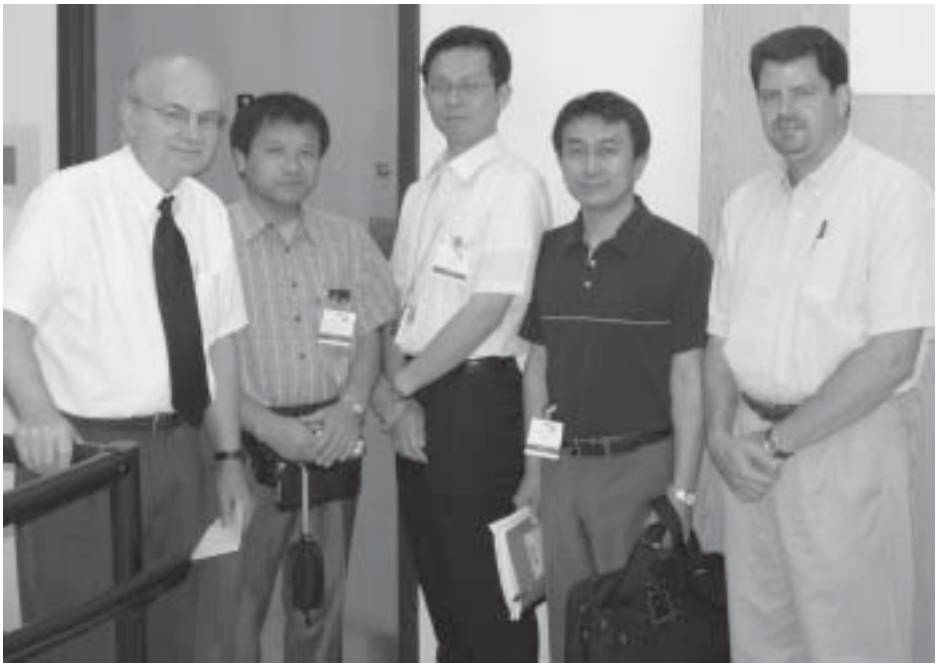
NURERC Welcomes Sabbatical Scholar

Ziva Yizhar, Ph.D., is spending a two-month sabbatical at NURERC. Specializing in the lower limb, she is conducting research about clinical gait analysis in the Motion Analysis Laboratory.

Currently a faculty member at Tel Aviv University in Israel, Dr. Yizhar completed a Ph.D. in Physical Anthropology (1999) and a M.S. in Physiology (1993). Dr. Yizhar has been a physical therapist since 1965 and has particular expertise in the rehabilitation of amputees.

Hiroshima University Researchers Visit NURERC

Koichi Shinkoda, Ph.D., RPT, Professor of Engineering at Hiroshima University's Graduate School of Health Sciences, Division of Physical Therapy and Occupational Therapy Sciences, Biomechanics Laboratory; **Munetsugu Kota, M.S.**, and **Hiroshi Maejima, Ph.D., RPT**, also from Hiroshima University, toured NURERC facilities on August 7, 2005.



(Left to right): Dudley S. Childress, Ph.D., Koichi Shinkoda, Ph.D., Munetsugu Kota, M.S., Hiroshi Maejima, Ph.D., and Steven A. Gard, Ph.D.

The group visited the Prosthetics and Orthotics School and attended an intensive overview of current research projects presented by NURERC faculty and students. Presenters included **Stefania Fatone, Ph.D., Andrew Hansen, Ph.D., Margrit Meier, Ph.D., Kiki Zissimopoulos, B.S., BJ Johnson, B.S., Kerice Tucker, Research Engineer, Todd Farrell, M.S., Bolu Ajiboye, M.S., Brian Ruhe, M.S., and Po-Fu Su, M.S.**

NURERC Hosts Booth at RESNA Meeting

The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) Meeting was held June 23-27, 2005 at the Hyatt Regency Hotel in Atlanta, Ga. The Rehabilitation Institute of Chicago (RIC) sent representatives from the Sensory Motor Performance Program (SMPP) and from the Machines Assisting Recovery from Stroke (MARS) program.

The Northwestern University Rehabilitation Engineering Research Center (NURERC) was represented by Steven A. Gard, Ph.D., Joshua Rolock, Ph.D. and Craig Heckathorne, M.S., who manned the exhibit booth on NIDRR's RERC row to demonstrate the work conducted in our laboratory.

The RESNA meeting featured twenty-one Special Interest Groups (SIG) and seven Professional Specialty Groups (PSG). Takeo Kanade, Ph.D., Director of the Robotics Institute at Carnegie Mellon University, was Keynote Speaker. Many disciplines that develop, evaluate and distribute assistive technologies were represented.

NEWS FROM THE DEPARTMENT OF VETERANS AFFAIRS

VA Care Coordination and Telehealth

By Dr. Adam Darkins and John Peters
(Office of Care Coordination, VACO)
and
Josephine Schuda
(Office of Public Affairs, VACO)

Operating the nation's largest health care system, the Department of Veterans Affairs (VA) uses a wide variety of communication and information technologies to ensure excellence in the health care it delivers to the nation's veterans. New information technologies are revolutionizing health care and VA has been recognized by the Institute of Medicine as a leader in using these technologies to improve the quality of its care delivery. VA's application of three areas of technology, health informatics, telehealth and disease management, enables VA to coordinate the care of patients by extending and enhancing current care and case management activities.

Care Coordination

Care coordination in VA uses information technologies to connect patients to health care services and help ensure the right care happens in the right place at the right time. Care coordination home telehealth supports care in the home and helps patients enjoy better health and remain living independently when appropriate. Designated VA clinical staff act as care coordinators. Through technology, they maintain daily contact with patients and reduce the need for clinic, emergency and hospital care.

When it is necessary for patients to come into clinics and hospitals, real-time video conferencing technologies enable veterans to receive specialist consultation and care in their local community clinic or hospital and eliminate avoidable travel to distant sites. These care coordination general telehealth services help ensure timely access to care.

VA supplements both home and general telehealth with "store-and-forward" telehealth — the storage of digital images that can be transmitted for review and reporting at another site by an expert in dermatology, pathology, radiology, eye care or wound care. Both kinds of telehealth are used in the routine delivery of care throughout VA with high levels of patient satisfaction.

Telehealth in VA

"Telehealth" can provide clinical care as well as support services, and patient education when those who provide services and those who receive them are separated by distance; whereas "telemedicine" generally refers to physicians who provide services at a distance. VA considers telemedicine part of the wider spectrum of "telehealth" services given by many types of care and support providers.

VA began systematic development of telemedicine in the mid 1990s with pilot projects to confirm technical feasibility and started funding demonstration projects in 1998 to define telemedicine's role in supporting home care and making specialty

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consultations locally available. The projects involved spinal cord injury, mental health, transplantation, geriatrics and extended care. In 2000, a survey showed that VA was conducting more than 300,000 telemedicine consultations a year and telemedicine activity in 32 clinical specialties.

Telehealth activities in VA are performed in association with VA's computerized patient records. In 2003, VA's use of these technologies to extend VA care into the home and to move specialty care to primary and ambulatory treatment sites resulted in the concept of care coordination. To support a national care coordination initiative, VA established an Office of Care Coordination within the Office of Patient Care Services.

Between 2004 and 2005, VA identified telehealth leaders in mental heath, rehabilitation, surgery, dermatology and endocrinology. These practitioners champion the development of home and general telehealth in VA, based upon sound clinical practice and scientific evidence, and help VA assess the outcomes of care coordination.

Advantages of Care Coordination & Telehealth to Veteran Patients

Care coordination and telehealth provide patient-centered care for veterans and support to their caregivers. Information technology can ensure that all data related to a patient's conditions are current and available to medical providers exactly when needed. Timely access to health information improves care and reduces the risk of medical errors.

As impressive as the technology is, the key to telehealth success is the way it helps to coordinate patient care. Successful home telehealth programs match a patient's needs to technology so that the caregiver or patient can manage at home, thus reducing clinic visits. As a veteran ages, the need for services frequently is determined by expert advice about appropriate treatment of chronic conditions. Having this advice available in the home is convenient and can expedite or defer hospital admission.

Telehealth makes it possible to exchange routine clinical data and visual assessments among medical facilities locally, regionally and nationally. Where distance and weather are barriers to care, telehealth brings care to the patient and avoids the cost and inconvenience of travel. Telepharmacy is one telehealth application that helps make medications available to veterans in VA community clinics. Telehealth permits a northern "snowbird" veteran who receives care at home through telehealth to continue a care regimen while in Florida during the winter.

Telehealth electronic information and communications may involve high-resolution images and sound through live video. An example of this is providing prompt access to expert advice from a cardiologist or a spinal cord injury center to veterans who live in remote, rural areas. Sometimes telehealth involves simply transmitting text records and digital images, such as remotely screening patients with diabetes for possible eye disease. Because telehealth moves information, rather than people, it can be more efficient and less expensive than traditional care and it can provide expert advice when a patient needs it. Improving access to care, and permitting more frequent monitoring of patients and their health status, are the features of care coordination and telehealth that produce high-quality care and satisfaction among patients.

Examples of Care Coordination & Telehealth

In VA's Sunshine Healthcare Network, including most of the medical facilities Florida, south Georgia and Puerto Rico, about 2,700 patients receive telehealth care in their homes. Many of them use text messaging devices to report their vital signs and other medical information to hospital staff that monitor the reports daily. In turn, staff sends patients reminders, health advice and feedback on their progress. VA patients in about 30 states use these and other home telehealth devices. Many of the patients have congestive heart failure, high blood pressure, pulmonary disease, diabetes or depression.

Many VA medical centers use an interactive voice-response system to take questions from patients and leave phone messages for them automatically about appointment scheduling and prescriptions. The system permits clinicians to pose questions to patients and

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NEWS FROM THE DEPARTMENT OF VETERANS AFFAIRS

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have their responses recorded, thereby becoming progress notes. Results of the calls are forwarded to a telemedicine computer so clinicians can follow up.

Clinicians providing telehealth care in the Sunshine Network and other locations studied their patients' outcomes. They found improvements in blood glucose levels, blood pressure and mental health, along with fewer emergency room visits, days of hospitalization and clinic visits, and less extended care.

The National Cancer Institute has collaborated in studying a Care Coordination Home Telehealth (CCHT) initiative by the VA Sunshine Network and the University of Florida to evaluate whether telehealth can deliver more effective care to cancer patients in their homes.

VA's home telehealth technologies can connect VA medical centers directly to veterans' homes. The technologies range from sophisticated clinical workstations that can assess complex care, to telemonitors in the home that can assess wounds, down to the least costly – the regular telephone, with personal computers and videophones somewhere in between.

In 2004, more than 10,000 VA patients received more than 20,000 telemental health visits. In mid-summer 2005, more than 6,000 patients are benefiting from home telehealth care for conditions that include diabetes, cardiac failure, depression and post-traumatic stress disorder.

New Initiatives – The Future

VA has established four polytrauma centers to treat the full scope of injuries to veterans, especially injuries sustained in Operation Enduring Freedom and Operation Iraqi Freedom. The polytrauma centers will use telehealth technologies both to improve access to these centers and to share the expertise of these national centers with all VA health care facilities.

VA has established two national multiple sclerosis centers of excellence, one at the Baltimore VA Medical Center and the other as a collaboration between the Portland (Ore.) VAMC and the Seattle VAMC. Both home and general telehealth are being explored to ensure that veterans who are seen at a VA clinic or medical center in other parts of the country will have the opportunity to receive care that is supported from these centers. In a similar manner, seven VA Parkinson's disease centers that specialize in treatment, education and research are developing a telehealth network to extend their expertise to veterans nationwide.

VA is working with experts in diabetes care to create a telehealth network to detect retinopathy, a disease of the retina of the eye prevalent among diabetic patients. Preventing diabetes-related blindness is a major VA priority.

Five telehealth "toolkits" have been distributed to VA medical facilities for home telehealth, mental health, dermatology, surgery and rehabilitation to connect those who are considering introducing telehealth with a network of practitioners using it. The toolkits contain resource materials, including templates and guides to best practices. VA is creating an additional toolkit for tele-retinal imaging.

To further develop toolkits and train staff in care coordination, VA established a training center for home telehealth in Lake City, Fla., in January 2004. This center has trained more than 1,600 VA employees, using distance education technologies and face-to-face teaching methods. In 2005, VA is establishing a general telehealth training center in Salt Lake City and a training center devoted to tele-retinal imaging in Boston.

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VA continues to work with the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) to ensure the quality of its telehealth services. A joint activity underway will develop ways to credential professionals who provide telehealth care. Because telehealth provides clinical services at multiple sites where medical staff may not know the qualifications and professional privileges of others, credentialing can be important both to caregivers and patients. VA is working with JCAHO to determine how home telehealth programs will be assessed under existing home or hospital care standards.

Other challenges in the future include developing large information networks that will support compatible hardware and software systems, deciding whether to standardize treatment approaches and equipment, and developing standard coding procedures for workload credit. VA is working to give patients decision support tools that complement those of the care coordinators and other practitioners by developing an electronic patient-held record called MyHealth-eVet. That achievement will be an important part of the partnership between VA, its care providers and its patients and help veterans to manage their own care.

VA supports veterans in their local communities by focussing on care in non-institutional settings, providing care coordination telehealth and developing caregiver partnerships for patient support. VA is acknowledged as a leader in using innovative technologies to change the locations of health care and improve the quality of care it provides. While many other health care organizations are beginning to envision health informatics, telehealth and disease management, already VA is using these care options to impact positively the lives of the veteran patients.

(This article was coordinated by Robert M. Baum, Prosthetic Program Manager; Prosthetic and Sensory Aids Program (113), VA Central Office, Washington, D.C.)

News from NURERC

Visit NURERC On-line at New Website

NURERC has launched a new, updated and expanded website. Please visit us on-line at www.medschool.northwestern.edu/depts./repoc This site is comprehensive and represents NURERC's personnel, research projects, history and numerous resources offered in our facilities, products and publications. Links to related sites provide an additional breadth of detail.

Kerice Tucker, Research Engineer, the site's administrator, together with other laboratory members, has designed and developed this outstanding site that makes many resources available and easily accessible. Please take a moment to visit this richly informative and useful site.

Gait at a Glance

The Veterans Affairs Chicago Motion Analysis Research Laboratory located at NURERC has acquired a COSMED Sport Treadmill (T170) that will be used in ergonomic and oxygen consumption research. The treadmill can interface with metabolic and electrocardiograph (ECG) systems and its motor is designed to avoid interfering with medical equipment.

This model features a large running surface (67-inches by 25.5-inches), safety arch with a chest belt and harness attached to the emergency stop, adjustable handrails, and an incline or decline up to 25%. This treadmill has a wheelchair stabilizer. It allows forward and reverse running and can accommodate a maximum running speed of 40 km/h (25 mph).

News from NURERC

Published Papers

S.C. Miff, Ph.D., D.S. Childress, Ph.D., S.A. Gard, Ph.D., M.R. Meier, Ph.D., and A.H. Hansen, Ph.D., published "Temporal Symmetries During Gait Initiation and Termination in Non-Disabled Ambulators and in People with Unilateral Transtibial Limb Loss" in the *Journal of Rehabilitation Research and Development*, Vol.42, No. 2, pp 175-182.

Recent Meetings

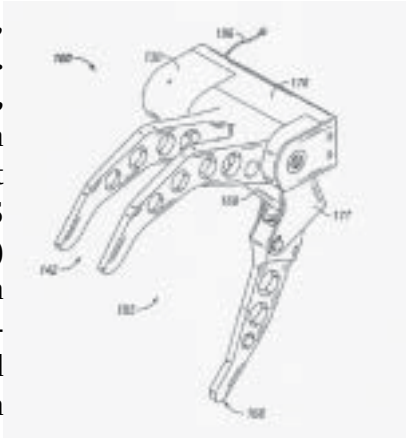
Dudley Childress, Ph.D., Steven Gard, Ph.D., and Stefania Fatone, Ph.D. attended an Advanced Planning Conference on Prosthetic and Orthotic education programs in Seattle, Washington.

Craig W. Heckathorne, M.S., was a recent guest lecturer at the Department of Biomedical Engineering at Marquette University, Milwaukee, Wisconsin. Mr. Heckathorne spoke on "Components and Control Methods for Electric-Powered Upper-Limb Prostheses."

Margrit Meier, Ph.D., attended and presented a poster at the combined meeting of the International Society of Biomechanics and the American Society of Biomechanics (ASB/ISB) in August in Cleveland, Ohio.

Patent Issued

Richard F. *ff*. Weir, Ph.D., and **Edward C. Grahn, M.S.,** were issued a patent (Patent Number: US 6,921,419 B2) for an Externally-Powered Hand Prosthesis on July 26, 2005.



Jonathon Sensinger, M.S., visited the Otto Bock Research Center in Vienna, Austria where he evaluated their developments in Sensor Speed Hands.

Richard F. *ff*. Weir, Ph.D., Craig Heckathorne, M.S., Todd Farrell, M.S., and Jon Sensinger, M.S., attended the Myoelectric Controls Conference (MEC) in Fredericton, New Brunswick, Canada, on August 15 through 19.

Craig Heckathorne, M.S., and Richard F. *ff*. Weir, Ph.D., attended the Annual Management of Burns and Multiple Trauma (AMSC) Meeting in August in San Antonio, Texas.

Committee Appointments

Dudley S. Childress, Ph.D., was invited to serve on the Institute of Medicine's Committee on Disability in America and he attended that meeting in Washington, D.C.

Doctoral Proposal Defenses

Jon Sensinger, M.S., presented his Ph.D. proposal defense on June 3rd.

Todd Farrell, M.S., presented his Ph.D. proposal defense on June 21st.

Pinata Sessoms, M.S., presented her Ph.D. proposal defense on July 29th.

Congratulations

Steve Steer, M.S., Research Engineer, left NURERC in August to attend St. Louis Medical School in St. Louis, Missouri. We appreciate his contributions to ongoing research during the past couple years. Recently, he worked with **Andrew Hansen, Ph.D.** on lower limb prosthetics, particularly the Shape&Roll Foot. Steve has many friends in this laboratory who will miss him and wish him every success in his new endeavor.

In Memory

Herbert Blair Hanger died June 15, 2005 at age 89 in Chapel Hill, North Carolina.

Born July 28, 1915 in St. Louis, Missouri, Mr. Hanger was a descendant of the Civil War veteran James Edward Hanger, an amputee who had whittled an artificial limb from barrel staves, patented it and in 1861 founded the J. E. Hanger Company. Devoted to prosthetics development and education throughout his life, Blair Hanger had managed the New York office of J. E. Hanger and lectured about prosthetics at Temple University and Kessler Institute.

H. Blair Hanger (center) at NUPOC, circa 1975

From 1958, Blair Hanger was recruited to Northwestern University's Prosthetic Education Program. Initially he was Chief Prosthetist and Associate Director and soon thereafter its first Director of Prosthetics Education.

Mr. Hanger leaves a legacy of knowledge embodied in his many students who continue to work in the field of prosthetics and orthotics, enriching the quality of life for amputees in the USA and abroad.

Sidney Fishman, Ph.D., distinguished in the field of Prosthetics and Orthotics (P&O), died February 7, 2005 at the age of 85 from cancer. Born in New Jersey, Dr. Fishman lived his life as a proud New Yorker. He earned Bachelor of Science and Master of Arts degrees from the City College of New York and a Ph.D. in psychology from Columbia University (1949). During World War II he served in the U.S. Army and was commissioned captain.

During the past 50 years Dr. Fishman incorporated medicine, surgery, engineering and psychology to expand the field of P&O and rehabilitation. He helped design and develop prostheses such as an electric elbow, a cable-actuated child-sized hand, and orthoses such as a detachable hip joint. Throughout his life he researched and published extensively. Some of his publications became core texts for P&O students, physicians and therapists.

Dr. Fishman established the first accredited, four-year program in Prosthetics and Orthotics at New York University and sent experts from the NYU P&O Department to conduct similar courses throughout the Americas, Europe, Africa and India.

An active proponent of rehabilitation in a global context, Dr. Fishman served as consultant to the United Nations, the World Health Organization, and the World Rehabilitation Fund, among others, and worked in health institutions in countries that include Austria, Denmark, Egypt, Iran, Nigeria and (the former) Yugoslavia. Dr. Fishman received notable awards including international recognition from the countries of India, Japan and Peru. We commemorate his many contributions to the field of P&O.

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○ Pediatric Prosthetics
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○ Prosthetics & Orthotics: General
○ Upper Limb Prosthetics & Orthotics

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