It’s Academic!

In the absence of additional punctuation or explanation, the phrase “it’s academic” usually refers to a discussion about a topic that will impact almost nothing. The picture is one of professorial-looking men with glasses, and at least a few have beards, actively engaged in a basically meaningless discussion. Being academic in this meaning of the word is not something we would ever strive for. Scarily, some of the changes facing academic PM&R departments make one wonder if we’ll be relegated to the meaningless. There are bundled payment, site neutral payment, academic medical centers excluded from large insurance contracts, and questions about future funding for graduate medical education. Medicine today is dominated by discussions related to cuts, narrow networks, and overtreatment. I’m not saying we don’t need to have these difficult conversations, but education and research are not front-and-center of the daily deluge. This deluge can be depressing.

Then I read the articles in this installment of Rehab Progress, and I feel better. This is the definition of academic I signed up for. It’s about residents getting great training, writing papers, and winning awards that recognize their efforts. It’s about new research that can truly change the way prosthetic hands work, and more importantly, feel. It’s about defining an entirely new field of medicine — Regenerative Rehabilitation, which has the potential to change the way we deliver care. Mostly it is about great faculty who are willing to make a little less money to have the privilege of being called an academic physiatrist.

And … I know great work like this is going on in PM&R departments across the country. In addition, we have trained the all-important non-academic physiatrists who are providing great care throughout the country and the world. We’re Academic!

Sincerely,

Michael L. Boninger, MD
Director, UPMC Rehabilitation Institute
Professor and UPMC Endowed Chair
Department of Physical Medicine and Rehabilitation
Regenerative Rehabilitation Update

Fabrisia Ambrosio, PhD

“The best way to predict your future is to create it.”
— Abraham Lincoln

Physical rehabilitation has foundations in the targeted application of mechanical stimuli to enhance intrinsic tissue healing potential. It is given that rehabilitation practice must constantly evolve to include innovative scientific and technological advances that can positively impact clinical care. This responsibility to change leads to questions like, “How can we be in tune with the latest scientific developments?” “Are we prepared to offer our patients the finest care?”

Regenerative medicine is the process of creating living, functional tissues to repair or replace tissue or organ function lost due to age, disease, damage, or congenital defects. Rehabilitation is the process of maximizing an individual’s functional capacity after an illness or trauma. Both fields hold great potential to drive progress in the treatment of a host of acute and chronic pathologies.

These fields are inextricably intertwined — an intersection of disciplines that is becoming known as Regenerative Rehabilitation. Regenerative rehabilitation is defined as “the integration of principles and approaches in rehabilitation and regenerative medicine with the ultimate goal of developing innovative and effective methods that promote the restoration of function through tissue regeneration and repair.”

Integration of rehabilitation approaches with regenerative medicine strategies can accelerate underlying tissue restoration after injury and disease. For example, to promote intrinsic healing of the host and to help integrate donor transplants in a useful and functional way, the application of modalities or graded exercise programs may augment normally occurring developmental sequences at the donor-host interface. An understanding of the basic science behind physical treatments as well as regenerative medicine will help guide the development of targeted rehabilitation programs and reduce trial-and-error in treatments and studies.

In 2011, the UPMC Rehabilitation Institute, along with the McGowan Institute for Regenerative Medicine and the School of Health and Rehabilitation Sciences, both at the University of Pittsburgh, partnered with the Palo Alto VA to hold the First Symposium on Regenerative Rehabilitation. This annual symposium brings together scientists and clinicians working in the fields of rehabilitative and regenerative medicine. The enthusiasm with which this annual meeting has been received over the last four years illustrates the strong biomedical rationale for the emerging field of regenerative rehabilitation. Indeed, since the first calls to rehabilitation colleagues highlighting the need for increased communication and interaction between the fields of rehabilitation and regenerative medicine (Ambrosio et al, 2010; Ambrosio and Russell, 2010), there has been a burgeoning national and international interest in the concept.

In 2013, delegates from several institutions across the country, including the University of Pittsburgh, Stanford University, the University of Washington, Emory University, Wake Forest University, the Mayo Clinic, and the University Hospital of Pisa, convened to hold the First Annual Meeting of the Regenerative Rehabilitation Consortium. This Consortium serves as a coordinated communication and planning nucleus that seeks to systematize the process of writing white papers, designing rehabilitation online education modules, promoting collaborative efforts, and disseminating cutting-edge discoveries through the annual Symposium.

In 2015, Kyoto University, Kyoto, Japan, held its first Workshop on Regenerative Rehabilitation with Fabrisia Ambrosio, PhD, assistant professor and original consortium member, delivering the keynote lecture. This workshop was successful in its goal of introducing the concept of regenerative rehabilitation to students in rehabilitation graduate training programs at Kyoto University.

The future of regenerative rehabilitation is bright, and the integration of these two fields, rehabilitative and regenerative medicine, will increase the efficiency of interventions designed to optimize physical functioning to the benefit of a wide range of individuals with disabilities. For more information on the Fourth Annual Symposium on Regenerative Rehabilitation that was held on September 24-26 at the Mayo Clinic in Rochester, Minnesota, visit the website at: http://www.mirm.upmc.edu/Symposium/default.asp or contact:

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Pathway — Study of Human CNS Stem Cell Transplantation in Spinal Cord Injury

Stem Cells Inc. has recruited the UPMC Rehabilitation Institute (RI), along with other top-level research hospitals and institutions, to participate in a clinical proof-of-concept trial to determine if neural stem cells can help improve spinal cord function and regain a level of strength and sensation in patients with cervical spinal cord injury (SCI). Known as the Pathway Study, it is the first clinical study designed to evaluate both the safety and efficacy of transplanting stem cells into the cervical spinal cord. Michael Munin, MD, professor and vice chair of Clinical Program Development in the Department of PM&R, is principal investigator of the trial at the UPMC Rehabilitation Institute.

“This study represents a totally new paradigm in treating cervical spinal cord injury,” says Dr. Munin. “We are frequently asked by patients and families if there are ways to repair an injured spinal cord. The Pathway Study is testing this concept through the use of stem cell injections.”

This groundbreaking research is predicated on a recent Phase I/II trial, completed in May 2014, testing the safety of transplanting tissue-derived adult CNS stem cells into 12 patients with thoracic (T2-T11) level spinal cord injury. Data from this study showed no safety concerns, and there was improvement in several patients. The gains included conversion from complete to incomplete injury in two patients and voluntary toe movement in another patient.

The Pathway Study will determine the effectiveness, safety, and benefits of transplanting tissue-derived adult CNS stem cells above and below the site of cervical spinal cord injury. The primary efficacy outcome after transplanting stem cells will be changes in sensory and motor function, using the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI).

Stem cells have been shown to repair, replace, or supplement damaged or diseased cells with healthy cells in both preclinical and clinical trials. Adult stem cells can produce all functional cell types found within the tissue from which they are derived. Stem Cells Inc. is using tissue-derived CNS stem cells because they are naturally programmed to become mature functional CNS cells and can be directly transplantable into the spinal cord. The premise is that the stem cells will differentiate to the CNS cell types needed to repair, replace, or supplement cells damaged as a result of spinal injury.

Eligibility criteria state that subjects are 16 weeks to 2 years out from injury and fall into one of three ISNCSCI classifications, depending on injury level: AIS A, AIS B, and AIS C. People who are interested in participating in the study should complete a secure online questionnaire to determine eligibility. This questionnaire and other information about the Pathway Study can be found at https://www.sciresearchstudy.com/.

Patients who undergo transplantation will have five follow-up visits after the surgery. For up to a year after the surgery, these visits will take place every one to three months and will involve physical exams, blood tests, and MRI scans. Participants in the transplant group also will be given immunosuppressant medications to prevent their immune systems from rejecting the transplanted cells.

Patients assigned to the control group will be seen routinely over the course of a year and undergo the same basic physical exams and MRIs as the patients who had surgery.

More information regarding the Pathway Study can be found at https://www.sciresearchstudy.com/, or Dr. Munin can be reached directly at muninmc@upmc.edu.
The Defense Advanced Research Projects Agency (DARPA) recently awarded funding of its Hand Proprioception and Touch Interfaces (HAPTIX) program to the Department of Physical Medicine & Rehabilitation at the University of Pittsburgh. The program’s aim is to develop a fully integrated upper limb prosthetic arm with sensory and motor capabilities that approach those of a natural limb.

Robert Gaunt, PhD, assistant professor of PM&R, will direct teams of engineers, scientists, and clinicians from the University of Pittsburgh, West Virginia University, and Ripple LLC in developing advanced technology to integrate movement and sensory functions in an upper limb neuroprostheses that approach those of a natural arm.

“Advanced prosthetic limbs that behave like the hand and arm they are replacing have been an unrealized promise for many years, largely because until recently, the technologies to really accomplish this goal simply haven’t been available,” Dr. Gaunt said. “To make the most of these new capabilities, we have to integrate the prosthetic limb into the remaining neural circuitry so the patient can use it like a regular hand that, for example, can pick up a pen, gently hold an egg, or turn a stuck doorknob.”

Present day commercially available myoelectric prostheses use surface EMG recordings to infer user intent, and they are advanced compared to the less technological body-powered devices. Unfortunately, function has not improved enough for the user to incorporate the myoelectric device into daily life in a fashion similar to a normal hand. This shortcoming is largely due to the lack of fine signal quality and consistency of surface EMG recordings, making the devices awkward and causing difficulty performing ADLs.

Added to these shortcomings is the lack of sensory feedback that has been cited by patients as a major dissatisfaction. Sensory feedback is the key to a fully integrative prosthetic arm. Without sensory perception, even the most advanced limbs will remain as numb, extracorporeal “tools” rather than fully integrated functional limbs.

**Motor Control**

Muscle activity will be recorded from implanted intramuscular electromyography (iEMG) electrodes at multiple points in the forearm muscles. Multiple iEMG contacts will resolve the multiple actions of composite muscles and increase the dynamic range of recordings over varying physiological recruitment levels. These iEMG recordings will be used to drive advanced musculoskeletal...
Advanced Upper Limb Prosthetic Research

models of the forearm and hand, using well-documented principles of motor control physiology to form prosthesis command signals.

Building and training the algorithms that will decode the EMG signals recorded from these intramuscular electrodes into motor commands will require a large dataset of iEMG signals for various hand movements. Extensive EMG, kinematic, and kinetic datasets taken from 10 able-bodied participants during a variety of hand postures and tasks will be collected. The signals will be recorded using fine-wire EMG electrodes implanted percutaneously in the muscles of the forearms of volunteers. EMG activity, high precision motion tracking data from the hand and arm, and forces from instrumented devices during sessions of object manipulation tasks will be collected simultaneously.

Sensory Control

Sensory information will be introduced by selectively stimulating primary sensory afferents at the dorsal root ganglia (DRG) through clinically approved percutaneous leads. Stimulation in the cervical DRG has three benefits in terms of control signal acquisition:

1. The majority of sensory afferents from the hand and arm project into two to three adjacent DRG, providing a compact target for accessing the complete set of sensory afferents from the limb.
2. The DRG are considerably less mobile than more distal portions of the peripheral nerve, and the vertebral bodies provide mechanical protection from disruption and injury.
3. Open surgery will not be required to install the devices on the cervical DRG, as there are well-established clinical procedures that are minimally invasive.

The motor and sensory information will be combined, producing a closed-loop prosthetic control. If successful, this proposed technology will provide an unprecedented level of sensation and control not currently available in any prosthetic system and will facilitate greater functional incorporation of upper extremity prosthetic devices into the lives of amputees.

UPMC Rehabilitation Institute Expands to Include Four New Transitional Rehab Units

As the health care landscape continues to evolve, so does the UPMC Rehabilitation Institute's commitment to patient care and recovery. The Rehabilitation Institute is opening four new transitional rehab units located within existing skilled nursing facilities.

The transitional rehab units (TRUs) are designed for relatively short stays, on average two to four weeks, for patients recovering from surgery, illness, or accidents. These patients need additional care, resources, and intensive therapy before returning home but are able to transition out of an acute facility. The goals are straightforward: help patients return to their previous level of activity or better, and return them home as soon as possible.

“As health care is evolving, it’s very important for patients to get the most appropriate level of care after they are discharged from the hospital,” says Cara Camiolo-Reddy, MD, medical director for the UPMC rehabilitation network. “Through the transitional rehabilitation units, we are helping to expand and elevate the already excellent care provided at the skilled nursing facilities by creating new partnerships with all the health care professionals involved in a patients’ care — from the point of admission to their return home. That collaboration ensures that patients have continuity of excellent care at every stage of their rehabilitation.”

The UPMC Rehabilitation Institute is part of one of the largest rehabilitation networks in Pennsylvania and one of the largest in the country.

Fast Facts:

- More than 200 acute rehabilitation beds in eight locations
- More than 70 outpatient locations throughout western Pennsylvania
- More than 150 short-stay beds in skilled nursing facilities
Recent Publications

Brain Injury


Clinical Studies and Reports


Herbie Yung, MD, (first author), is a third-year resident and is mentored by Megan Cortazzo, MD, (second author), an assistant professor in the Department of Physical Medicine & Rehabilitation.

The article describes a case of lateral antebrachial cutaneous nerve (LABCN) entrapment following biceps tenodesis procedure and the route of diagnosis and treatment.

To the authors’ knowledge, this is the first case of LABCN entrapment being attributed to biceps tenodesis. The case report describes various treatments used with unsatisfactory results and the eventual surgical resolution to the nerve entrapment.

For a short video showing release of the nerve, go to: http://www.sciencedirect.com/science/article/pii/S1934-1482(15)00140-9/fulltext

The article can be found at: http://www.pmrjournal.org/article/S1934-1482(15)00140-9/fulltext


Recent Publications


Health Care Trends


Spinal Cord Injury and Related Brain-Computer Interfaces


Sports Medicine


AWARDS

American Congress of Rehabilitation Medicine

Michael L. Boninger, MD, professor and chair, Department of Physical Medicine & Rehabilitation, is the recipient of the 2015 John Coulter Stanley Award recognizing his professional achievements that contributed significantly to the field of PM&R. Dr. Boninger’s Coulter lecture “Neuroprosthetics to Wheelchairs: the Good, the Bad, and the Ugly of Assistive Technology” was presented at the Annual ACRM meeting on October 29, 2015, in Dallas, Texas.

Association of Academic Physiatrists (AAP)

Prakash Jayabalan, MD, PhD, received the AAP McLean Outstanding Resident Award, which honors a resident who demonstrates outstanding academic performance in academic leadership, teaching, education, and research. Dr. Jayabalan also was the recipient of the 2013 Electrode Store Best Resident Paper.

Jessica Ziebarth, DO (PGY4), was the 2015 recipient of the Electrode Store Best Resident Paper: “The Impact of Early Mobility on Length of Stay in the Acute Care Hospital Setting.”

Drs. Jayabalan and Ziebarth join the ranks of past UPMC Rehabilitation Institute PM&R residents recognized by the AAP. Brad Dicianno, MD, (’05), received the 2004 AAP Best Paper Presentation by a Resident. After joining the department faculty in 2005, Dicianno went on to receive the Electrode Store Faculty category and Young Academician awards. Stephen J. O’Connell, DO, (’10), was presented with the AAP Outstanding Oral Scientific Paper Presentation Award in 2009, and Angela Garcia, MD, (’10), received the 2011 Ernest W. Johnson Excellence in Research Writing Award from AAP.
UPMC VIDEO ROUNDS

Video Rounds is a series of informative and educational short videos created for physicians and covering a variety of medical and surgical disciplines, including:

Brain Injury Biomarker Research
Amy Wagner, MD
Dr. Wagner, endowed research chair, Physical Medicine and Rehabilitation, has extensively researched brain injury biomarkers, and explains how this field of research can be valuable when applied to rehabilitation medicine and specifically traumatic brain injury.
https://www.youtube.com/watch?v=S92NxsMf6lc&feature=youtu.be

Creating a Medical Home for Musculoskeletal Conditions
Gwendolyn Sowa, MD, PhD
Dr. Sowa, associate professor in the Department of Physical Medicine and Rehabilitation at UPMC, is spearheading the creation and development of a musculoskeletal medical home. This model aims to provide patients with a comprehensive approach to care, to advance recovery, and to improve quality of life.
https://www.youtube.com/watch?v=x-y3gX2w9m4&feature=youtu.be

UPMC Rehab Grand Rounds Fall 2015
Traumatic Brain Injury and Post-Traumatic Epilepsy: Current Practice and Future Proposals for an Individualized Approach

To view this issue of Rehab Grand Rounds, and the video and slide presentations, please visit http://www.upmcphysicianresources.com/cme-course/rehab-grand-rounds-fall-2015.

About the UPMC Rehabilitation Institute

• UPMC is ranked by U.S. News & World Report as one of the top hospitals in the country for rehabilitation.

• Stroke rehabilitation at the UPMC Rehabilitation Institute is certified by The Joint Commission.

• Our experts combine extensive clinical experience with advanced technology and research to offer our patients cutting-edge treatments.

• We are one of only seven institutions with both SCI and TBI Model System designations from the NIDRR.