

# PROGRESS

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## Faculty and Resident Highlights

## Brain-Computer Interface Researchers Receive \$8 Million From NIH to Expand Groundbreaking Work

A team of University of Pittsburgh and UPMC researchers from the Department of Physical Medicine and Rehabilitation was recently awarded two grants from the National Institutes of Health (NIH) totaling more than \$8 million to expand their groundbreaking brain-computer interface (BCI) research in collaboration with researchers at the University of Chicago and Carnegie Mellon University.

The BCI team at the University of Pittsburgh and UPMC, composed of **Jennifer Collinger, PhD**, **Michael Boninger, MD**, and **Robert Gaunt, PhD**, from the Department of Physical Medicine and Rehabilitation, and Elizabeth Tyler-Kabara, MD, PhD, of the Department of Neurological Surgery, has worked with two Pittsburgh-area clinical trial participants since 2012, both of whom had paralysis of their arms and hands, to allow them to control a robotic arm with their minds. One of them even regained his sense of touch through the robotic arm. The new funding will support critical next steps in their research.

The first grant, led by Dr. Boninger, provides \$7 million in NIH funding over the next five years to expand the University of Pittsburgh and UPMC BCI trial to a second site at the University of Chicago, where the researchers will collaborate with a team led by Sliman Bensmaia, PhD, and Nicholas Hatsopoulos, PhD, with the goal of restoring dexterous hand function through a biomimetic sensorimotor BCI.

The Pittsburgh and Chicago teams will each enroll two additional research participants over the next five years, allowing them to replicate the promising work done already in Pittsburgh and increasing their research

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*Former President Barack Obama meets with researcher Jennifer Collinger and study participant Nathan Copeland.*



Affiliated with the University of Pittsburgh School of Medicine, UPMC Presbyterian Shadyside is ranked among America's Best Hospitals by *U.S. News & World Report*.

**UPMC** LIFE CHANGING MEDICINE

# “Longevity Protein” Rejuvenates Muscle Healing in Old Mice

One of the downsides to getting older is that skeletal muscle loses its ability to heal after injury. New research from the University of Pittsburgh Department of Physical Medicine and Rehabilitation implicates the so-called “longevity protein” Klotho, both as culprit and therapeutic target.

The paper “Age-related Declines in  $\alpha$ -Klotho Drive Progenitor Cell Mitochondrial Dysfunction and Impaired Muscle Regeneration,” published in *Nature Communications*, showed that, in young animals, Klotho expression soars after a muscle injury, whereas in old animals, it remains flat. By raising Klotho levels in old animals, or by mitigating downstream effects of Klotho deficiency, the researchers could restore muscle regeneration after injury.



Lead author **Fabrisia Ambrosio, PhD, MPT**, associate professor of physical medicine and rehabilitation at the University of Pittsburgh, director of Rehabilitation for UPMC International, and core faculty at the McGowan Institute for Regenerative Medicine, says, “We found that we were able to rescue, at least in part, the regenerative defect of aged skeletal muscle. We saw functional levels of muscle regeneration in old animals that paralleled those of their young counterparts, suggesting that this could potentially be a therapeutic option down the road.”

Suspecting that Klotho acts through mitochondrial dysfunction, the researchers gave Klotho-deficient animals a mitochondria-targeting drug called SS-31, which currently is in phase III clinical trials. Treated animals grew more new muscle tissue at the site of injury compared to untreated controls, and their strength after recovery rivaled that of genetically normal mice.

Similarly, injecting Klotho into older animals a few days after injury resulted in greater muscle mass and better functional recovery than their saline-treated counterparts. Normal, healthy mice did not benefit from SS-31 after injury.

Clinically, these findings could translate to older adults who either sustained a muscle injury or underwent muscle-damaging surgery. Giving them Klotho at the appropriate timepoint could boost their muscle regeneration and lead to a more complete recovery.

Dr. Ambrosio cautions that the timing, dosage, and route of administration will require future research. “If you just bombard the muscle with Klotho, we do not expect to observe any functional benefit. We’ve found that mimicking the timing profile we see in young animals seems to be critical. We think that this gives some insight into the therapeutic window.”

This research was funded by National Institutes of Health grant R01-AG052978 from the National Institute on Aging and grant R01-ES023696 from the National Institute of Environmental Health Sciences.

*Dr. Ambrosio and laboratory staff discuss their ongoing research.*



# Brain Injury Medicine Acute Care Consultation Service

Under the direction of **Amy Wagner, MD**, and **Gary Galang, MD**, the UPMC Department of Physical Medicine and Rehabilitation in 2016 initiated a consult service for patients in need of brain injury management (BIM). This service was initially offered at UPMC Presbyterian two afternoons per week, providing an opportunity for residents to assist with brain injury management cases.

In 2018, with the recruitment of **Kevin Franzese, DO**, the Department grew this service to three afternoons per week, with regular follow-up for patients on the service and a more structured educational model for the residents in training. The program also includes the Department's traumatic brain injury (TBI) fellow who is able to support the service and enhance the educational experience for the residents.

BIM physician Amy Wagner, MD, professor of physical medicine and rehabilitation, vice chair of Faculty Development, director of Translational Research, and director of the Brain Injury Medicine Fellowship, says, "We serve as a valuable resource to our acute care colleagues and co-manage conditions that we see every day in our inpatient brain injury rehabilitation populations using a continuity care paradigm. Our perspectives on long-term outcomes are critical to the decisions and recommendations we make for patients in the acute care setting. These perspectives shape how we work to educate families, patients, and the acute care team to inform prognostication and transitions of care. Together these contributions support safer transitions of care and the initiation of rehabilitation approaches in the acute care setting that have a positive impact on recovery trajectory. In addition to its educational mandate, the BIM service is a research-informed service. In fact, our approach to BIM care is continually informed by research findings from our laboratory and others, and the clinical outcomes we observe also have informed our research agenda."

Looking forward, the current plan is to expand the BIM service to five days and include physician assistant (PA) support along with resident physicians and fellows. The expanded service will allow for improved follow-up.

"I hope to see this service expand into multiple acute care settings where patients with acquired brain injury are treated. Importantly, the BIM Acute Care Consultation Service is an example of the strategic vision that our specialty's leadership believes will maximize our field's impact on clinical care and function," says Dr. Wagner.



*Clockwise, from above: Amy Wagner, MD; Gary Galang, MD; Kevin Franzese, DO.*

## Brain-Computer Interface Researchers *Continued from Page 1*

capacity with the goal of uniting the sensory and motor systems so they can work together for improved and more functional control of the robotic arm. Recruiting is currently underway at both sites.

"Expanding our BCI research is a critical part of the translational process of bringing research to the people who need it most," says Dr. Boninger, the UPMC endowed vice chair for research in the Department of Physical Medicine and Rehabilitation. "Together with our collaborators at the University of Chicago, we hope to reach our eventual goal of making this technology functional for everyday use."

The second grant, led by Dr. Collinger, provides \$1.2 million in NIH funding for the research team over the next two years to study how the environment and the context of a task impacts motor plans and sensory perception. The grant is part of the federal BRAIN Initiative, a large-scale effort announced in 2013 aimed at gaining a deeper understanding of the brain and applying the knowledge to prevent and treat brain disorders.

Additional collaborators on the grant include Steven Chase, PhD, and Byron Yu, PhD, of the Carnegie Mellon University College of Engineering; and Aaron Batista, PhD, and Patrick Loughlin, PhD, of the University of Pittsburgh Swanson School of Engineering.

"When someone is controlling a robotic arm using a BCI, we get a very strong signal that tells us how they are planning to move that arm, but that signal is drastically impacted by changes in the environment around them," says Dr. Collinger. "For example, the way we move our arm to grasp is likely very different if we are reaching for a full glass of water, an empty glass, a hot cup of coffee, or a plastic water bottle. Uniting our expertise with new collaborators at Pitt and CMU will allow us to gain a better understanding of how and why the brain functions in this way when generating motor plans or perceiving sensory information."

This research will be funded by NIH grants UH3NS107714 and U01NS108922.

# 2019 AAP Presentations/Workshops



**Fabrisia Ambrosio, PhD, MPT** (Plenary Speaker)  
*Regenerative Rehabilitation: Physical Medicine Meets Stem Cell Therapeutics*



**Gwendolyn Sowa, MD, PhD**  
*Women in Academic Physiatry Panel Discussion*  
*Program for Academic Leadership, Session 3: Academic Medical Centers*



**Kentaro Onishi, DO**  
*Orthobiologics for Tendon & Joint Mechanistic Understanding to Inspire Clinical Trials*



**Michael Boninger, MD**  
*Getting the Most Out of the Mentor-Mentee Relationship*



**James Eubanks, MD** (Resident Panelist)  
*Success in the PM&R Match: Roundtables with Residency Program Directors*

## 2019 AAP Resident Oral Presentations



**Rohit Navlani, DO**  
*Analysis of Health Care Utilization and Outcomes in Smokers With Low Back Pain*



**Allison Schroeder, MD** (Rehabilitation Medicine Scientist Training Program [RMSTP] Paper Presentation)  
*Does Variability in Knee Extensor and Flexor Torque During Maximal Strength Testing Predict Change in Knee Pain and Physical Function at 60-month Follow-up?: Data From the Multicenter Osteoarthritis Study (MOST).*



**Justin Weppner, DO, and Joelle Gabet, MD**  
 (Oral Presentation)  
*A Rare Case of Donepezil Induced Rhabdomyolysis*



## 2019 AAP Resident Poster Presentations

Resident	Title
Alexander D'Angelo, MD	Ultrasound Visualization of Displaced Surgical Screw Resulting in Ulnar Neuropathy at the Elbow
William Austin Davis, MD	Factors Associated With Ambulation in Myelomeningocele: A Longitudinal Study From the National Spina Bifida Patient Registry
Lauren Desmarais, DO	Management of Orthostatic Hypotension in a Parkinsonian Type Multiple System Atrophy Patient
James Eubanks, MD	Successful Use of Social Media by Medical Students Pursuing Physical Medicine and Rehabilitation
James Eubanks, MD	An Analysis of Trends in Physical Medicine and Rehabilitation Using NRMP Match Data
James Eubanks, MD	Criteria for Acute Inpatient Interdisciplinary Rehabilitation in Spinal Cord Injury (SCI): A Review for the Non-SCI Physician
James Eubanks, MD	A Case of Traumatic Heterotopic Ossification (HO) Mimicking Pyomyositis and Cellulitis
James Eubanks, MD	Role of DHA/EPA Utilization in Traumatic Brain Injury (TBI) Management: A Narrative Review
James Eubanks, MD	The Educational Impact of a Required, Combined Neurology-Physical Medicine and Rehabilitation Clerkship for Fourth-Year Medical Students: Design, Introduction, and Preliminary Data
Joelle Gabet, DO	<i>Clostridium Difficile</i> Infection Reservoirs in the Environment Within an Acute Rehabilitation Unit
Andrew McCoy, MD	A Rare Presentation of Acquired Sensory Ganglionopathy Secondary to Mycoplasma Pneumonia Infection
Brittini Micham, MD	Early Chemodenervation for Malignant Tone Improving Long-term Outcomes in Anoxic Brain Injury
Brittini Micham, MD	Reducing Readmissions to Acute Care From Inpatient Rehabilitation: Identifying Trends and Implementing Intervention
Marissa Pavlinich, MD	Brachioradial Pruritus Treated with Gabapentin, Cervical Traction, and Selective Nerve Root Block: A Case Report

# The Role of the Neuropsychologist With Pediatric Physical Medicine and Rehabilitation Populations

The role of a neuropsychologist within the inpatient rehabilitation setting is uniquely poised to not only answer the traditional questions of how behavior is affected based on injuries to the brain, but also to help with school and community reintegration. Additionally, children and adolescents on rehabilitation units often have behavioral or psychological difficulties that can be pre-existing or recent onset in nature associated with their medical issue. A neuropsychologist can help address these issues from the perspective of understanding an individual's cognitive level.

Many children who have a congenital condition, such as spina bifida or cerebral palsy, are at high risk for cognitive difficulties. Once they reach school age, neuropsychologists frequently complete assessments to help address cognitive difficulties and aid in treatment and school planning.



**Melissa Sutcliffe, PhD, ABPP-CN**, assistant professor and clinical director of Pediatric Neuropsychology, leads the Pediatric Neuropsychology Service within the Department of Physical Medicine and Rehabilitation. This division and its five pediatric neuropsychologists saw 337 patients in 2018.

Neuropsychology is an integral part of the treatment team for rehabilitation populations.

"Neuropsychologists are positioned to play a key role in the lives of children and adolescents with rehabilitation needs. The ability to provide a unique perspective that targets aspects of physical health, emotional well-being, and school functioning allows us to help children and adolescents achieve a high quality-of-life," says Dr. Sutcliffe.

## Faculty and Resident Highlights



**Amy Houtrow, MD, PhD, MPH**, was elected into the National Academy of Medicine (NAM). Election into the academy is considered one of the highest honors in the fields of health and medicine, and recognizes individuals who have made major contributions to the advancement of the medical sciences, health care, and public health. Dr. Houtrow

was chosen for her research evaluating disability trends in childhood and the interactions among families, the health system, and social factors. This work has uncovered disparities with enormous policy implications for the pediatric population. UPMC PM&R is the only PM&R department with two active physiatrists in NAM. Dr. Houtrow joins current member Michael Boninger, MD.



**James Eubanks, MD**, a current PGY-1 resident, was part of the faculty for two presentations at the American Congress of Rehabilitation Medicine (ACRM) Annual Meeting: "Technology & the Future of Pain Management: Bridging the Gap Between Clinic & Daily Life" and "Multi-track Symposium on Chronic Pain Management: A Complementary, Integrative Perspective."



**Daniel Lueders, MD**, was elected as a member of the Little League® International Board of Directors. The role of the board's volunteers is to provide expertise, guidance, and oversight to Little League's global program and set the direction for the organization's future.

**Kentaro Onishi, DO**, was selected as one of three junior traveling fellows through the American Medical Society for Sports Medicine (AMSSM). Dr. Onishi, along with Aaron Gray, MD, from the University of Missouri-Columbia, and Kyle Smoot, MD, from the University of Kentucky, will join a founder and past president of AMSSM, Brian Halpern, MD, for a trip to Japan in September 2019. The potential stops on this trip include Tokyo, Kobe/Osaka, Kanazawa, and Akita. The fellows will share cases, tour sports medicine facilities, and watch live patient encounters with the goal of inspiring academic exchanges, exploring common interests, and sharing research.



Dr. Onishi (right) discusses his research with Department of Orthopaedic Surgery Chairman Freddie H. Fu, MD.

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**ABOUT THE DEPARTMENT OF PHYSICAL MEDICINE AND REHABILITATION**

- UPMC Presbyterian Shadyside is ranked by *U.S. News & World Report* as one of the nation's best hospitals for rehabilitation.
- The Department of Physical Medicine and Rehabilitation is consistently a top recipient of NIH funding for rehabilitation-related research.
- The Spinal Cord Injury Program at UPMC is one of only 14 in the country selected by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) as a model for other rehab providers.
- Department clinicians lead UPMC's rehabilitation network of more than 90 inpatient, outpatient, and long-term care facilities — one of the country's largest.