

# NEW YORK-PRESBYTERIAN Rehabilitation Medicine

Affiliated with COLUMBIA UNIVERSITY COLLEGE OF PHYSICIANS and SURGEONS and WEILL MEDICAL COLLEGE OF CORNELL UNIVERSITY

Spring 2006

*From the Desk of:*

## James S. Lieberman, MD, Physiatrist-in-Chief

The landmark merger of New York Hospital and Presbyterian Hospital resulted in the creation of NewYork-Presbyterian Hospital, "The University Hospital of Columbia and Cornell." One outcome of the merger was the development of a combined Physical Medicine and Rehabilitation Residency Program at NewYork-Presbyterian Hospital, which is directed by Nancy E. Strauss, MD. The innovation doesn't stop with the residency program, of course. Matthew N. Bartels, MD, MPH, is the director and founder of the Human Performance Laboratory at NewYork-Presbyterian/Columbia, where he and others are engaged in cardiopulmonary rehabilitation research.

Technology has always played an important part in physiatry, and a modern rehabilitation program is likely to draw on some sophisticated devices designed to prompt cerebral reorganization after stroke. As noted by Michael O'Dell, MD, patients can recover lost function more often than previously thought with the right exercises, plenty of repetition, and the use of these new devices.

All of this information, including the important role of rehabilitation medicine in the recovery of burn patients, is discussed in this inaugural edition of the NewYork-Presbyterian Rehabilitation Medicine Newsletter, whose purpose is to present the latest advances in clinical thought and patient care from one of the nation's premier physical medicine and rehabilitation centers.

## NIH-Funded Cardiopulmonary Rehabilitation Research Demonstrates Evidence-Based Efficacy

The Human Performance Laboratory, located at NewYork-Presbyterian Hospital/Columbia University Medical Center, is the site of a cutting-edge cardiopulmonary research and clinical testing program. Columbia researchers are pursuing projects that examine the physiologic basis for cardiac and pulmonary disease and are translating this knowledge into innovative rehabilitation approaches.

"Many of the rehabilitation patients that we take care of now are older, so they tend to have multiple disabilities," explained Matthew N. Bartels, MD, MPH. "It's rare to see a pure simple stroke. It is far more common to find a patient who has had a stroke and also has co-morbid cardiac and pulmonary disease. Physiatrists, particularly those who work in nursing homes or inpatient rehabilitation, need to know how they can help manage these complex conditions and how to exercise their patients safely."

In 2003, heart disease was the leading cause of mortality in the United States, accounting for 685,000 deaths, according to the National Committee on Health and Vital Statistics. Chronic lower respiratory disease ranked fourth and killed nearly 160,000 people. Despite these high prevalences, only 20% of patients with access to cardiac rehabilitation actually obtain treatment, and pulmonary rehabilitation is "extremely underused," Dr. Bartels noted. One great obstacle is that many physicians fail to understand the benefit of rehabilitation for patients. Much of the difficulty also lies in obtaining Medicare and other health insurance coverage for

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Dr. Matthew N. Bartels: Cutting-edge research

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## Rehabilitation Medicine Harnesses Technology To Facilitate Upper Extremity Recovery After Stroke

Recent studies suggest repetition and task-specific exercise are of prime importance to facilitate motor recovery during stroke rehabilitation. Upper extremity paralysis remains a particularly difficult treatment challenge. Neuroimaging and basic science research over the past decade have helped clarify the central role and importance of rehabilitation to optimize motor recovery and enhance functional outcome following stroke.

Compensatory treatments focus on using the unaffected systems to work around motor deficits. These approaches have a role in rehabilitation after stroke, but both active and facilitated movement of the paretic arm and hand may improve strength more efficiently than was once thought. "The team must identify critical functional activities and target the muscle groups used in those same activities," noted Michael W. O'Dell, MD. "Repetition is paramount. A patient may need to perform a particular muscle movement

hundreds, perhaps even thousands of times, to facilitate the recovery process."

Fortunately, the introduction of several new technologies has provided rehabilitation professionals with new tools to help restore impaired movement in the upper extremities following stroke. Occupational therapists at NewYork-Presbyterian Hospital/Weill Cornell Medical Center now employ two devices to facilitate repetition and proprioceptive input, which helps retrain hand and arm movements to the greatest possible extent.

The Ness H200® (Neuromuscular Electrical Stimulation Systems, Ltd.) is an orthosis custom-fitted over the forearm that uses a system of surface electrodes to provide electrical impulses to the finger muscles. The device is then programmed to activate specific muscle groups resulting in a simulated grip motion. Even with patients who have little voluntary movement, proprioceptive feedback from the joints to the injured

brain is felt to play a role in facilitating remodeling of the injured cerebrum. Depending on the clinical manifestations, the unit can also be used to reduce spasticity, increase range of motion, or curb atrophy.

The SaeboFlex® (Saebo, Inc.) resembles a dynamic splint and fits onto the forearm, positioning the wrist and fingers in relative extension, and can use both voluntary movement and flexion synergy to facilitate passive opening of the hand. From this extended position, the patient can initiate active finger flexion with the same goal of improving proprioceptive feedback. Since they facilitate repetition of movement, the Ness2000 and SaeboFlex both require substantial patient compliance.

The Department of Rehabilitation Medicine has advanced the technology even further with the addition of a state-of-the-art upper-extremity stroke rehabilitation robotics device, the InMotion2 Shoulder-Elbow Robot and InMotion3 Wrist Robot (both by Interactive Motion Technologies, Inc.). The units allow up to 1000 repetitions of a particular shoulder or wrist movement during a 30-minute session.

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### Cardiopulmonary

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treatment. Establishing evidence-based efficacy may be the greatest contribution of this research.

In a paper in *Chest* (December 2005; 128:3799-3809), for example, Dr. Bartels and colleagues from the NIH-funded National Emphysema Treatment Trial (NETT) demonstrate that pulmonary rehabilitation effectively improves exercise ability, dyspnea, and quality of life among patients with severe emphysema. The Human

Performance Laboratory was one of 17 NETT centers nationwide. In another study in *Respiratory Medicine* (2005; 99:1431-1439), Columbia researchers, working with Dr. Bartels, establish two parameters to predict the survival of patients with diffuse parenchymal lung disease awaiting lung transplantation. Those patients whose oxygen saturation was less than 95% during unloaded exercise had a 75% risk of dying on a one-year waiting list, while those on the list who could walk fewer than 350 meters over six minutes stood a 67% chance of dying. Such simple measures

could help prioritize which patients are in greatest need of lung transplantation.

Current research projects at the Laboratory involve exercise, autonomic feedback from carbon dioxide receptors, and a wide range of severe cardiopulmonary diseases: emphysema, cystic fibrosis, hypertension, and parenchymal lung disease. Several clinical trials are underway that study bronchoscopic valves, devices that channel air flow into the healthiest regions of lungs damaged by severe emphysema. The valves may offer a non-surgical alternative to lung volume reduction surgery. Another study

# Comprehensive Burn Rehabilitation Program at Forefront of Research

**T**hrough ongoing collaboration with the William Randolph Hearst Burn Center since its inception in 1976, NewYork-Presbyterian Hospital/Weill Cornell Medical Center's Department of Rehabilitation Medicine has created a vibrant burn rehabilitation therapy program that integrates patient care and research. Current projects apply new technologies, including virtual reality, as well as improve upon pressure gloves, splints, and other widely-used interventions.

"For more than a decade, our rehabilitation therapists have published papers almost every year, leading to an outstanding resume of clinical research," said Delia Gorga, PhD, OTR/L. "The emphasis is on very practical rehabilitation research rather than basic science, things that would be of particular interest to therapists working in the burn arena." The Department supplies more than 10 physical and occupational therapists, along with psychiatric consultations, to the Burn Center, one of the nation's busiest and most respected.

Currently, the therapy team is studying whether SnowWorld, a virtual reality game developed at Harborview Medical Center in Seattle specifically for burn patients, enhances therapy sessions. Previous research has shown that the game effectively distracts patients from

pain. Completed by eight subjects thus far, patients immerse themselves in the computerized world by wearing goggles; while their non-involved hand moves a mouse to control that world, the therapist stretches the involved side to improve the patient's passive range of motion. The idea is that, because patients are less limited by pain, they will have increased motion and function during therapy.

In another application of innovative technology, the Department's therapists have produced burn masks since 2002 using a three-dimensional non-contact surface scanner, one of only five such machines at burn centers worldwide. The laser scanning process, created by Total Contact, Inc., takes less than one minute, versus the hours needed to take a plaster mold. These masks better match facial contours and are lined with Silon, material that effectively softens and flattens scars. In a recent case study of a 14-year-old male, presented at the American Burn Association national conference in 2006, the team documented how the scanner also designed a pressure orthosis for the ear. Because the method safely stopped the progression of his scarring, it is now being made available to a second patient.

The team has developed an alternative to the standard pressure glove—The NewYork-Presbyterian Dexterity Glove

(NYPDG). Trademarked in 2005, the glove is being licensed and sold by Torbot Group, Inc.'s Jobskin Division. Unlike traditional gloves made of smooth elastic fabric, the newer design incorporates Silon-impregnated fabric onto the outside surface of the palm and fingers to improve friction. A pilot study on non-injured adults, published in the July/August 2005 issue of *Journal of Burn Care & Rehabilitation*, demonstrated that functional tasks were faster and easier to perform when using the NYPDG.

The rehabilitation therapists play a crucial role in comprehensive burn care. "A burn patient needs rehabilitation from the minute they get burned, so therapists need to be involved in the care from the beginning and all the way through until after the patient is discharged from the hospital," explained Roger Y.W. Yurt, MD, FACS. "They're really working side by side all the time with the nurses and physicians throughout the continuum of care."

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is examining whether Pfizer's sildenafil is effective in facilitating pulmonary vasodilation with milder emphysema.

Other research examines cardiopulmonary disease at a biochemical level. Greg Gates, PhD, the Laboratory's Coordinator, is looking at how carbon dioxide receptors, located in carotid bodies and in the brain, affect respiration control. By studying hypercapnia and hypoxia, more effective exercise prescriptions can be developed for patients with heart and lung disease.

Dr. Bartels' research team is also exploring how cardiopulmonary rehabil-

itation may benefit certain populations with neurological diseases. One project, now in an early stage, plans to focus on patients with Parkinson's disease. "We know that exercise can make these patients better, but no one's ever documented it," he said. He hopes that rehabilitation may reduce autonomic problems. "We might be able to improve orthostatic tolerance and achieve better blood pressure control, decreasing falls and improving balance and function."

All of their projects, no matter how specific, have broad applications, stressed Dr. Bartels. In recognition of his work

in the area, he served as Co-Chair of the Cardiopulmonary Study Guide, released in March by *Archives of Physical Medicine and Rehabilitation*. In the supplement of this journal, Dr. Bartels wrote 4 articles in which cardiopulmonary rehabilitation and functioning are discussed.

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# Unified Rehabilitation Residency Creates Learning Opportunities

One would imagine that the learning opportunities available to residents at NewYork-Presbyterian Hospital would be impressive, given the fact that the hospital is affiliated with two Ivy League medical schools, each of which has an outstanding reputation in medical academia.

The truth is more complicated than that, however, as the unified Physical Medicine and Rehabilitation Residency Program has become more than the sum of its parts. The residency program offers a unique educational experience that profits from the expertise of its two academic medical centers: NewYork-Presbyterian Hospital/Columbia University Medical Center and NewYork-Presbyterian Hospital/Weill Cornell Medical Center. The use of innovative didactic programs, a fully dedicated staff, and the program's association with four specialty institutions have all served to create a fully merged residency program that has become one of the nation's strongest.

Nancy E. Strauss, MD, believes the physiatry residency program's excellence lies in its innovation. "The innovative aspect is fitting into our program the best resources from each of these institutions so that each of our residents can benefit from the offerings."

Each rotation site has significant strengths:

- "NewYork-Presbyterian/Columbia

has an outstanding inpatient rehabilitation unit, with a population that is extremely diverse in terms of diagnoses and cultural and socioeconomic backgrounds. The electrodiagnostic laboratories from the psychiatry and neurology departments have been merged into one lab at the world-renowned Neurological Institute of New York."

- "NewYork-Presbyterian/Weill Cornell has a relatively new inpatient rehabilitation center which has given the residents a chance to see what is needed to start a new unit and create a highly respected center. The Randolph Hearst Burn Unit gives residents the opportunity to participate in the challenging rehabilitation of burn patients. And residents get to work closely with faculty in their outpatient practices, thereby learning every aspect of running a private practice – from medical management to billing compliance."
- "The Hospital for Special Surgery is one of the premier orthopedic hospitals in the country, with cutting-edge procedures in interventional spine and injection techniques."
- "Memorial Sloan-Kettering Cancer Center gives our residents the opportunity to learn cancer rehabilitation and see patients with unusual diagnoses."
- "Helen Hayes Hospital gives our

residents the incredible opportunity to lead a specialized inpatient care team, on the hospital's Spinal Cord Injury Unit."

- "Blythedale Children's Hospital is a free-standing pediatric rehabilitation hospital."

"Each resident has the opportunity to rotate at each site with each of the designated faculty, and there is no better or weaker rotation track," Dr. Strauss said.

The residency program is further strengthened by innovative programs. Examples include: hands-on workshops to learn techniques for interventional procedures, electrodiagnosis, etc.; communication skills workshops; using patients themselves to discuss their particular diagnoses in didactic sessions; panel discussions; and regional educational meetings and visits by nationally recognized experts.

What makes a good candidate for the residency program? "I look for someone who has a deep understanding of the specialty and a conviction that this is the field they would like to choose," Dr. Strauss said. "They must also have a passion for improving the function of individuals with disabilities."

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