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FRONTIERS IN REHABILITATION

NEWS FOR PHYSICIANS FROM THE DEPARTMENT OF PHYSICAL MEDICINE AND REHABILITATION

PM&R Fellowships in Sports
and Musculoskeletal Medicine:
**Gateways to Deep
Experiential Learning**



PM&R FELLOWSHIPS IN SPORTS AND MUSCULOSKELETAL MEDICINE:

Gateways to Deep Experiential Learning

12-month programs pack a punch
with diverse practice exposures

During his year as a sports medicine fellow with Cleveland Clinic's Department of Physical Medicine and Rehabilitation (PM&R), Yogen Patel, DO, worked with athletes ranging from high school students to professionals. One of his most memorable experiences came last winter, when he cared for a top college swimmer who had chest pain.

"With the help of the athletic training staff, physical therapists and physicians from multiple specialties — including sports cardiology and pulmonology — we were able to return the swimmer back to sport within two weeks," says Dr. Patel. Soon after, the athlete won a relay event in the league championship.

Multidisciplinary to the Core

Multidisciplinary collaboration is a highlight of Cleveland Clinic's sports medicine and musculoskeletal medicine fellowships. Cleveland Clinic offers three sports medicine fellowships each year, one of which is reserved for PM&R. Five years ago, Cleveland Clinic began offering a musculoskeletal medicine fellowship to meet increasing demands for musculoskeletal care, particularly in PM&R.

"The opportunity to work alongside other disciplines is one of various aspects of the fellowship that definitely sets Cleveland Clinic apart from many other programs," says Mary Apiafi, MD, who was a PM&R sports medicine fellow in 2016-17. "Getting firsthand learning from world-renowned experts in so many fields affords trainees breadth and depth of experience. It gave me confidence going into practice as a new graduate."

Preparing the Wave of PM&R Sports Med Physicians

Cleveland Clinic added a PM&R sports medicine fellowship in orthopaedic sports health a decade ago. "There are many avenues you can take in sports medicine, including family and internal medicine, pediatrics and emergency medicine," says sports medicine and PM&R physician Carly Day, MD. "PM&R represents a growing share of the physicians going into sports medicine." Among her roles, Dr. Day is a member of the fellowship faculty at Cleveland Clinic, a board member of the American Medical Society for Sports Medicine, a team physician with the U.S. Soccer Women's National Team and head primary care team physician at Notre Dame College in suburban Cleveland.

During their 12-month stint, PM&R sports medicine fellows work alongside surgical and nonsurgical sports medicine physicians. They complete rotations with hand and upper extremity specialists, foot and ankle specialists, orthopaedic surgeons, radiologists and cardiologists. Fellows participate in a continuity clinic, spending a half-day each week with a sports medicine physician and another half-day with physiatrist Michael Schaefer, MD, program director of the musculoskeletal medicine fellowship.

On-field experience is also a prime focus, with fellows assigned to one local high school and college. They work in training rooms and attend all football games, as well as other sporting events. "We train fellows to manage anything that happens on the sidelines, whether it's minor or a catastrophic event," says Dr. Day. Fellows participate in a catastrophic sports injury simulation to practice on emergencies such as spine boarding for cervical injuries and sideline defibrillator use.

PM&R sports medicine fellows also join family practice colleagues, the musculoskeletal medicine fellow and musculoskeletal radiology fellows in robust ultrasound training.

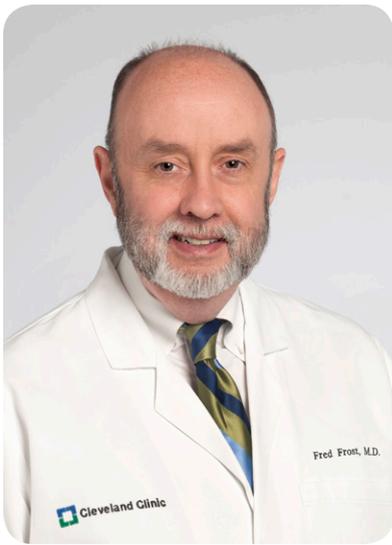
Training for Nonsurgical Musculoskeletal Care

The musculoskeletal medicine fellowship focuses on nonsurgical orthopaedic musculoskeletal care, notes Dr. Schaefer. "It's a fairly distinctive program that fills the gap between traditional sports medicine and pain management fellowships."

New to the program is the continuity clinic, where fellows spend a half-day with Dr. Schaefer in clinic. They also have rotations in subspecialties including hand and upper extremity, foot and ankle, spine medicine and spine interventions, physical therapy, occupational therapy, rheumatology and joint replacement, along with observing orthopaedic surgeons in the OR.

Ready for Life After Fellowship

"The depth of faculty, intense nature of the curriculum and opportunities afforded prepare you for life after fellowship," says sports medicine fellowship graduate Dr. Apiafi, who now works in PM&R/sports medicine at Community Howard Regional Health in Kokomo, Indiana. "What stands out from my time at Cleveland Clinic was the sense of growth after every rotation. I realize how far I've come."



Frederick Frost, MD

Dear Colleagues,

Every day I park my car and enter our hospital through the T building. It was built in 1921 — the building, not my car. There's a tarnished plaque by the door stamped with the Cleveland Clinic credo: *Care of the sick, investigation of their problems, and education of those who serve.* An army of 21st-century consultants won't come up with anything better. One hundred years later, we're still privileged to spend our days doing just that.

Medicine's role has changed a lot in 100 years. In PM&R, we swim upstream against cultural expectations that science, engineering and money can fix all. The 60-year-old executive is incredulous that he can no longer run marathons. The 30-year-old complete paraplegic man is "not satisfied" with his recovery, and the healthy young woman with fibromyalgia says, "I want my life back." Folks with a "Just Do It" mentality just can't get it done, and we are responsible. In PM&R, we can choose to polish the apple, or gently help patients re-engage with reality. Reality is not a crutch.

We can acknowledge that the impact of widgets, robots and sensors on recovery is modest, but the impact of rehab on function is great. We get there by guiding patients to stable health, teaching them how to adapt and restoring the confidence to excel. Our confidence comes from knowing our daily successes are the rule, not the exception.

I hope you take a moment to scan these pages. We have great people doing great things, big and small. It's my honor to work with them and feature their successes.

Respectfully,

Frederick Frost, MD (frostf@ccf.org)

Professor and Chair, Department of Physical Medicine and Rehabilitation
Executive Director, Cleveland Clinic Rehabilitation and Sports Therapy

FRONTIERS IN REHABILITATION

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Thoughtful Tech Adoption Enhances the Value of OT for Rehab Patients

Last fall, three Cleveland Clinic rehabilitation hospitals adopted the Bioness Integrated Therapy System (BITS™), a multiprogram tool that aids patient assessment, therapy and monitoring with a user-friendly, large-screen computer interface.

The system, used by occupational therapists (OTs) for patients with physical or cognitive impairment, was obtained as part of a joint venture between Cleveland Clinic and rehabilitation services provider Select Medical.

BITS consists of an interactive, large-display touch screen that offers engaging therapy-directed activities to assess and enhance patients' coordination, perception, visual and auditory processing, physical endurance, attention, memory and reaction time. Multiple therapy categories (e.g., visual scanning, visual pursuit, cognitive skills) are covered by a variety of activities addressing a range of skill levels to accommodate varying abilities and progression speeds.

"The beauty of the system is that what are essentially rote exercises can be practiced as often as desired and in new and interesting ways," says Mary Stoffiere, MA, CCC-SLP, Regional Director of Rehabilitation.

The system is often used for patients who have two OT sessions daily: a morning session with BITS and an afternoon session for practicing self-care skills. "The earlier BITS session often enhances patients' functional activities later in the day," explains George Choma, PT, C/NDT, Director of Rehabilitation at Cleveland Clinic Rehabilitation Hospital, Avon.



Stoffiere watches a patient engage with the BITS screen.

The system also conducts baseline assessments and monitors patient progress. Having a single tool with multiple capabilities allows OTs to dramatically reduce the time needed to set up and conduct a therapy session, Choma says.

It also appears to help improve patient outcomes. The Functional Independence Measure change from admission to discharge at Choma's rehabilitation hospital rose to 27.45 in the first quarter of 2018. This change ranks close to the 70th percentile nationally. "We attribute much of the improvement to the incorporation of BITS into our plan of care," he says.

[www More at consultqd.clevelandclinic.org/bits](http://www.consultqd.clevelandclinic.org/bits)

Another First from a Historic Trial: Novel Pairing of Cerebellar DBS with TMS

Study of DBS for stroke recovery charts new territory in TMS use

By Ela Plow, PhD, PT

Cleveland Clinic's ongoing EDEN study (see consultqd.clevelandclinic.org/dbs4stroke) is notable for being the first-in-human clinical trial of dentate nucleus deep brain stimulation (DBS) for post-stroke rehabilitation. Now the investigation is charting new territory in yet another way — as the first study to combine the use of cerebellar DBS with transcranial magnetic stimulation (TMS). The goal is to study the additive effects of stimulating alternate pathways that facilitate movement in a paretic upper limb.

The combination of DBS with TMS is unique because DBS is a “pacemaking” technique involving surgical implantation of a stimulator, whereas TMS is a nonsurgical technique that modulates brain activity through delivery of a series of magnetically induced pulses of current. Although pairing these techniques is generally fraught with artifacts, noise and data corruption, our group has achieved success in applying these techniques together in real time.

Lead investigators Andre Machado, MD, PhD, and Kenneth Baker, PhD, have designed the trial to test DBS of the dentothalamocortical pathways originating from the cerebellum, a site remote from the target area of TMS, which is used to target the motor cortices. My lab's contribution has been to build filtering strategies to extract valid TMS data during application of DBS.

Thus, while a handful of teams around the world have successfully paired DBS with TMS, our group is the first to pair *cerebellar* DBS with TMS. The implications of employing this study paradigm are substantial:

- First, this study design gives us, for the first time, the ability to evaluate mechanisms tested so far only in animals. Preclinical work led by Drs. Machado and Baker has repeatedly shown that cerebellar DBS can facilitate the lesioned motor cortices in the stroke brain. By studying the effect of cerebellar DBS on motor cortical excitability using TMS, we are creating the first opportunity to replicate in humans findings witnessed only in animal studies.



- In a broader sense, combining cerebellar DBS with TMS opens up possibilities for the field of neuroscience. One example is the prospect of new insights into the effects of TMS on cerebellar functioning. These effects have remained elusive, in part because cerebellar nuclei are deep and cannot easily be investigated using TMS and also because of technical challenges of delivering TMS during functional neuroimaging. Our paradigm, which allows application of TMS to the motor cortices with simultaneous recordings from externalized cerebellar DBS leads, offers the first opportunity to monitor real-time effects of TMS on the deep cerebellar nuclei.
- In the same vein, combining TMS and DBS can be temporally synchronized to maximize opportunities for plasticity. One can envision that timing TMS and DBS pulses in a tight interstimulus synchrony may generate additive effects on residual pathways.

We look forward to reporting our findings from this unprecedented pairing of TMS with cerebellar DBS in the months and years ahead.

[Dr. Plow has appointments in the Department of Biomedical Engineering and Department of Physical Medicine and Rehabilitation.](#)

NIH Award Bolsters Investigations of DBS for Stroke Rehabilitation

Cleveland Clinic researchers recently received a \$2.5 million grant from the National Institutes of Health to advance their unprecedented use of deep brain stimulation (DBS) of the dentate nucleus to enhance motor rehabilitation in stroke survivors.

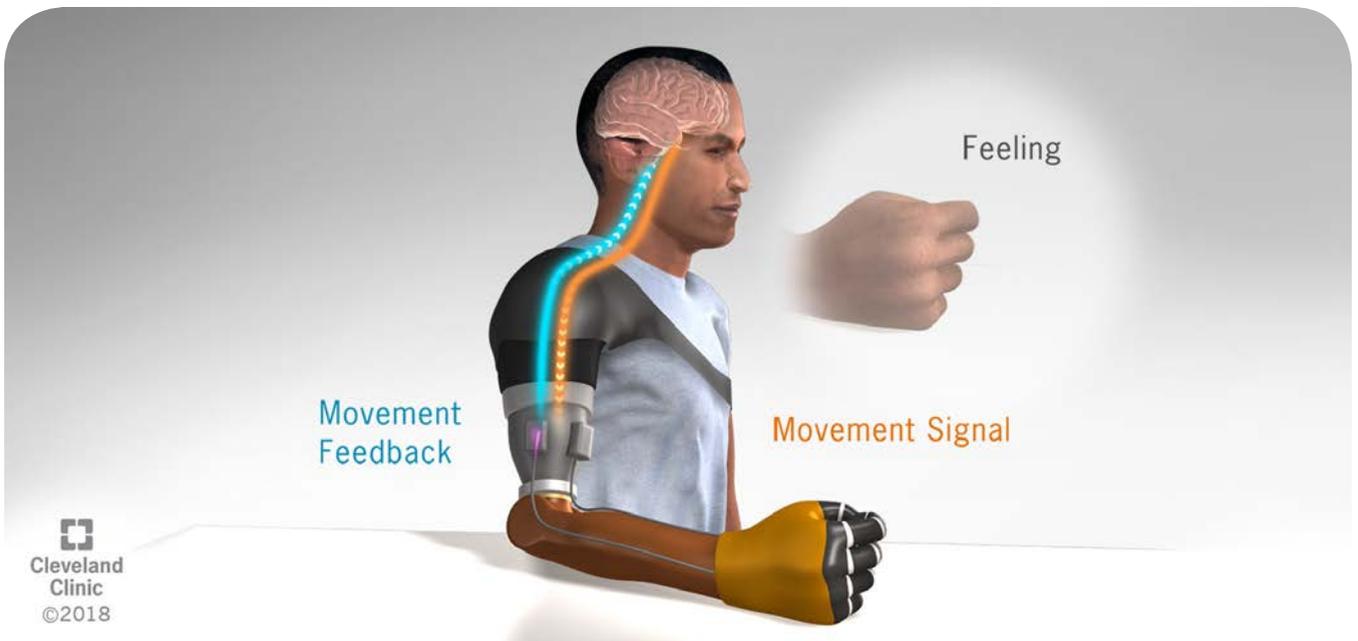
The award supports continuing work in preclinical models to improve the efficacy and better elucidate the mechanisms of DBS in restoring post-stroke motor function. It will operate in parallel with the researchers' ongoing first-in-human clinical trial, known as EDEN, exploring use of DBS to restore motor function in patients after a stroke.

“If this research succeeds, it will offer new hope for patients who have suffered a stroke and remained paralyzed,” says Andre Machado, MD, PhD, Chairman of Cleveland Clinic's Neurological Institute and co-primary investigator on the grant. “It's an opportunity to allow patients to rehabilitate and gain function — and thereby gain independence.”



More at consultqd.clevelandclinic.org/dbsgrant

Prosthetic Function Advances with First Demonstration of Illusory Movement Perception in Amputees



A newly developed computerized system has allowed amputees for the first time to effortlessly conduct complex motor tasks in real time using a prosthetic hand while perceiving that their missing hand is present and carrying out the action.

The approach and results of experiments on six above-the-elbow amputees were described by a Cleveland Clinic-led research team in *Science Translational Medicine* earlier this year. The work provides a critical new element that could lead to fully integrated and efficient prosthesis control, says lead investigator Paul Marasco, PhD, of Cleveland Clinic's Department of Biomedical Engineering. "Combining kinesthetic, cutaneous and motor systems could result in an integrated prosthetic limb that's intuitively controlled and provides a natural perception of complex movement," he notes.

Although modern motorized prosthetic hands can be programmed to conduct complex movements, they provide no feedback, so patients remain conscious of using an artificial limb and must watch the prosthesis while performing even simple tasks.

The method described in Dr. Marasco's study creates an illusory perception that the user's missing hand is acting

by vibrating a muscle that contains the nerves that would be used for natural control. It involves surgically redirecting motor and sensory nerves that previously innervated muscles no longer being used due to amputation. The nerves are moved to muscles higher in the arm or chest, where they reinnervate the host muscle. Using a wearable vibration unit and a 22-sensor data glove on the remaining hand, the subject simulates what's perceived to be occurring in the missing hand. From the data, a virtual reality prosthetic system is created that integrates the movement sensations into control of the hand.

"When connected to the system and without any training, our subjects say they can feel that their arm is present," Dr. Marasco says. "When we disconnect them, they report that their arm vanishes. The brain interprets the signals from our system very effectively."

Continued investigation will focus on miniaturizing and refining the system's computer interface and adapting the system for other amputation sites and for potential use after stroke or spinal cord injury.

www.consultqd.clevelandclinic.org/marasco

BY THE NUMBERS: Cleveland Clinic's 6 Clicks Tool

Cleveland Clinic's 6 Clicks functional measurement tool — created as a short form of the AM-PAC™ instrument developed by Boston University — continues to expand in nationwide use and clinical impact. Here are a few numeric examples. For more, see consultqd.clevelandclinic.org/6clicks.

>1,000



Number of hospitals/health systems that have licensed 6 Clicks to date

~75%

Reduction in precertification therapy visits over a 12-month pilot study of Cleveland Clinic's "Floor to SNF" initiative allowing prompt discharge from hospital to SNF without a precertification visit if the patient meets a 6 Clicks score threshold

100%

Compliance with CMS Chapter 8 criteria for appropriateness of disposition for Cleveland Clinic patients discharged to a SNF as part of the Floor to SNF initiative in the latest reporting period

Using Mini-Cog Screening to Transform Cognitive Rehab for Older Patients

Cleveland Clinic health system has launched an enterprisewide initiative to screen all patients 65 years or older for cognitive impairment during routine visits at all primary care facilities.

Screening is done using the Mini-Cog® instrument, which takes just three minutes to complete and consists of a three-item recall test plus a clock-drawing component (see photo). It can be administered and scored by an allied health professional after brief training.

Rollout is underway across primary care sites, with screening to be routinely offered at more than 70 Cleveland Clinic locations by early 2019. The effort aligns with Cleveland Clinic's systematic screening of inpatients who exhibit new-onset physical limitations that may impact discharge destination.

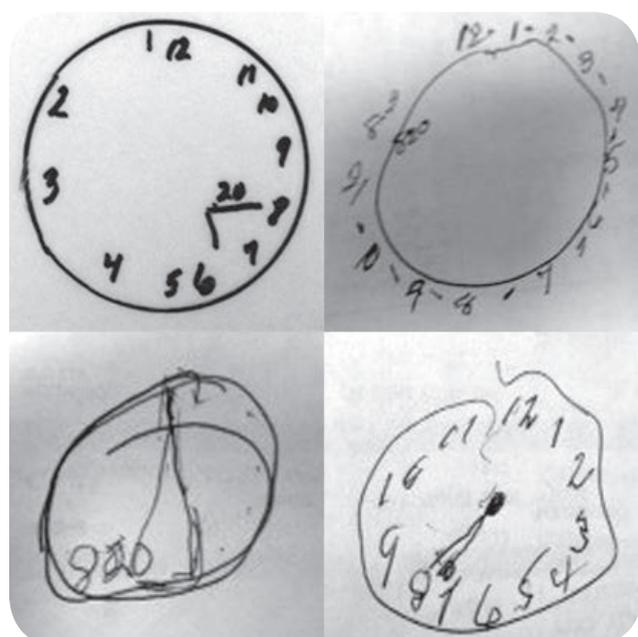
"With our aging population, the prevalence of cognitive impairment has exploded," says Frederick Frost, MD, Chair of Cleveland Clinic's Department of Physical Medicine and Rehabilitation, who helped spearhead the initiative. "Identifying it is the first step in addressing the issue for our older patients."

The initiative was piloted in February 2018 at an outpatient health center. "We were pleasantly surprised by how efficiently the screening test was incorporated into busy clinic schedules," says internist Robert Jones Jr., MD. "And many patients who needed additional help were identified."

Dr. Frost, who oversees Mini-Cog screening by hospital therapists, says it's shifted the focus of occupational therapy from mainly addressing physical limitations to greater emphasis on helping patients manage cognitive deficits. For those 65 or older, the first encounter with a physical therapist now involves taking the Mini-Cog test. If it indicates cognitive impairment, follow-up is triggered and an occupational therapist is called in to provide services on medication management, memory function and performing household tasks.

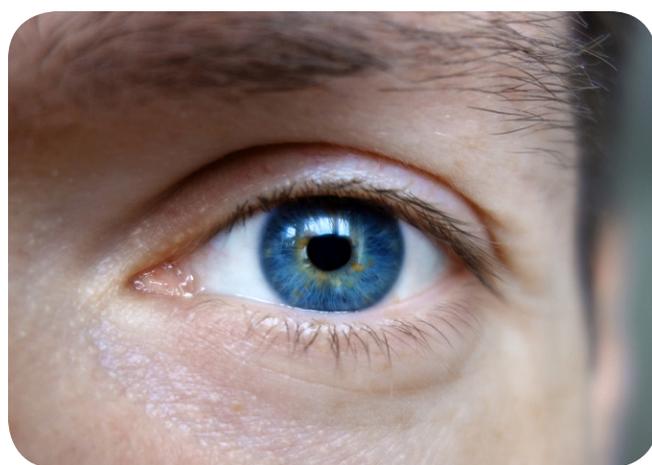
"Cognitive rehabilitation is like the weather — everyone talks about it, but no one does anything about it," Dr. Frost observes. "We're tackling this problem head-on by developing resources and training an army of rehabilitation professionals to assess and treat this disability we're now seeing all the time."

www [More at consultqd.clevelandclinic.org/minicog](http://consultqd.clevelandclinic.org/minicog)



Lessons in Managing Locked-In Syndrome

By Richard Aguilera, MD



A 32-year-old man was transferred to a Cleveland Clinic inpatient rehabilitation hospital from a long-term acute care hospital. Two months earlier, a pontine hemorrhage had left him with aphonia, dysphagia and quadriplegia.

After several attempts at communication, we finally broke through by asking him to use eye blinks to signal yes/no responses to simple questions. He was then diagnosed with locked-in syndrome, a rare condition that most often results from ischemic or hemorrhagic stroke affecting the corticospinal, corticopontine and corticobulbar tracts. Patients are conscious and aware but cannot communicate because of paralysis and inability to speak. Often the ability to blink and move the eyes is preserved, sometimes along with control of facial and neck muscles, offering the only potential avenues of communication.

While initially eye blinks can offer communication beyond simple questions (i.e., having the patient "spell words" with Morse code — using long and short blinks — or having the questioner recite the alphabet and the patient blink for each desired letter), this method is excruciatingly cumbersome.

Our speech and occupational therapy teams kicked into gear, working with local university bioengineering programs to identify the best fit for communication augmentation tools. Fortunately, a number of options are available for disabled patients.

Not all devices work for every patient. One that tracks gaze as a person focuses on words or icons on a computer screen caused our patient to fatigue quickly and develop nystagmus that persisted for hours. NeuroNode, a small wireless EMG device, translates electrical activity from a working muscle to operate an iPad or computer. Placed on a forehead muscle that our patient could consciously activate, it worked much better.

We similarly found a customized solution to enhance mobility. A power wheelchair operated by controls connected to a head array allowed our patient to drive the chair with the minimal neck movement that he retained. By discharge, he was motor-ing down the hospital corridors.

High-tech gadgets are pricey and quickly become obsolete, so there is no sense in acquiring a closet of devices to collect dust. Customizing a search for each patient is preferable. Some devices can be rented while you try them, and manufacturers will often offer in-house training on their use.

Despite the grave disability of patients with locked-in syndrome, they can be helped. It is incumbent on the rehab team to find ways for them to reconnect and live a stimulating life.

Dr. Aguilera is a member of the Department of Physical Medicine and Rehabilitation.