



NUPOC: Signs of Change

R. J. Garrick, PhD

New Location, Enduring Excellence

The Northwestern University Prosthetics/Orthotics Center (NUPOC) has a new address: 680 North Lake Shore Drive, Suite 1100, Chicago. NUPOC's suite in this historic, landmark building features a custom-designed facility that houses the Prosthetics/Orthotics Education Program, the National Institute on Disability and Rehabilitation Research (NIDRR) funded Rehabilitation Engineering Research Center for Prosthetics and Orthotics, the Prosthetics/Orthotics Research Laboratory, and the Jesse Brown VA Chicago Motion Analysis Research Laboratory. The purposeful unification of education with research programs enables NUPOC to provide superlative P&O training that seamlessly meshes new knowledge with best practice.



From left to right, Steven A. Gard, Edward Grahm, John Michael (and Mike Brncick, not shown) were instrumental in moving NUPOC to its new, custom-designed site.

welcomed the first cohort of Prosthetics and Orthotics Certificate students to the new site. Also, new research, headed by **Stefania Fatone**, PhD, BPO(Hons), has begun a large project funded by the Department of Defense (see page 3).

Focus on the Future

Currently, NUPOC's Blended Learning Certificate Program for Orthotics or Prosthetics can be completed in 3 academic quarters. Looking to the future, on or before January 2013, NUPOC will begin offering a 2-year master's degree program in Prosthetics and Orthotics and Certificate Courses will be phased out. From this ideal

location adjacent to the Northwestern University Feinberg School of Medicine, NUPOC will continue to be a cornerstone of excellence as it prepares new Prosthetists and Orthotists to enter the field and actively integrates state-of-the-art P&O research into clinical practice.



Signs of change at NUPOC!

Achieving the Vision

Two years of team work, careful planning, and assiduous effort have resulted in NUPOC's relocation to an outstanding suite dedicated to education and research in prosthetics and orthotics. The NUPOC team, headed by **Steven A. Gard**, PhD,

Michael Brncick, M.Ed, CPO, **John Michael**, M.Ed, CPO, and **Edward Grahm** worked tirelessly to identify, design, and manage the renovation of this site. Now, P&O education and research programs are unified under the single entity: **NUPOC**.

Fortuitous timing and a convenient location allow NUPOC to join research and education programs in a single, unique setting. Amid a flurry of packing, moving, and unpacking, education and research productivity has continued throughout the relocation. From September 7, NUPOC

President Schapiro to Preside at NUPOC Ribbon Cutting

The Department of Physical Medicine and Rehabilitation and NUPOC will host a Ribbon Cutting Ceremony and Open House on November 22, 2010 (4:30 to 6:30PM). Northwestern University President and Professor **Morton O. Schapiro** will preside over the celebration, offer opening remarks, and officially cut the ribbon to open the new NUPOC. **Elliot Roth**, MD (Chairman, Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine), and **Steven A. Gard**, PhD (Executive Director, NUPOC), will offer welcoming remarks. Guests at the event are invited to tour the new facilities.

The event rededicates the new space and honors the vision and generosity of donors. NUPOC appreciates all who have contributed to this momentous move toward a new future for Prosthetics and Orthotics at Northwestern University.

Kudos to NURERC Advisory Panel

R. J. Garrick, PhD

The **Advisory Panel** of the **Northwestern University Rehabilitation Engineering Research Center (NURERC) for Prosthetics and Orthotics (P&O)** has met regularly throughout 2010 to propose and discuss themes for the upcoming **State of the Science Meeting** scheduled for the last quarter of 2012. NURERC appreciates the time, effort, and contributions of the Panelists who represent consumer activists, P&O clinicians, and researchers.

We salute the following individuals who serve on the NURERC Advisory Panel: **John Angelico**, CPO (Scheck and Siress Orthotics and Prosthetics, Inc., Oak Park, IL); **Linda Ehrlich-Jones**, PhD, RN (Center for Rehabilitation Outcomes Research,



NURERC Advisory Panelists (from left to right) Jack Uellendahl, CPO, John Angelico, CPO, and Kerice Tucker.

Rehabilitation Institute of Chicago); **Michelle Hall**, CPO (Gillette Lifetime Specialty Healthcare, St. Paul, MN); **Andrew Hansen**, PhD (engineer and Health Science Specialist

at the Minneapolis VA Medical Center, Minneapolis, MN); **Gerry Harris**, PhD (Director of the Orthopaedic and Rehabilitation Engineering Center (OREC) at Marquette University and the Medical College of Wisconsin); **Allien Heinemann**, PhD (Center for Rehabilitation Outcomes Research, Rehabilitation Institute of Chicago); **Tammie Higginbotham** (working farmer and consumer advocate); **Terry Karpowicz** (sculptor, artist, and consumer advocate); **Dulcey Lima**, CO (Orthotic Interventions, Lombard, IL); **Donald McGovern**, CPO (Rehabilitation Institute of Chicago); **David Rotter**, CPO (Scheck and Siress Orthotics and Prosthetics, Inc., Chicago-UIC, IL); and **Jack Uellendahl**, CPO (Hanger Prosthetics and Orthotics, Phoenix, AZ).



NURERC Advisory Panelists (from right to left) Don McGovern, CPO, Linda Ehrlich-Jones, PhD, RN, and Terry Karpowicz.

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Stefania Fatone Garners Major DoD Grant

R. J. Garrick, PhD

Stefania Fatone, PhD, BPO(Hons), has been awarded a 3-year **Department of Defense (DoD) Peer Reviewed Orthopedic Research Program (PRORP) Technology Development Award** in excess of two million dollars. The project is "Development of Sub-Ischial Prosthetic Sockets with Assisted-Vacuum Suspension for Highly Active Persons with Transfemoral Amputations."

Project Goals

Project goals are to develop a highly flexible, sub-ischial prosthetic socket with assisted-vacuum suspension for highly active persons with transfemoral amputation. This project proposes to provide clinicians a new prosthetic socket technology that offers increased comfort, hip range of motion, and improved coupling between the residual limb and prosthesis. Dr. Fatone explained, *"We plan to develop a better socket for high activity transfemoral amputees. We will devote the first two years to development and the final year to a feasibility study. Initially, we will focus on manufacturing processes to determine whether we can use rapid prototyping to bring more finite control to socket manufacture than hand fabrication offers."*

Feasibility Phase

During the feasibility phase, final qualitative feedback about the prototype will be solicited from six active duty military personnel by project collaborators at the **Center for the Intrepid (CFI)** and **Brooke Army Medical Center (BAMC)**. Improved socket comfort and coupling can benefit military service personnel who may wish to return to duty, as well as other highly active persons with transfemoral amputation.

Building the Research Team

Principal Investigator **Stefania Fatone, PhD, BPO(Hons)**, has assembled a team of Northwestern



Stefania Fatone (center) with team members Sean Wood (left) and Ryan Caldwell (right).

University experts to work on the DoD Project. Team members include Co-Investigators **Steven A. Gard, PhD** (Executive Director, NUPOC; Research Associate Professor, Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine); **Wei Chen, PhD** (Wilson-Cook

Professor in Engineering Design, Department of Mechanical Engineering Industrial Engineering and Management Science, Faculty Fellow, Segal Design Institute); and **Cheng Sun, PhD** (Assistant Professor, Department of Mechanical Engineering, Nanoscale Science and Engineering Center for Scalable and Integrated Nanomanufacturing). Other members of the team include **Ryan J. Caldwell, CP/LP** (Research Prosthetist, NUPOC), **Andrew Hansen, PhD** (Hansen Engineering Consulting), **Kerice Tucker** (Research Engineer, NUPOC), and **Sean Wood, BS/MS** student. In the near future, a postdoctoral fellow will join the team to assist with socket and liner development. Off-site specialists are Sub-Award Principal Investigator **Jason Wilken, PhD, PT** (Director, Military Performance Lab, Center for the Intrepid, Brooke Army Medical Center) and Sub-Award Co-Investigator **John Ferguson, CPO** (Chief of Prosthetics, Center for the Intrepid, Brooke Army Medical Center).

Benefits to Persons with Transfemoral Amputation

Better suspension and a more comfortable fit between the residual limb and the prosthetic device can offer better functional performance for individuals with combat-related or another etiology of transfemoral amputations. Dr. Fatone summed up, *"This project represents a major effort to enhance socket fit and comfort, while ensuring that it is rugged enough for high activity levels and military use."* Periodically during the 3-year project, *Capabilities* will report research progress and spotlight members of the DoD project team.

Impresa: Stefania Fatone, PhD

R. J. Garrick, PhD

Stefania Fatone, PhD, BPO(Hons), was honored as a recipient of the 11th bi-annual **Impresa Award**, presented by the Women's Division of the Joint Civic Committee of Italian-Americans on September 11, 2010. *Impresa* is the Italian word for "achievement". The Impresa Award honors women from the Chicago Italian-American community who have demonstrated outstanding accomplishments and are recognized as role models for younger generations of Italian-American women. A graduate of LaTrobe University (Australia), Dr. Fatone is recognized as a leader in her discipline. She is a prolific researcher and author on prosthetics, orthotics and rehabilitation, as well as a respected clinician, teacher, and mentor.



Stefania Fatone, PhD, BPO(Hons), recognized with an Impresa Award for career achievements in P&O.

Dr. Fatone was nominated for the award by

Phyllis Schoene of **Bardach-Schoene Prosthetic Lab** (Elmwood Park, IL). This firm also represents a connection to **Gunter Gehl, CP** (NUPOC's Director of Prosthetics Education from 1967 until 1992), who worked at Bardach-Schoene before he came to Northwestern University. The **Gunter Gehl Scholarship** continues to support students who are residents of Illinois, Indiana, and Wisconsin in their pursuit of P&O education.

Also a 2010 Impresa Awardee is **Linda Mastandrea**, a Paralympic gold and silver track medalist, disability rights attorney, and board member of **Access Living** (See

www.accessliving.org). Past awardees have included prominent Italian-American women who are judges, attorneys, artists, and entrepreneurs.

Bravo, Stefania! Complimenti per l'impresa!

Tom Karolewski Selected Member of the Feinberg Academy of Medical Educators

R. J. Garrick, PhD

Thomas Karolewski, CP, FAAOP, Director of Prosthetics Education at NUPOC, has been selected to serve a four year term on the **Feinberg Academy of Medical Educators (FAME)**. Members are recognized leaders at Northwestern University (NU) in the area of medical education who liaise with their departmental faculty and enhance medical education through collaborations with other **Feinberg School of Medicine (FSM)** educators. Members have the opportunity to contribute to FSM educational initiatives, including Education Day, Technology in the Curriculum Retreat, and faculty development workshops. Other contributions are development



Tom Karolewski, CP, FAAOP

of the Educational Portfolio in the faculty database and standardization of faculty evaluation by students. A ceremony recognized the inaugural members of FAME during the NU Education Day on October 8.

In 2005, Mr. Karolewski was recognized as an **Outstanding Educator** by the **American Academy of Orthotists and Prosthetists (AAOP)** for teaching skill, laboratory expertise, and his ability to mentor students. Mr. Karolewski is a member of many professional associations, including the **International Society of Prosthetics and Orthotics (ISPO)** and the **AAOP**.

Congratulations, Tom!

NUPOC Welcomes Matthew J. Major, PhD

R. J. Garrick, PhD

Matthew Major, PhD, has joined NUPOC as a Northwestern University **Clinical and Translational Sciences Institute (NUCATS) sponsored Engineering into Medicine Postdoctoral Fellow**. With his 1st year of funding from NUCATS and 2nd year of support from NUPOC, he will be co-mentored by **Steven A. Gard, PhD**, in engineering and **Elliot Roth, MD**, in clinical medicine. Dr. Major proposes to investigate the relationships between the mechanical



Matthew J. Major, PhD

properties of a below-the-knee prosthesis and the independent functional balance of below-knee prosthesis users with respect to stability during gait and standing. He noted, *"I want to observe the post-amputation rehabilitative process, measure the influence of prosthetic mechanical properties, and identify predictive factors that contribute to falling among prosthesis users."*

Specific aims of Dr. Major's project are: 1) to observe the rehabilitation process of transtibial amputee patients with respect to functional stability; 2) to identify objective means of distinguishing between transtibial amputee fallers and non-fallers; and 3) to identify differences in the mechanical compliance of transtibial prosthetic components and their influence on user stability during walking and quiet standing.

Dr. Major completed his doctorate (*The Influence of the Mechanical Properties of Transtibial Prostheses on Amputee Performance*, 2010) at the University of Salford (Greater Manchester, UK) where he validated an experimental procedure for quantifying relationships between prosthetic mechanical properties and user performance (e.g., metabolic demand and lower-extremity dynamics) under the guidance

of David Howard, Laurence Kenney and Martin Twiste. At the University of Illinois (Urbana), he completed his Bachelor's of Science (*Ergonomic Design of the Cockpit and Driver Control of a Formula One Race Car*, 2002) and Master's of Science (*Bio-mechanical Analysis of Aggressive Inline Skating: Landing and Balance on a Grind Rail*, 2004) degrees in mechanical engineering.

Working on the inline skating project inspired him to pursue biomechanical research. Additionally, he was inspired by **Bernard Amadei**, a visiting professor from the University of Colorado and founder of **Engineers without Borders-USA**, to develop devices and instruments for people worldwide who live with a disability.

Dr. Major has combined his interest in designing appropriate technology with a love of learning new cultures and languages. He has studied in Italy, Germany, China and Japan. *"I am interested in how people in different cultures perceive their experiences. Particularly, I want to experience how scientists in other countries operate their research laboratories. My main goal is to conduct research in a discipline like bioengineering and biomechanics that has direct impact on people. Prosthetics and Orthotics research is a field where I can see immediate improvement in people's lives."*

During his scant free time, Dr. Major enjoys trekking, rock climbing, and cycling. Recently, he has renewed a previous interest as a vocalist. He sings baritone in the Northwestern University International Chorus, where NURERC's **Stefania Fatone** and **Erin Boutwell** also sing.

We are delighted to welcome Matty Major and his engineering skills to NUPOC!

NUPOC Welcomes Sam Kwak

R. J. Garrick, PhD

Sam Kwak, a senior at Illinois Mathematics and Science Academy (IMSA), has begun a 9-month Student Inquiry and Research (SIR) at NUPOC. This mentored study program focuses on gait analysis. Stefania Fatone, PhD, BPO(Hons) is his on-site Advisor and evaluates his weekly progress. Last year Sam worked with Northwestern University's David Brown, DPT, PhD, on stroke rehabilitation and spent his summer in a pre-college engineering program at Vanderbilt University where he worked as a research assistant in the biomaterials laboratory.

A dedicated distance runner, Sam is especially interested in prosthetic research for the lower limb. During his time at NUPOC, he is focusing on prosthetic design and functional gait. Weekly, Sam meets with Dr. Fatone for didactic guidance. Also, Master's degree candidate and seasoned science mentor Eric Nickel (see *Capabilities* 18(2)7-8) works with Sam on further developments to a mechanical foot-ankle system that adapts passively to surface variations, also a NIDRR-funded study.



Sam Kwak (left), with science mentor Eric Nickel (right), examines the passive adaptation to surface of a prosthetic prototype.

A primary goal of the NUPOC Rehabilitation Engineering Research Center (RERC) for Prosthetics and Orthotics (P&O) is to provide education in the science of P&O and to disseminate the results of this lab's research and development projects to a broad audience. Throughout the internship, Sam is documenting his project's progress in a journal.

In compliance with SIR guidelines, Sam's study with Dr. Fatone and Eric Nickel will culminate in a formal research paper that presents and disseminates his investigations, analysis and conclusions.

Sam's extracurricular activities include 40-miles of running per week as well as competitive races on Saturdays. He enjoys spending time with friends in his residential dorm and twice each month he visits his parents in Palatine, IL. Considering his future, Sam mused, "I want to keep my options open, but I am considering a pre-medical course in university. I may pursue medicine or perhaps the allied health field."

NUPOC welcomes Sam's enthusiastic interest and contributions to P&O education and research.

NURERC NEWS

Presentations

Stefania Fatone, PhD, BPO(Hons), attended the **American Academy for Cerebral Palsy and Developmental Medicine (AAPDM) 64th Annual Meeting** in Washington, D.C., on September 22 to 25. Dr. Fatone, **Donald McGovern**, CPO (Rehabilitation Institute of Chicago), and **Elaine Owen**, PT (Wales, UK), presented a "Breakfast with the Experts" on *The Importance of Being Earnest about Shank and Thigh Kinematics When Designing, Aligning and Tuning Ankle-Foot Orthosis Footwear Combinations*. This meeting was well

attended and generated significant interest for future instructional courses. International representatives, including orthopaedic surgeons from Iraq, Bangladesh, Brazil, and Vietnam, presented excellent talks about children's illnesses and the management of cerebral palsy in their respective countries.

Rebecca Stine, MS, attended the **EMED Scientific Meeting (ESM) 2010 – Dynamic Load Distribution in Biomechanics**, where she presented *A Study of the Effects of Gel Liner Thickness on In-Socket Residual Limb*

Continued on page 7

NURERC NEWS

BME Research Day

These NURERC graduate students presented their research posters at the **Northwestern University Biomedical Engineering (BME) Research Day** in Evanston on September 15: **Erin Boutwell**, MS, *A Study of the Effects of Gel Liner Thickness on In-Socket Residual Limb Pressures in Transtibial Prosthesis Users*; **Sara Koehler**, MS, *Cross Validation of a Portable, Six Degree-of-Freedom Load Cell for Use in Lower-Limb Prosthetics Research*; and **Kiki Zissimopoulos**, MS, *Lateral Margin of Stability in an Able Bodied Individual*.

The RERC for P&O was one of 20 BME laboratories whose research was featured at this annual forum.

Continued from page 6

Pressures in Trans-Tibial Prosthesis Users, co-authored with **A Hansen**, **K Tucker**, **E Boutwell**, **M Edwards**, and **S Gard**. The meeting was held in Providence, RI, on August 14 to 17.

Stefania Fatone, PhD, BPO(Hons), was invited to present at the **Annual Meeting of the Canadian Association of Prosthetists and Orthotists (CAPO)** in Quebec, Ontario, Canada, on August 4 to 7. Dr. Fatone presented *The NIDRR Rehabilitation Engineering Research Center for P & O at Northwestern University and Functional Evaluation of AFOs for Persons with Post-Stroke Hemiplegia*.

Allen Heinemann, PhD, **Linda Ehrlich-Jones**, PhD, RN, and **Dustin Williams**, MS, of the Center for Rehabilitation Outcomes Research (CROR) presented a research update about the NURERC-CROR collaborative project, *Enhancing the Quality of Prosthetic and Orthotic Services with Process and Outcomes Information* at NURERC on July 28.

Sara Koehler, MS, and **Wendy Murray**, PhD, presented *From Remediation to Application: An Investigation of Common Misconceptions Associated with Vector Analysis in an Undergraduate Biomechanics Course* at the **American Society of Engineering Education Annual Conference and Exposition**, held in Louisville, KY, on June 20 to 23.

Publications

Hansen, AH and Wang, CC. *Response of Able-bodied Persons to Changes in Shoe Rocker Radius During Walking: Changes in Ankle Kinematics to Maintain a Consistent Roll-*

Over Shape in the *Journal of Biomechanics*, 43:2288-2293(2010).

Exhibits

Steven Gard, PhD, attended the **33rd Annual International Conference of the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)** in Las Vegas, NV, on June 26 to 30. As part of the Rehabilitation Engineering Research Center (RERC) Row, he manned an information exhibit about research conducted at the **Northwestern University Rehabilitation Engineering Research Center** for P&O.

Meetings

Steven A. Gard, PhD, attended the *Journal of Rehabilitation Research & Development* **Editorial Board Meeting** in Baltimore, MD, on July 22. Dr. Gard is a member of this editorial board.

Stefania Fatone, PhD, BPO(Hons), was invited to participate in the **Telemedicine and Advanced Technology Research Center (TATRC) Rehabilitation Medicine/Military Amputee Research Program (MARP) Lower Extremity Gait Systems Portfolio** in Frederick, MD, on July 27.

Steven A. Gard, PhD, attended the annual **National Institute on Disability and Rehabilitation Research (NIDRR) RERC Project Directors' meeting** in Arlington, VA, on August 4 to 6.

Stefania Fatone, PhD, BPO(Hons) was invited to participate in the University of Washington **Mobility Outcomes in Lower Limb Amputation Expert Panel**. The first meeting of the panel was held on August 23 to 24 in Seattle, WA.

Boutwell Defends

Erin Boutwell, MS, has successfully defended her qualifying proposal for her doctoral dissertation. Her proposal is entitled, *The Effect of Vertical Compliance on Shock Absorption and Proprioception in Transtibial Amputees*. **Steven A. Gard**, PhD, will supervise her doctoral work.

Congratulations, Erin!



Erin Boutwell, MS

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Recent Visitors to NURERC

R. J. Garrick, PhD

NURERC promotes information about rehabilitation engineering for prosthetics and orthotics and provides educational tours of the lab and its research projects. Recent visitors to NURERC are introduced below.



Mr. Hiroaki Yaguchi (left) and Mr. Yutaro Kobayashi (right).

Mr. Yutaro Kobayashi and Mr. Hiroaki Yaguchi, members of the **Mabuchi-Suzuki Laboratory, Department of Information Physics and Computing, Graduate School of Information Science and Technology, The University of Tokyo**, visited NUPOC on September 10. They observed a prosthetics class fabricate

upper limb impressions; met with researchers, **Steven A. Gard, PhD, Stefania Fatone, PhD, BPO(Hons), Craig Heckathorne, MSc**, post doctoral fellows **Pranitha Gottipati, PhD, Matthew Major, PhD**, and doctoral candidate **Erin Boutwell, MS**; visited the **Veterans Affairs Chicago Motion Analysis Research Laboratory (VACMARL)**; and attended graduate students' doctoral proposal practice defenses. **R. J. Garrick, PhD**, facilitated their visit.

Dale Dougherty, editor and publisher of **MAKE** (www.makezine.com), technology innovator, and proponent of hands-on design and fabrication, visited NURERC on August 13 when he met with **Craig Heckathorne, MSc**, and **R. J. Garrick, PhD**. Mr. Dougherty



Dale Dougherty, innovator and entrepreneur.

and his work encourage innovation at the grass roots level, open source technology, and the organization of communities that share ideas and value hands-on education. He visited NURERC about the possibility of developing a **MAKE** issue featuring the human body and design, including disability technology.

Frank Wilson, MD, a neurologist who specializes in the hand and is a Board Member of **Big Picture Learning (BPL)**, visited NURERC on July 28. Dr. Wilson seeks ways to incorporate prosthetic design and fabrication opportunities into educational curricula at BPL-affiliated schools. **Craig Heckathorne, MSc, R. J. Garrick, PhD, Sara Koehler,**



Frank Wilson, MD

MS, and Angelika (Kiki) Zissimopoulos, MS, discussed programs for young students that develop knowledge about prosthetics and orthotics. Ms. Koehler and Ms. Zissimopoulos reported their experiences as volunteer instructors in **Get-A-Grip!**, Northwestern University's public education module that introduces 8th graders to the design and fabrication of rudimentary upper limb prostheses.