SPECIAL EDITION

InsideSARGENT

Boston University College of Health & Rehabilitation Sciences: Sargent College

ACCOMPLISHMENTS IN **PHYSICAL THERAPY**

BOSTON UNIVERSITY

Chair's Message

Dear Colleagues,

I am pleased to introduce this special issue of *Inside Sargent*, which highlights the educational, clinical, and scholarly activities in the physical therapy programs at BU Sargent College. Our new state-of-the-art research and clinical facilities, the addition of three highly accomplished faculty members, and our new national rehabilitation and research training center all speak to the tremendous growth in our programs. In the summer of 2011, we also enrolled the first students into our neurological physical therapy residency program.

"OUR NEW STATE-OF-THE-ART RESEARCH AND CLINICAL FACILITIES, THE ADDITION OF THREE HIGHLY ACCOMPLISHED FACULTY MEMBERS, AND OUR NEW NATIONAL REHABILITATION AND RESEARCH TRAINING CENTER ALL SPEAK TO THE TREMENDOUS GROWTH IN OUR PROGRAMS."

As you will see, our faculty and students are engaged in a wide range of interdisciplinary teaching, research, and scholarship activities at home and abroad. You'll read about the innovative ways faculty and students are improving the lives of patients who have Parkinson's disease, arthritis, and many other conditions. In one of our most inventive pieces of research, Assistant Professor Cara Lewis has built a robotic exoskeleton that could help prevent and treat painful hip osteoarthritis.

Our entry-level and transitional doctor of physical therapy students develop projects during their academic practicum course that have a broad impact as well, and their successes have been recognized through American Physical Therapy Association awards and acceptance into selective post-professional programs.

I hope you enjoy reading more about the many new and inspired happenings in the physical therapy programs at Sargent College. I welcome your comments and feedback at pt@bu.edu.

With warm regards,

Diane M. Heislein

Diane M. Heislein
Director, Programs in Physical Therapy, and Clinical Associate Professor

SPECIAL EDITION InsideSARGENT

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Accomplishments in Physical Therapy

FEATURES

ALSO IN THIS ISSUE

Staying Active with Arthritis

By Rich Barlow and Andrew Thurston

For the 46 million Americans grappling with arthritis, the pain shooting through bones, joints, muscles, and tissues can turn the everyday—a stroll in the park, holding a dinner plate—into an arduous task. A new national center at Sargent College dedicated to tackling arthritis, the most common chronic musculoskeletal condition among adults, could restore such simple pleasures—and many others.

Funded by a $4 million, five-year grant from the National Institute on Disability and Rehabilitation Research, the Center for Enhancing Activity & Participation among Persons with Arthritis (ENACT) will explore ways of keeping arthritic people active and able to pursue their regular activities.

"Advances in medication over the past decade have been tremendous, and people with arthritis and rheumatic conditions are much better off," says the center's director, Associate Professor Julie Keysor. "But people still have pain and functional limitation, so there's a huge need for effective rehabilitation programs."

That's something Keysor knows from personal experience—she and her daughter both have the often disabling condition. Keysor's own combat with arthritis began in her mid-twenties after an injury and a series of knee surgeries. Of the more than 100 types of arthritis, Keysor suffers from the most common, osteoarthritis, which can also result from aging, obesity, or joint-stressing activities. Her daughter has psoriatic arthritis, a type that afflicts some people with psoriasis, although most children with the disease have juvenile rheumatoid arthritis.

The center, which includes an international advisory board and faculty from BU's Sargent College, School of Medicine, and School of Public Health, will soon begin research on rehabilitative and behavioral strategies for coping with the disease, focusing on three major studies. One will seek to help people with arthritis remain working. Another will research "physical activity adherence," or ways to motivate people to stick with strength-training and aerobic exercises that can mitigate arthritis. Finally, an epidemiological project will measure how patients fare after knee surgery. Researchers will be supported by four predoctoral fellows—an important step, according to those behind the center, because of a severe shortage of doctoral trainees in the field.

Julie Keysor

For those 46 million people in the U.S. with arthritis, including Keysor and her daughter, the center's work will be measured in simple terms—the opportunity to live active, pain-free lives.

*This article was originally published in the **2011** edition of Sargent's alumni magazine,* Impact.

Get Research Updates

Join the Center for Enhancing Activity & Participation among Persons with Arthritis's mailing list at **www.bu.edu/enact/contact-us**.

MD-Style Residency for Therapists

By Sheryl Flatow

Sargent College has become the first school in New England to offer a Neurologic Residency Program for physical therapists, an intensive year of study and training that puts new clinicians on the fast track to becoming experts in their field.

"Traditionally, once you graduate from physical therapy school it takes about a decade to become an expert and be ready for your board exams," says Clinical Associate Professor Terry Ellis, director of the new program. "Now the profession is moving toward developing residency programs that are similar to the medical model. Our program takes recent graduates and people who have been practicing for a year or two and provides them with very pointed experiences and expert mentoring in all the relevant areas. At the end of the year, they should be prepared to sit for the board exam, which designates one as having more clinical expertise."

BU is teaming with a consortium of West Coast hospitals and the University of Southern California—which developed the syllabus with Ellis's help—and is collaborating with Braintree Rehabilitation Hospital and Beth Israel Deaconess Medical Center, both in the Boston area, to provide the clinical training. The curriculum includes 30 hours a week of clinical practice, with five hours of one-on-one mentoring and weekly interactive webinars with established practitioners. "The idea is that the consortium will be tapped into by multiple residents all over the country who will be building a professional network," says Ellis.

The first two students to enroll in the program at BU will spend six months working at Beth Israel, an acute care hospital, and six months at Braintree, working with longer-term rehab patients. They'll also assist Ellis at BU's Neurorehabilitation Center doing research and community service. "Our goal," says Ellis, "is to train the next generation of leaders."

Students observe Terry Ellis working with a patient.

Find Out More

Take an in-depth look at the residency program at **www.bu.edu/ptresidency**.

Clinical rounds—in a Sargent classroom.

An Insight into Interdisciplinary Care

By Jennifer Burke

The mother of a child with autism sits in a Sargent College lecture hall before an audience of graduate students. She has come to tell her family's story and give students an honest look at how autism can impact a family. She tells them she wants to be a parent and not a therapist; she simply wants her family to live their lives.

After her presentation, a panel of faculty members from the College's programs in speech-language, occupational therapy, physical therapy, and nutrition assesses the case and recommends various treatment approaches.

This special event, Interdisciplinary Grand Rounds, is offered to graduate students once a semester and mirrors the "rounds" that commonly take place at hospitals.

The concept was developed by Elizabeth Gavett, clinical associate professor in the Department of Speech, Language & Hearing Sciences, and Ellen Cohn, clinical professor in the Department of Occupational Therapy. They had found that students—so immersed in their individual studies—were not interacting with their peers in other fields.

"We're preparing these professionals to work in health care environments," says Cohn, "and most health care environments are interdisciplinary."

In clinical care, teams of specialists work together, and the rounds give practitioners-in-training a chance to learn what other specialists bring to the table.

"So often in students' early preparation they learn a lot of theory in class, and it's wonderful for them to see patients and connect the theory to what they're going to be practicing," says Gavett.

Since the rounds began in 2007, students have seen patients with a range of illnesses, from aphasia to traumatic brain injuries. According to Gavett, the most memorable was a 62-year-old man with Parkinson's disease who not only showed "that the patient is the expert on his condition and an essential part of the interdisciplinary team," but was also the first patient to take part in the rounds, proving just how powerful such a class can be.

Taking a Run Against Parkinson's

A NATIONAL CENTER FOR PEOPLE WITH PARKINSON'S IS USING EXERCISE TO HELP KEEP THE DISEASE'S SYMPTOMS AT BAY.

By Sheryl Flatow

It's unlikely that most people took notice of runner No. 21173 in the 2011 Boston Marathon, 66-year-old Peter Bleiberg. But he was definitely worth a look. Three years ago, Bleiberg placed 229th out of 801 finishers between the ages of 60 and 64, with a time of 3:58—the exact same time he posted in the 2006 Vermont City Marathon.

Between those two races, Bleiberg (a 1980 graduate of the BU School of Social Work) was diagnosed with Parkinson's disease.

Bleiberg, who has been a runner for 40 years, is an active testimonial for Sargent College's National Resource Center for Rehabilitation, which advocates exercise and rehabilitation in managing and improving the quality of life and day-to-day function of people with Parkinson's disease.

"We're trying to promote intense exercise early in the course of the disease," says Clinical Associate Professor Terry Ellis, a leader in neurological physical therapy research and the center's director. "It's a paradigm shift in the way we think about the role of exercise in people with Parkinson's disease. It's much more of a preventative approach. With a progressive neurological disease, most people think their fate is inevitable, so why exercise? But there's a lot that you can control. And if you can change the slope of decline a bit, that can impact your day-to-day life quite significantly.

"Our message to people with Parkinson's is to stay active and exercise at a high intensity. For some people, high intensity is marathon running. For others, it's walking."

The resource center, sponsored by the American Parkinson Disease Association (APDA), was established in January 2010 as an outgrowth of Sargent's Community Wellness Programs and is the first of its kind in the country. Physical therapists conduct research, run group exercise programs, do consultations, and field questions via a toll-free helpline and email, directing callers to programs in their area. Once a year, the center hosts a two-day seminar for health care professionals to learn about the latest advances in treatment.

< **Thanks to an exercise program at Sargent, Peter Bleiberg still runs marathons—despite suffering from Parkinson's disease.**

"When we started this research about a decade ago, nobody was asking whether exercise might actually help people maintain their function and quality of life longer despite the presence of a degenerative disease," says Ellis. "We've contributed to this literature, and we know that people can make short-term gains. People walk better and faster and have more endurance. They can stand up from a chair better. They can get in and out of bed better. They gain strength, range of motion, and flexibility. The question now, and the emphasis in research now, is whether they can maintain exercise over the long term, and whether that will lead to long-term gains."

When Bleiberg was diagnosed with Parkinson's, he assumed it would put an end to his running. Once he learned otherwise, he went to the resource center, where he received an evaluation and learned exercises that he incorporated into his workout. "The exercises help me get loose and strengthen certain areas, especially the core, so that I'm not stooping over, which is a natural progression of Parkinson's," he says.

Bleiberg is a self-starter who has always put a premium on exercise, but a majority of people diagnosed with Parkinson's find that they need the structure of a group to fully commit to working out. Based on the results of their research, Ellis and her colleagues have developed exercise programs that include stretching, strengthening, and cardiovascular activities. The classes are now given at 14 locations around New England and some of them include speech therapy, as people with Parkinson's disease tend to have hypophonia.

"WITH A PROGRESSIVE NEUROLOGICAL DISEASE, MOST PEOPLE THINK THEIR FATE IS INEVITABLE, SO WHY EXERCISE? BUT THERE'S A LOT THAT YOU CAN CONTROL. AND IF YOU CAN CHANGE THE SLOPE OF DECLINE A BIT, THAT CAN IMPACT YOUR DAY-TO-DAY LIFE QUITE SIGNIFICANTLY."
TERRY ELLIS

"The exercise programs run for six or eight weeks, and they're typically offered cyclically," says Ellis, who has also launched, in conjunction with neurologists at Boston Medical Center, a unique inpatient rehab program at Braintree Rehabilitation Hospital, Massachusetts, for people with Parkinson's disease. "Some people take the exercise programs over and over because they don't like to exercise on their own or they need somebody with expertise. We encourage people to continue exercising at home. But in this population, you have a lot of mobility challenges, there's a higher instance of depression, and there are motivation issues inherent in the disease."

Jack Farina was diagnosed with Parkinson's seven years ago and his symptoms are far more advanced than Bleiberg's. He has participated in the exercise program at BU, and his daughter, Paula, says the effect is obvious: "He has more energy, he's not as sleepy during the day, he sleeps better at night, and he's in a happier mood. When my father is active, he doesn't need to see the doctor as often, he doesn't need as much medication. The disease is definitely progressing, but doing all the exercise and therapy keeps it at bay a little bit."

Paula Farina and Bleiberg believe that physicians do not do enough to encourage exercise; they found out about the resource center not through neurologists, but through the APDA. "Physical activity is underrated in the world of neurology," says Bleiberg. "They don't discourage exercise, but for them it's the disease model rather than the health model."

Ellis is hoping the center will help change conventional thinking. "Exercise is safe, effective, and available," she says. That's a message she takes to the classroom and the next generation of therapists, too, giving students the benefit of her clinical and research experience. "We know the short-term gains, and at the center we have the expertise to tailor exercise programs to meet the individual needs of people with this very variable disease."

WEB Extra

Watch Terry Ellis present the case for making exercise part of the routine care of people with Parkinson's at **www.bu.edu/sargent/ellis-wagenaar**.

Muscle Memory

A STUDENT'S RESEARCH ON THE WIRING BETWEEN OUR BRAINS AND THE MUSCLES IN OUR HANDS AND LEGS COULD HELP MORE PEOPLE STAY ACTIVE LONGER.

By Jessica Ullian

In the Motor Unit Lab, Farah Zaheer is using noninvasive technology to test the relationship between the brain and fine-motor muscles.

Even as a student, Farah Zaheer ('12) has already taken her research where few rehabilitation scientists have dared to: deep into the muscle fibers of a squirming seven-and-a-half-year-old, without so much as a needle stick.

Zaheer, who works in the Motor Unit Lab at BU's Neuro-Muscular Research Center, is studying how the brain's relationship with fine-motor muscles in the hand and stability muscles in the leg changes—and typically degenerates—with age. A few years ago, such tests were conducted by inserting sensors into the muscle fibers using needles. But Zaheer and her colleagues are the first generation of students to benefit from new technology developed with the aid of BU professors: a surface sensor that collects as much as ten times the data without ever breaking the skin. It's an innovation, doctoral student Zaheer says, that has allowed her to perform her muscle-force tests on volunteers ranging from ages 7 to 86, and that will change our understanding of how our muscles develop and decline.

"Researchers have always focused on healthy, adult control groups, and there wasn't a continuum to see what happens in between the other stages," she says. "Filling in the gaps from the developmental stage to the degenerative stage will paint a more complete picture."

The new data could mean more targeted rehabilitation programs for the elderly—an increasing health and quality-of-life concern with U.S. life expectancy at an all-time high. To get the answers, Zaheer sits research volunteers in a chair that resembles a gym's leg-extension machine with an added feature: an armrest with a splint isolating the thumb from the rest of the hand. They're asked to contract the first dorsal interosseous muscle, which is between the thumb and forefinger on the back of the hand, at minimum, average, and maximum force; then the same for the vastus lateralis, which is at the front of the thigh. By contrasting these two very different muscle groups, Zaheer can compare how the brain issues commands for dissimilar tasks, such as using a fork versus standing upright. When the data is applied to the study of aging, it could lead to the development of precise interventions to improve control of specific muscles. For both a clinician seeking to help a patient self-feed and another trying to help a patient walk, that's good news.

"You don't want to say, 'aging does X to muscles.' That would be too broad a statement, because the needs are different in a hand than they are in a big leg muscle," says Research Professor Serge Roy ('81, '82), Zaheer's advisor. "The wiring between the brain and the muscle is the other half of the story; it's more precise, and [improving our understanding of it could help us] design the exercises or interventions that may be more specific to restoring that wiring. So we don't give up on people who are 80 or 90; we say, 'We can tailor an exercise to this individual and get a response regardless of their age.'"

"RESEARCHERS HAVE ALWAYS FOCUSED ON HEALTHY, ADULT CONTROL GROUPS, AND THERE WASN'T A CONTINUUM TO SEE WHAT HAPPENS IN BETWEEN THE OTHER STAGES. FILLING IN THE GAPS FROM THE DEVELOPMENTAL STAGE TO THE DEGENERATIVE STAGE WILL PAINT A MORE COMPLETE PICTURE."
FARAH ZAHEER

The applications of such new technologies aren't limited to the study of aging, either. Sargent faculty members are collaborating with BU's College of Engineering, for example, to develop a watch-sized device with an accelerometer and a gyroscope that collects movement data and wirelessly transmits it to a patient's doctors.

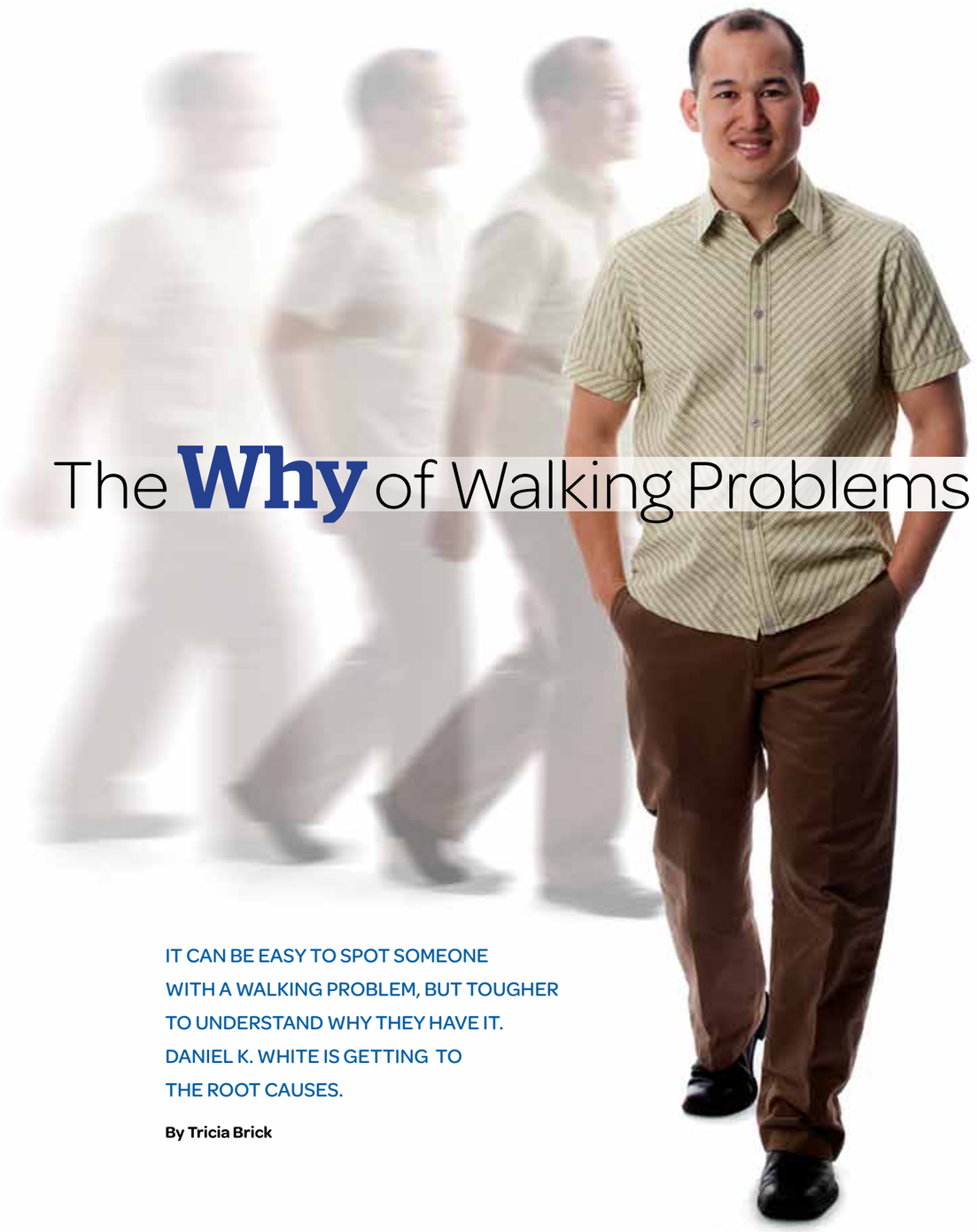
"It will allow us to directly measure what a person's level of activity is, because a very important issue in rehabilitation is how to measure improvement in home and community settings," says Robert Wagenaar, director of the Doctor of Rehabilitation Sciences Program. "It will also measure, when a physical therapist gives some instruction, whether the patient is compliant."

Such interdisciplinary approaches are a hallmark of Sargent's doctoral program, where students are encouraged to gain a better understanding of their colleagues' projects and learn how to communicate effectively about their own.

"In clinical practice, people from different disciplines work together in intervention programs designed for individual clients," explains Wagenaar. "Therefore, it's important they know what the different perspectives are, and where the other participants are coming from in terms of their theoretical framework."

The promise of such interactions is exactly what lured Zaheer to Sargent College. An undergraduate physicist at MIT, she became fascinated with the body's neuromuscular wiring when she was asked to help design a sensor interface that mimicked the kinetics of a monkey's grasp. When it came time to choose a doctoral program, she says she knew she wanted to be at the intersection "of math, science, and rehabilitation."

Three years later, she—and squirming seven-and-a-half-year-olds—have reaped the benefits. With an engineering team working on the technology that allows her to collect forty motor units (the measurement baseline for groups of muscle fibers) at a time—up from three or four using the old sensors—she's free to focus on gathering data from a newly widened range of subjects, examining results, and drawing conclusions about future interventions to keep older Americans writing and walking with greater ease.



The **Why** of Walking Problems

IT CAN BE EASY TO SPOT SOMEONE WITH A WALKING PROBLEM, BUT TOUGHER TO UNDERSTAND WHY THEY HAVE IT. DANIEL K. WHITE IS GETTING TO THE ROOT CAUSES.

By Tricia Brick

As a newly minted physical therapist working with inpatients at the Braintree Rehabilitation Hospital in the Boston suburbs, Daniel K. White ('98, '00, '07) often wished he could peek into his patients' lives outside of the clinic. A patient who could barely walk during therapy sessions reported finding her balance easily in the comfort of her own home, while another who moved confidently across the clinic's smooth linoleum floors was stymied by the unpredictable terrain of the world beyond the hospital doors. White realized that his patients' success out in the community was influenced by more than just the physical challenges he was helping them to negotiate in the clinic; factors from balance confidence to social support systems also seemed to significantly affect their progress.

White, who today is a Sargent research assistant professor studying knee osteoarthritis, continues to be interested in how physical factors, such as pain and obesity, and psychological factors, such as optimism and depression, affect patients. "For me, doing several years of clinical practice instead of going straight from a physical therapy degree to research was critical," says White, who earned his bachelor's, master's, and doctoral degrees from Sargent. "The crux of clinical research is going beyond the mechanisms of disease and instead asking, 'What are the most salient issues we need to tackle to, ideally, improve patient outcomes?'"

"IF SOMEBODY COMES IN COMPLAINING OF KNEE PAIN, WHAT IMPLICATIONS MIGHT THAT HAVE FOR BEING HEALTHY? AND IF THE PATIENT IS ALSO DEPRESSED, WHAT IMPLICATIONS MIGHT THAT HAVE?"
DANIEL K. WHITE

Through a study of 1,800 patients diagnosed with or at high risk of developing knee osteoarthritis, White aims to shed light on the factors that can affect patients' day-to-day walking. He will consider a wide spectrum of potential causes for a decline in habitual walking, looking beyond pain and disease to consider factors from muscle strength to emotional vitality and optimism.

The focus on walking dovetails with White's concern for the connections between disease and overall well-being. A primary predictor of general health among older adults, walking has been shown to play a role in preventing or managing a range of conditions, including diabetes, obesity, cardiovascular disease, depression, arthritis, and certain cancers. New research continues to support the correlation between walking and good health: A paper published in January 2011 in *The Journal of the American Medical Association* identified a direct association between faster walking speeds and longer life expectancy among adults over age 65. Walking also prevents social isolation, allowing older people to remain independent and engaged in their communities.

The study of walking among people with knee osteoarthritis is particularly important because the disease can lead to pain and functional limitations that make walking difficult. But White's project has also been designed to allow for the likelihood that the effects of pain and mechanical impediments are not uniform. "It may not be a universal truth that just because you have knee osteoarthritis you have limitations in walking," says BU School of Medicine's Associate Professor of Medicine Tuhina Neogi, who is working with White on this project. "Even with individuals who have the same level of pain and the same functional limitations, we expect there will be differences in levels of walking due to other factors."

In the past, studies predominantly relied on individuals' self-reporting about how much walking they were doing. But over the past two years, White and his colleagues in the long-running Multicenter Osteoarthritis Study (MOST) have been taking weeklong measurements of patients' walking habits outside the clinic, using a pedometer-like device that records both distance and speed. The data will provide information about what percentage of people with knee osteoarthritis are meeting recommendations for walking for health, as well as about whether clinic-based measures of patients' walking abilities accurately reflect their day-to-day walking in the community.

To begin to understand *why* walking varies among individuals, White will focus on those patients whose habitual walking has changed significantly over the last two years. He will analyze the data in correlation with an extensive series of measures assessing variables including pain in one or both knees, radiographic evidence of disease, knee buckling, depression, catastrophizing, and balance confidence.

Through MOST, White is collaborating with a multidisciplinary team of researchers from Boston University and other institutions. "The study brings together people with a variety of different areas of expertise, including rheumatology, epidemiology, physical therapy, [and] biostatistics," says Neogi. "So this project utilizes the expertise of a group that understands osteoarthritis very well, and pain and function very well, in addition to understanding these other factors that might be less commonly seen in traditional osteoarthritis research."

This comprehensive multidisciplinary research may lead to new approaches for restoring mobility to patients with osteoarthritis; a next step might be to investigate the effectiveness of cognitive-behavioral therapy or other psychotherapeutic interventions, for example. White hopes that in time, his findings about the varied factors that can affect walking will offer new insights for physical therapists and other practitioners.

"I'd like for this research to give clinicians a better appreciation of the implications not only of disease and pain but of everyday things they see in the clinic," White says. "If somebody comes in complaining of knee pain, what implications might that have for being healthy? And if the patient is also depressed, what implications might that have?"

The answers should help clinicians support their patients in improving their walking and, in turn, their overall health—even if they only see them striding across the linoleum of a clinic floor.

Bringing the Clinic to the Classroom

FORGET THE NOTEPAD—FOR NOW, STUDENTS AT SARGENT ARE EXPECTED TO WORK WITH REAL PATIENTS.

By Sheryl Flatow

Lisa Brown brings her clinical expertise—and her patients—to Neurological Systems lab classes.

When Lisa Brown's students gather for their lab classes in Neurological Systems, they often find themselves face to face with actual patients—her patients. Brown, a clinical assistant professor, is also a practicing clinician at BU's Center for Neurorehabilitation and Spaulding Framingham Outpatient Center in Framingham, Massachusetts, and her patients play a key role in helping train her students. Like a number of active physical therapists who teach at Sargent College, Brown integrates her work in the clinic and the classroom to such a degree that she believes each would be incomplete without the other.

"I think that in order to be an effective teacher, you have to be working in a clinic," says Brown, who works with patients who have a variety of neurological problems and is particularly interested in balance and vestibular disorders. "Working with students forces you to be up on the most current evidence and to be able to explain it in different ways. And it certainly benefits your clinical practice when you have a better understanding of the most current literature. But by working in the clinic, you're always aware that the literature doesn't cover everything; people don't fit into neat groupings. So you can go back to your students with examples directly from the clinic, scenarios specific to individual patients that you don't necessarily find in books. And you can bring your patients into the classroom. It's such a unique opportunity for me, for the students, and for the patients."

According to Diane Heislein, director of the physical therapy program at Sargent, at least a half-dozen full-time faculty members are practicing clinicians. "That's not typical of most physical therapy programs," she says. "That's a unique strength of our program, and really makes our teaching very contemporary. It's not like we're living in an ivory tower and telling students, 'This is how you're going to do it.' We're treating patients; we understand what it's like to be a clinician. And the students know they're learning from the best."

In her Neuro I class, Brown teaches the basic components of a neurological exam. In Neuro II, the students learn about various diagnoses, including multiple sclerosis, Parkinson's disease, and spinal cord injury. Brown shows videotape of her patients so that students can hear them describe what their pain feels like, or what it's like to be told that they need to use a wheelchair. "That's something that can be very difficult to teach, so it's important to hear directly from the patient," she says.

But nothing is as powerful as having the patients in the classroom. "They have to apply everything they've learned and problem-solve," says Brown of her students. "Often at the end of labs, students will come up to me and say, 'I did not understand that concept until today.' Until they can actually touch it and feel it and have that conversation with the person in front of them, it doesn't become real."

Julia Baldenko ('09, '11), completing her final year in Sargent's physical therapy program with an internship at Carondelet St. Joseph's Hospital in Tucson, Arizona, concurs. "When you're starting out, you're very nervous about putting your hands on a real patient," she says. "But being able to do the exams and treatments in the classroom, in a safe environment, really increases your confidence when you go out to do it for real. I've talked to other students here in Arizona, and none of their schools has patients coming into the classroom. These students have didactic information, and they're first trying to apply it now.

"Our education at BU is really case-based and about problem solving; the professors make us go through the whole thought process of being a clinician. And one of the most important things I learned is that there aren't always clear-cut answers. That's not necessarily something you learn in a textbook."

According to Brown, patients who take part in the labs find it equally rewarding. "They love the enthusiasm of the students, and they love the effect that they have on future health care professionals," she says. "They like being able to say, 'This is what I liked about the physical therapy experience, and this is what I didn't like. If you want to be an effective clinician, this is what you need to do.' It makes so much more sense for students to hear that directly from the patient, rather than from another clinician."

"BY WORKING IN THE CLINIC, YOU'RE ALWAYS AWARE THAT THE LITERATURE DOESN'T COVER EVERYTHING; PEOPLE DON'T FIT INTO NEAT GROUPINGS. SO YOU CAN GO BACK TO YOUR STUDENTS WITH EXAMPLES DIRECTLY FROM THE CLINIC, SCENARIOS SPECIFIC TO INDIVIDUAL PATIENTS THAT YOU DON'T NECESSARILY FIND IN BOOKS." LISA BROWN

Brown has had the opportunity, both at the Center for Neurorehabilitation and at Spaulding, to work side by side with some of her students. In those settings, the relationship between student and professor takes on a new dynamic. "I treat them as colleagues," she explains. "I'm not constantly asking questions or telling them what to do. I'm building a relationship: how can we work together to solve a patient's problem? I ask for their input. I think students have incredible insight, but they don't always trust it; I find that changes when they're put into a leadership role. So I try to let them be the ones taking charge of the patient. They feel like they're being treated as professionals, and it gives them the confidence to then go out and be their own clinician."

Heislein adds, "When your students have the opportunity to work with you in a clinic, they see you in a different light. I think it helps inspire them."

WEB Extra

Watch Lisa Brown's students in action as they work with a patient with MS at **www.bu.edu/today/node/12593**.

THE RACE FOR A NIMBLE OLD AGE

HIP PAIN? WITH CARA LEWIS'S ROBOTIC EXOSKELETON YOU MIGHT BE ABLE TO WALK IT OFF.

By Patrick L. Kennedy

You were taught to read and write. You were taught to do arithmetic. But chances are, you taught yourself to walk. And quite possibly you got it all wrong. Sure, you get from point A to point B. But you might also be damaging your hip. As a result, you could be on track to needing a hip replacement someday, according to Cara Lewis, an expert on gait and the musculoskeletal causes of hip pain. Fortunately, she's built a robotic device that can be used to teach both the healthy and the injured how to correct a hip-battering walk.

"My goal is to intervene early on, so that osteoarthritis doesn't progress—or doesn't even develop," says the assistant professor of physical therapy.

"There are a lot of questions in physical therapy that we don't know the answers to, like why one treatment works and another doesn't. I kept running into that as a clinician." So she got a PhD in Movement Science.

Lewis's biggest questions as a therapist were, "Why do people have hip pain, and how can I fix it?" The answers could help a sizeable population: Nearly 200,000 hips are replaced in the United States every year.

After completing her degree with a concentration in biomechanics, Lewis undertook postdoctoral work with kinesiology expert Dan Ferris at the University of Michigan, Ann Arbor. In a study of types of gait, Lewis and Ferris determined that walkers who push off harder from the foot take the stress off their hip joints.

< **Every year, nearly 200,000 hips are replaced in the U.S. Changing the way we walk in our 20s could spare us that late-life pain, says Cara Lewis.**

"You can experiment with this on the street," Lewis says. "If you push more with your feet, your legs kind of launch *themselves* forward."

Conversely, walkers who unwittingly rely on hip torque to swing their legs forward are using energy much less economically, Lewis says. They're also, by repeatedly straining the hip muscles, putting themselves at risk of injuring the tissue in their joints.

Hip pain can't be written off as a burden of old age, a sign of wear and tear. That wouldn't explain the increasing number of young people, especially runners and other athletes, who are now being diagnosed with acetabular labral tears. A source of hip pain that has been recognized only recently, labral tears heighten the risk of developing arthritis in the hip earlier than expected, says Lewis.

The labrum is a ring of fibrocartilage attached to the rim of the acetabulum, the hip socket in which the femur sits. "The labrum is some of the tissue that helps add stability, similar to that in the shoulder," says Lewis.

"MY GOAL IS TO INTERVENE EARLY ON, SO THAT OSTEOARTHRITIS DOESN'T PROGRESS—OR DOESN'T EVEN DEVELOP."
CARA LEWIS

The repetitive stress from an improper gait, Lewis believes, will cause hip pain, "which then progresses to a labral tear; you then start losing stability in the joint, which then leads to the arthritis—which [may result in the need for] a hip replacement. The replacement might be happening when you're 60, but it's because of something you did when you were 30.

"That's the population [20- and 30-somethings] to target. If you change the way they're walking now, you can change their pain after they already have a tear—or maybe change it *before* they get the tear." The way lies in "identifying the people who are at risk for the tear and changing their mechanics."

But how do you change the mechanics of a person's gait?

For Lewis, the answer came in Michigan while she worked with Ferris on robotic exoskeletons for the ankle joints.

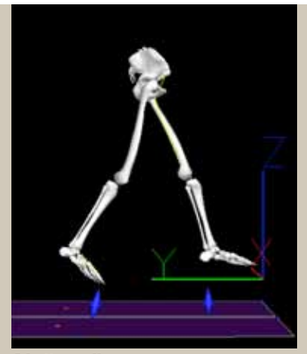
"Because of advancements in orthotic materials, in actuator technology," Lewis explains, "we were able to finally move the technology to doing work at the hip joint."

Lewis built a robotic orthosis, a pneumatically powered exoskeleton—more on the air tanks that power it later—consisting of a brace each for the waist and two legs. An orthosis is any device that supports or corrects limb or torso movement; splints and arch supports are orthoses.

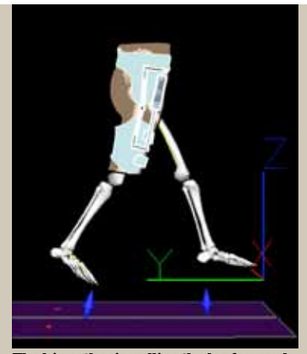
Whereas Ferris focuses on studying how people walk, Lewis wants to change the way people walk. "She's in virgin territory," says Ferris. "She's using an orthosis for motor retraining rather than for assistive technology…that's what's novel."

In a newly built lab at Sargent College, where Lewis has been teaching since fall 2009, healthy subjects wear the orthosis while walking on a custom treadmill with two plates measuring force separately for the left and right foot. Electrodes on their legs record their muscle activity. And they are >>

A lazy walk.



A better walk.



The hip orthosis pulling the leg forward.

Capturing Walking Styles
The graphic representation of a patient's skeleton is generated by a special computer program in Assistant Professor Cara Lewis's lab in BU Sargent College's physical therapy department. "The representation allows us to measure the hip angle," says Lewis. In the first image, the hip and upper leg are dragging behind when compared to the second image (without the benefit of Lewis's sophisticated software or trained eye, you may need to look closely). "From the hip angle, we can see if the person is going into too much hip extension—the lazy walk." Lewis can then use a robotic orthosis powered by pressurized air tanks to "keep someone from getting into that bad position." Computer-generated images courtesy of Cara Lewis.

In the Lab
Eight cameras follow reflective markers on a subject and feed the data into a computer program. "The camera system and split belt treadmill make this lab unique," says Lewis.

>> covered in reflective markers monitored by several motion-capture cameras.

"The computer system picks up the marker positions, and then can re-create a model of the skeleton," Lewis explains. "From that we can tell differences in angles, and figure out when we want to apply the robotic force, and how much."

That means when subjects exhibit what Lewis calls "the lazy walk," in which they're straining their hips by using them to swing one leg forward while the other leg lags far behind, Lewis presses a button. Air from a large pressurized air tank bursts into the orthotic actuators and corrects their gait.

"It'll start bringing your leg forward sooner," Lewis says, "so it keeps you out of that bad position" more effectively than verbal direction does.

Then, "Because I have such precise control over the timing and amount of assistance, I can wean people off of the bad position," Lewis says. "And then they can walk normally on the street."

Currently the lab is for research, not intervention. But Lewis envisions a time when this system is replicated in clinics all over. If you were recovering from a hip injury, you could make regular visits to a clinic to work out on the treadmill until you'd trained yourself to walk better. Furthermore, Lewis hopes, healthy people could use the orthosis to *prevent* a hip injury from ever happening.

No one can say whether this will work, because nobody's ever tried it, says Ferris. But if anyone can pull it off, it's Cara Lewis. "Most physical therapists—in fact, virtually all—do not have the level of technical understanding in terms of quantitative biomechanical analysis that she does," Ferris says. "She has a unique background that's going to really set her up for success regardless of what project she undertakes."

*This article was originally published in the **2010–11** edition of Sargent's annual magazine,* Inside Sargent.

WEB Extra
From digital motion capture to real-time robotics control, learn more about Cara Lewis's lab at **www.bu.edu/sargent/human-adaptation-lab**.

Staying Ahead of **BACK PAIN**

TEACHING, PRACTICING, AND SPREADING THE WORD ABOUT A MORE EFFECTIVE APPROACH TO SOLVING BACK PAIN.

By Patrick L. Kennedy

When it comes to back pain, things are not what they seem.

For example, your spine might have a herniated disc, without your even knowing it—up to 35 percent of us have the bulging or ruptured discs, without feeling any pain.

But, if you do have back pain, and an MRI shows that you have a herniated disc, *that doesn't mean the herniated disc is causing your back pain.* The pain's provenance may remain a mystery.

That, according to Diane Dalton, is just one of the many quirks of low back pain—all reasons health care practitioners should stop being so quick to order MRIs and prescribe catch-all medications.

Dalton is a clinical associate professor and orthopedic certified specialist who teaches in Sargent College's Doctor of Physical Therapy program and treats patients at the Boston University Physical Therapy Center.

She's also a proponent of a new and more targeted, methodical system of managing back pain, one grounded in evidence.

"My biggest interest is in changing practice," says Dalton. "Low back pain is very common. As many as 85 percent of adults will have at least one major episode of low back pain in their lifetime. So it's pretty prevalent. And the practice for treating it is very, very varied. That doesn't speak well to our ability to treat something that's so common."

Because the spine is such a complex structure, and low back pain is seldom attributable to any known pathology, the conventional reliance on patho-anatomical diagnoses has proven inadequate, Dalton says. Primary care providers and physical therapists will have more success using what's known as the treatment-based classification approach to low back pain.

In this system, clinicians sift patients into subcategories and treat them according to what has been shown to work for other people in the same grouping (that is, other people with the same combination of symptoms and characteristics).

Patients are sorted into these subtypes based on data gleaned through a meticulous regimen of inquiry and investigation (patient history, detailed questionnaires, movement tests). In the relatively few cases where certain "red flags" pop up, Dalton says—for example, in addition to back pain, the patient has also experienced rapid weight loss or bladder control problems—then he or she may be referred to an appropriate specialist to test for cancer or other serious conditions. But for the majority of cases, the focus is on determining combinations of variables such as "the location of the pain, whether the onset is recent, the patient's age," Dalton says.

Diane Dalton

For example, a study published in *Annals of Internal Medicine* in 2004 demonstrated that patients who had experienced pain for less than 15 days, had no pain below the knee, and had a hypomobile (stiff) spine—and *only* patients with those traits—benefited from a manual manipulation therapy called a grade 5 thrust, which physical therapists use to mobilize sections of the spine. So now, physical therapists can reliably predict that patients who match that profile are likely to benefit from that manual manipulation therapy.

"It's an actual change in the way we look at something, from start to finish," says Dalton. "The treatment-based classification was first described by Anthony DeLitto and colleagues in 1995 and has been tested and altered over the years. Still, its use is not as widespread as we would like it to be."

But Dalton is one of a growing number of adherents. And she's not only using the system to help her patients at the BU Physical Therapy Center, she's also disseminating the research among the future clinicians who are her students.

Furthermore, Dalton has begun a continuing education program to spread the word to veteran therapists as well. In weekly meetings [in summer 2010], she guided groups of working clinicians—many of them her former students—through the latest literature.

"One of the things I try to teach my students is that it isn't simply about what they're learning this minute," Dalton says. "It's also about staying up with the constant developments in the field, because what I teach this year is different from what I taught last year; probably only a small amount, but a lot different from what I taught ten years ago.

"And this particular area, low back pain, because of the costs associated with it to our country"—billions of dollars every year—"has tons and tons and tons of research looking at it. So what we should be thinking about and doing changes all the time."

Keeping up with those changes is hard for the average, harried therapist. But "one of the great things about the system at BU," Dalton says, "is that it's easy for [teaching faculty] to team up with clinicians up the street [at the BU Physical Therapy Center], and the clinicians to come down and teach in our labs, so the students are getting some real-life experience and guidance, and the clinicians are getting really good firsthand knowledge and staying up-to-date with the field."

And ultimately, Dalton adds, "the patients benefit."

*This article was originally published in the **2011** edition of Sargent's alumni magazine,* Impact.

The Keys to Better Treatment
For more information about the treatment-based classification approach to low back pain, contact Diane Dalton at **ddalton@bu.edu**.

Physical Therapy Program: Faculty

Lois Benedetti Adjunct Faculty Lecturer

Lisa Brown Clinical Assistant Professor

Diane Dalton Clinical Associate Professor

Carlo De Luca Professor and Director, NeuroMuscular Research Center

Terry Ellis Clinical Associate Professor

Diane M. Heislein Clinical Associate Professor

Kenneth Holt Associate Professor

Karen Hutchinson Clinical Associate Professor

Alan Jette Professor and Director, Health & Disabilities Research Institute

Julie Keysor Associate Professor

JoAnn Kluzik Assistant Professor

Cara L. Lewis Assistant Professor

Lee Marinko Clinical Assistant Professor

Jessica Maxwell Clinical Assistant Professor

Mary Palaima Clinical Associate Professor

Jean Peteet Clinical Assistant Professor

Serge Roy Research Professor, Neuromuscular Research Center

Elliot Saltzman Associate Professor

Trace Sears Clinical Instructor

Mike Severo Adjunct Faculty Lecturer

Julie Ann Starr Clinical Associate Professor

Robert Wagenaar Professor

Daniel White Research Assistant Professor

Rebecca White Adjunct Faculty Lecturer

New Post-Professional Opportunities

Sargent College has a range of new post-professional educational opportunities for students and practitioners who want to continue their studies in arthritis or neurology. If you're ready to push yourself to the next level—or if you know someone who wants to kick start or accelerate their career—visit www.bu.edu/enact/fellowships and www.bu.edu/ptresidency to find out more and apply.

Center for Enhancing Activity and Participation among Persons with Arthritis (ENACT)

ENACT has a number of doctoral fellowships available. Health professionals whose research interests include promoting activity and participation outcomes among adults with chronic conditions—including arthritis—should consider these fellowships. ENACT's accomplished faculty are national and international leaders in clinical research, rheumatology and rehabilitation research, and education. To find out more, visit www.bu.edu/enact/fellowships.

Neurological Physical Therapy Residency Program

In collaboration with Beth Israel Deaconess Medical Center and Braintree Rehabilitation Hospital, Boston University's Neurological Residency Program offers licensed physical therapists the opportunity to elevate their level of clinical practice, further their careers, and become leaders in the field. For more information, visit www.bu.edu/ptresidency.

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If you'd like to learn more about the physical therapy programs at BU Sargent College, we'd like to hear from you. To speak with a professor or student, make an appointment to visit the campus, or find out more about degree programs, financial aid, and degree requirements, please contact us:

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