

2019-2020

InsideSargent

Boston University College of Health & Rehabilitation Sciences: Sargent



**MENTORING THE
NEXT WAVE OF
EDUCATORS AND
RESEARCHERS**

TEACHING TOMORROW'S PROFESSORS



A map to understanding autism and schizophrenia, P 14

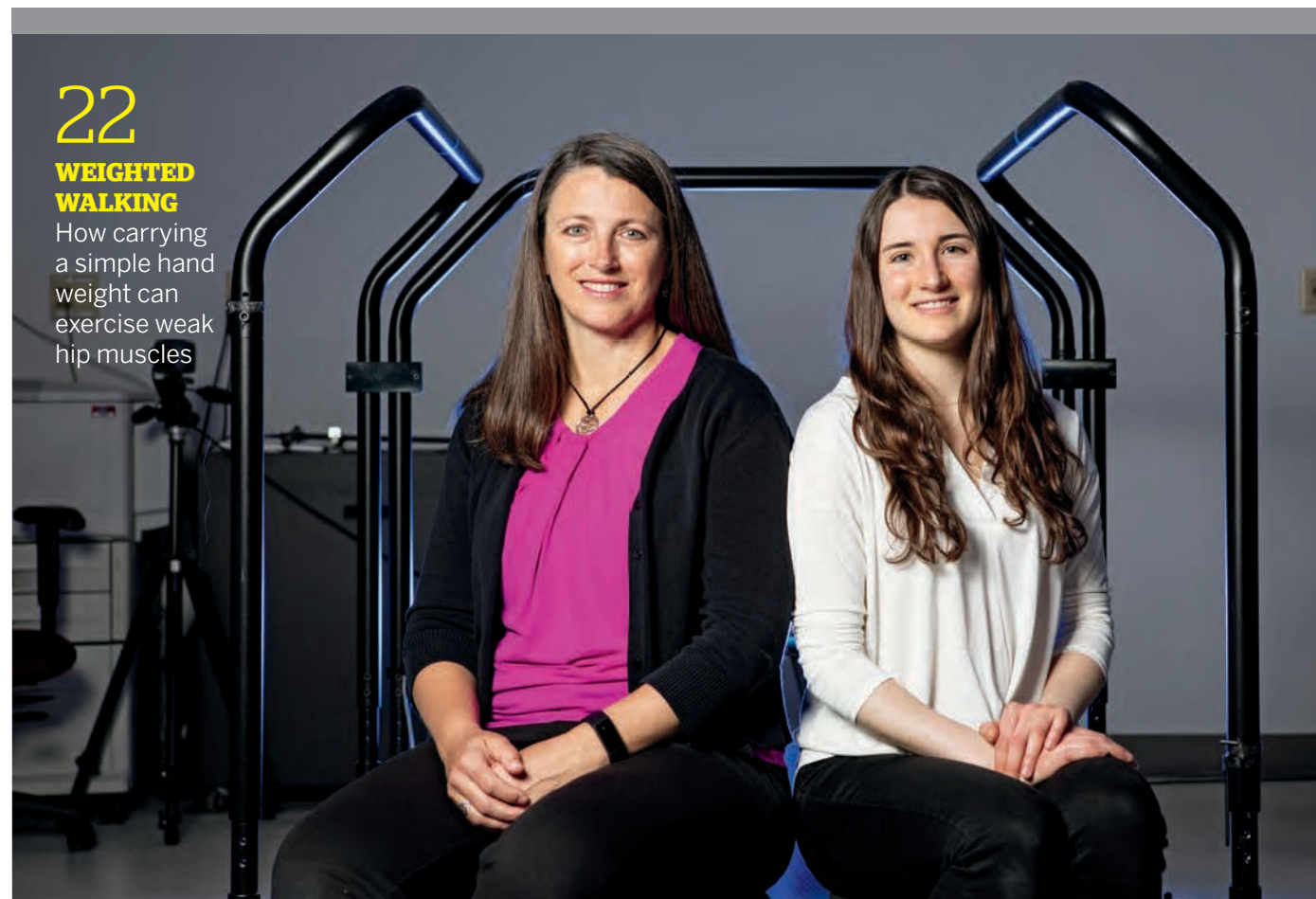
Students integrate speech therapy and preschool play, P 16

An analytical approach to physical therapy, P 20

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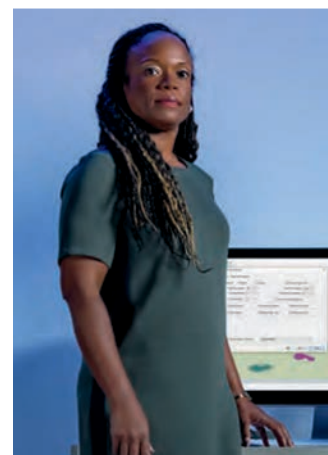
Boston University College of Health & Rehabilitation Sciences: Sargent College



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2019 Meredith E. Drench Lecture

Watch Donald Berwick discuss the connection between inequity and health, in a video at go.bu.edu/sargent/inside-sargent.

Circling the Globe

See a slideshow of students participating in International Service Learning Programs around the world at go.bu.edu/sargent/inside-sargent.

Research News

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InsideSARGENT

2019-2020



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About
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Dean's Message



“Whether through data analytics, innovative collaborations, or mentorship of our student researchers, we’re working to solve the healthcare challenges of today—and those we’ll face tomorrow.”

Dear Friends,

What a year it’s been for Sargent College!

This fall, we welcomed two new department chairs: Associate Professor Terry Ellis in physical therapy and athletic training (PTAT) and Clinical Professor Michelle Mentis in speech, language, and hearing sciences (SLHS). Our fundraising campaign concluded with record-breaking and far-reaching impact, expanding our endowed professorships, scholarships, and fellowship opportunities (see page 7 for more about this). And our faculty continue to be honored as the best in their fields, particularly by our professional associations: Clinical Professor Ellen Cohn delivered the American Occupational Therapy Association’s Eleanor Clarke Slagle Lecture this spring; Clinical Associate Professor Julie Starr was honored as a 2019 Catherine Worthingham Fellow by the American Physical Therapy Association; and two members of our SLHS faculty—Mentis and Associate Professor Cara Stepp—were named lifetime Fellows of the American Speech-Language-Hearing Association. Most notably, Stepp and Adjunct Associate Professor Conor Walsh each received the Presidential Early Career Award for Scientists and Engineers.

Our faculty aren’t the only ones making an impact. At Sargent, one of our most important objectives is developing today’s students into tomorrow’s colleagues. In particular, our PhD and doctoral students participate in research, mentoring, and interdisciplinary collaborations, preparing them to be the next generation of health and rehabilitation leaders. In “Tomorrow’s Professors” (page 10), you’ll read about three exceptional SLHS PhD students gearing up for the next phase of their academic careers. In occupational therapy, Danny Shin (’22), a PhD candidate in rehabilitation sciences, is working with Associate Professor Simone Gill to study the relationship between walking and self-confidence (page 8). And doctor of physical therapy student Kerri Graber (’17;’19) is developing

expertise in biomechanics under the mentorship of Associate Professor Cara Lewis (page 22).

Also in this issue, you’ll see how we’re using big data to make a big difference in patient health outcomes (page 20). Our BU Physical Therapy Center implemented a rehab outcomes management system to show patients and their clinicians a treatment plan’s projected improvement, and Assistant Professor Basilis Zikopoulos is charting the brain’s pathways, mapping characteristics of disorders like depression and autism.

I’m particularly proud that at a large research university like Boston University, our students and faculty lead an array of interdisciplinary and interprofessional (IPE) collaborations. Our IPE programming allows students across Sargent disciplines to work with, and gain an understanding of, other health professions they’re likely to encounter in their careers; there are opportunities for cross-University collaborations as well. Clinical Professor Karen Jacobs and her occupational therapy students joined forces with BU College of Engineering for a class assignment using 3-D printing to create adaptive devices—bringing two groups of problem solvers together for a common goal (page 24).

Whether through data analytics, innovative collaborations, or mentorship of our student researchers, we’re working to solve the healthcare challenges of today—and those we’ll face tomorrow. Thanks for your continued support of Sargent College and all that we do.

Best wishes,

Christopher A. Moore
Dean and Professor,
@SARDeanBU

DAN AGUIRRE

MAKING A HABIT OF EXERCISE

A FIVE-YEAR STUDY AIMS TO REVOLUTIONIZE PARKINSON'S TREATMENT

THE DATA ARE CLEAR: exercise helps people with Parkinson’s disease. “Not only is exercise good for you but it slows the progression of disability,” says Terry Ellis, an associate professor and director of Sargent’s Center for Neurorehabilitation. “It may even slow progression of the disease.”

But exercise is hard. It requires physical ability and daily motivation. “It’s not like just taking a pill,” says Ellis, chair of the physical therapy and athletic training department, who is joined by researchers at Washington University in St. Louis to study the use of an mHealth (mobile health) app to help—and even inspire—people with Parkinson’s to exercise.

Based on the success of a one-year pilot study, Ellis and her colleagues recently received a five-year, \$3.2 million NIH R01 grant to continue their work. They will follow the progress of 200 people with Parkinson’s engaged in physical therapy and who begin exercise regimens. “We’re trying to help people make exercise part of their everyday life,” Ellis says. The model of care she’s suggesting is like dental health: you see your dentist twice a year, but you also need to brush your teeth every day.

Here’s how Ellis’ treatment works: Participants begin with a series of face-to-face sessions with a physical therapist and receive a personalized set of exercises and a walking regimen to follow at home. The therapist films them doing the exercises, then creates videos with customized advice—all of which will be available in the app.

In between sessions, participants open the app on a tablet or phone to



Terry Ellis hopes that an app can help inspire people with Parkinson’s to exercise consistently.

review their daily workout, receive personalized advice, and communicate with their physical therapists. They also respond to questionnaires, grading their progress and rating the ease or difficulty of the exercises. And, says Ellis, the therapists can adjust the workouts based on this information. Even in the months between in-person sessions, “You know somebody cares about what you’re doing,” she says.

The treatment works. In the one-year pilot study, participants walked, on average, 10 percent more than baseline, compared with a 12 percent decrease Ellis found in previous studies. But, she says, “We noticed that not everybody improved.” Participants dealing with negative thoughts more frequently failed to reach their goals, she says.

That’s where Ellis’ colleague, Dan Fulford, comes in. Fulford, a psychologist and a Sargent assistant professor of occupational therapy, helped design cognitive behavioral elements for therapists to use in person and then for patients to use on the mHealth app. “The goal is to help people identify thoughts that might interfere with their walking or other exercises,” Fulford says. That meant training physical therapists in some of the techniques of clinical psychology

and designing elements of the app to positively modify behavior.

Those elements include the questionnaires, which create a sense of accountability, and a display showing the participant’s goal, providing a constant reminder of how exercise will benefit them. These goals can range from “I want to be able to travel the world” to “I want to walk my daughter down the aisle.” Users also receive feedback for tasks completed—the sort of visual validation people with Fitbits and other fitness trackers get. The aim is to help more participants stick to their regimen. “It’s the cognitive behavioral piece that we think is kind of the secret sauce for our patients who struggle the most,” Ellis says.

The study’s impact could be far-reaching. “What I hope is that we can change standard practice so that patients with Parkinson’s, when they’re diagnosed, are routinely sent to a physical therapist—and they see them every six months, just like their neurologist,” Ellis says. Beyond that, she thinks the results could even change the way chronic diseases, from arthritis to diabetes, are treated.

“Exercise is a powerful, effective treatment—and underutilized,” she says. “We just need the data to drive policy change.” — *Marc Chalufour*

JAKE BELCHER

COLLABORATIVE CARE

INTERPROFESSIONAL CURRICULUM MODELS REAL-WORLD TEAMWORK

It's a fall day, and 12 students from three Sargent College programs are bustling about a kitchen, helping people with a language disorder enjoy one of life's simpler joys: cooking.

The students—from the speech-language pathology, nutrition, and occupational therapy programs—discussed balanced diets, pored over recipes, and introduced adaptive cooking equipment tailored to the needs of clients with aphasia. This is one of several cocurricular interprofessional education (IPE) opportunities that complement Sargent's curriculum, enabling students from five disciplines—occupational therapy, physical therapy, speech-language pathology, nutrition, and athletic training—to learn from and about each other.



Students from across Sargent collaborate in the innovative interprofessional education program.

"In healthcare we are largely working in teams, and health issues are quite complex," says Craig Slater, a clinical assistant professor and director for interprofessional education and practice. "There's not one profession that usually can meet all of a patient or client's needs," Slater says. "We can introduce students to each other's disciplines and familiarize them with their colleagues' scope of practice."

Interprofessional education is relatively new, Slater says, having first emerged 20 years ago and achieved

prominence in the last 10. Accrediting bodies are increasingly interested in students with interprofessional education experience; many require it.

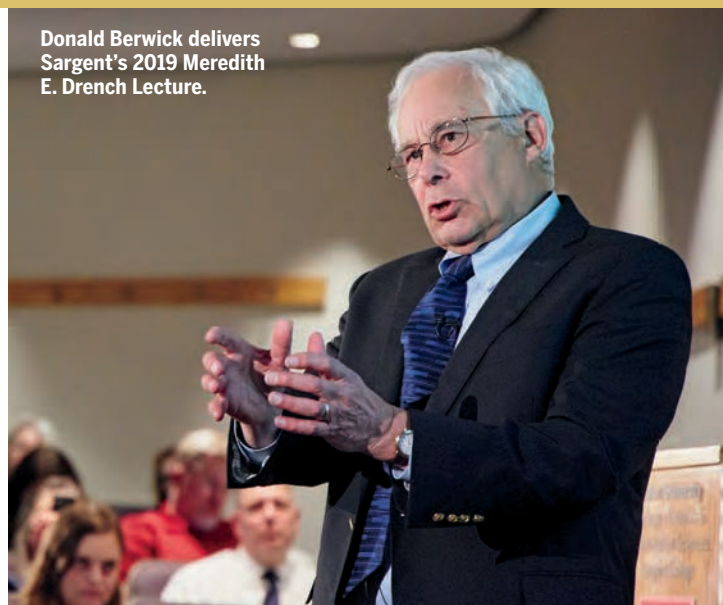
Sargent's program, which began in 2017, involves online and face-to-face module learning, as well as guest speakers, case studies, simulations, and cocurricular activities.

The end result of the fall 2018 cooking session? Guacamole, quesadillas, chicken salad, and a clinical intervention that harnessed the best of each student's chosen profession.— *Geoffrey Line*

DRENCH LECTURE WHAT A SUBWAY RIDE TEACHES US ABOUT HEALTH

"If you want to improve health, you have to reduce inequity," said Donald Berwick, a pediatrician and an expert on healthcare quality and improvement, who delivered Sargent's 2019 Meredith E. Drench Lecture, "Start Here: Getting Real about Social Determinants of Health." Using New York City's subway map, Berwick highlighted how inequality affects health. On a D Line ride from the Upper East Side of Manhattan into the Bronx, average annual household income shrinks from \$180,000 to \$45,000 and the unemployment rate doubles. Life expectancy of the nearby residents drops 2.3 years for each mile the train travels. Berwick, president emeritus and senior fellow at the Institute for Healthcare Improvement and a former Massachusetts gubernatorial candidate, argued that health isn't determined only by what happens in hospitals and doctors' offices, but instead by the conditions of our early childhood, education, career, aging, community resilience, and fairness. How can we begin to address these gaps? Find the areas of greatest socioeconomic need, Berwick said. "You start where the causes of causes lie," he said. "You start where a plague of inequality and social isolation and racism and its consequences hide and right their tragedies."

Donald Berwick delivers Sargent's 2019 Meredith E. Drench Lecture.



WebExtra Watch Berwick's lecture at go.bu.edu/sargent/inside-sargent.

DAVE GREEN

A HIDDEN PROBLEM

Broadcast journalist Soledad O'Brien visited BU to interview Paula Quatromoni, associate professor of nutrition and chair of health sciences, about the often-overlooked topic of male athletes with eating disorders. The segment, filmed for HBO's *Real Sports with Bryant Gumbel*, included a tour of BU's Varsity Athletics Strength and Conditioning Center and the Terrier Fueling Station. "[Eating disorders have] tremendous potential to be hidden and remain invisible and undetected in a male athlete," Quatromoni said, because they are stereotyped as a female problem. "How are you going to come forward and [admit you're] suffering with something that makes you feel less masculine?" The episode aired on HBO in February 2019.



Paula Quatromoni (above right) spoke to Soledad O'Brien about male athletes with eating disorders.

TOP AWARDS

Ellen Cohn, clinical professor of occupational therapy, delivered the 2019 Eleanor Clarke Slagle Lecture at The American Occupational Therapy Association's annual conference (see page 6).

Diane Constantino, clinical associate professor of speech, language, and hearing sciences, was honored with the Continued Commitment Award from the National Student Speech Language Hearing Association.

Terry Ellis, associate professor of physical therapy, received the Excellence in Research Award from the Academy of Neurologic Physical Therapy at the APTA Combined Sections Meeting.

Diane Heislein, clinical associate professor of physical therapy, was elected to the nominating committee for the American Council of Academic Physical Therapy (ACAPT).

Jerry Kaplan, a speech-language pathologist in the Aphasia Resource Center, received the Innovator Award at the Aphasia Access Leadership Summit.

EMMETT KNOWLTON/HBO

NEW FACULTY & PROMOTIONS

NEW FACULTY

Jennifer Bentley, lecturer, speech, language, and hearing sciences

Elizabeth Co, clinical assistant professor and director, programs in human physiology

Claudio Ferre, assistant professor, occupational therapy

Meghan Graham, clinical assistant professor, speech, language, and hearing sciences

Dara L'Italien, lecturer, physical therapy and athletic training

PROMOTIONS

Joan Salge Blake, clinical professor, health sciences, programs in nutrition

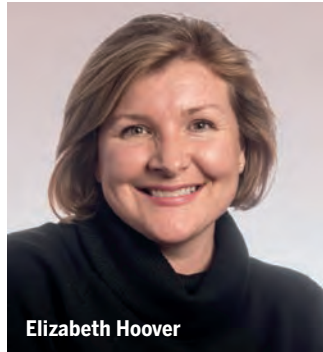
Terry Ellis, associate professor and chair, physical therapy and athletic training

Michelle Mentis, chair, speech, language, and hearing sciences

Gael Orsmond, associate dean of academic affairs

APHASIA ATTITUDES

ELIZABETH HOOVER'S RESEARCH HIGHLIGHTS GAP BETWEEN HOW PEOPLE WITH APHASIA AND THEIR CAREGIVERS VIEW THE CONDITION



Elizabeth Hoover

Every week, about 75 people with aphasia, a breakdown in language or communication following a brain injury, come to Sargent's Aphasia Resource Center to practice conversation, learn new skills, and share experiences with others who have the disorder.

The center, one of the largest of its kind in the country, is also a training ground for students in Sargent's speech-language pathology program and a hub for research. In one recent study, Elizabeth Hoover, the center's clinical director, examined whether the perceived impact of the center on recovery correlated with other factors, such as a person's age or the length of time they have been living with the disorder.

With support from a 2018 dean's summer stipend, Hoover and her colleagues interviewed more than 30 volunteers from the center, including people with aphasia and their spouses and parents, and found significant differences in how individuals with aphasia and their caregivers responded.

"I think we often will interview people with aphasia and their spouses together and we'll accept their decisions as a unit," says Hoover, who is also a clinical associate professor of speech, language, and hearing sciences. But the study showed that these groups of people have different needs and goals. For example, people with aphasia generally expressed more feelings associated with hope and optimism, whereas family members identified more feelings of frustration and fear about the future. Hoover says this was a reminder that "we really have to talk to all of the people who are living with aphasia, because their perspectives and their lenses are very different."

The study builds on Hoover's previous work looking at the effects of group treatments for individuals with aphasia, and she says it will also inform future research at the center. For example, she is using a National Institutes of Health grant to evaluate the power of group size in therapy. Fewer people in a group means more opportunity for each person to practice conversation, says Hoover, but a larger group might lead to more camaraderie and better psychosocial benefits. Hoover is also interested in understanding how group treatment components, such as group size and homogeneity, affect outcomes for individuals with different profiles of aphasia.—*Madeleine O'Keefe*

3 INSIGHTS: THE FUTURE OF OCCUPATIONAL THERAPY

SLAGLE LECTURER ELLEN COHN ON THE TRENDS FORCING CHANGE

Occupational therapist Ellen S. Cohn is optimistic about the future of her field. Today, people demand quality care and patient-centered care—priorities shared by Cohn and her colleagues. The director of Sargent's entry-level occupational therapy doctoral program, Cohn was recognized in April 2019 with the Eleanor Clarke Slagle Lectureship Award, the American Occupational Therapy Association's highest honor.

"The shifts in what's considered important in healthcare are very congruent with the long-standing values and beliefs of the occupational therapy profession," says Cohn, whose Slagle lecture was titled "Asserting our competence and affirming the value of occupation with confidence." Cohn is the third Sargent professor to be so honored in the last 12 years.

Cohn—who focuses on qualitative research, including developing a new intervention to facilitate friendship in adolescents with autism spectrum disorder—offered *Inside Sargent* three insights on the future of occupational therapy:

1. Quality over quantity

"In the past, reimbursement for healthcare has been based on the amount of services provided instead of the quality of care or meaningful outcomes for clients. Reimbursement is shifting to value-based care and quality care, as opposed to how many hours, minutes, or days people are receiving intervention."

2. Research advancement

"Occupational therapy is a relatively young profession. Yet, we now have enough practitioners and researchers who are prepared to conduct sophisticated, scientifically rigorous research to communicate and document the distinct value of the profession."

3. Growth

"We have the infrastructure and the capacity to truly demonstrate to payers, to legislators, and to the public the tremendous benefits of occupational therapy, which is really exciting. I think it's a great time to be an occupational therapist."

—*Abigail Freeman*

WebExtra Watch Cohn's lecture at go.bu.edu/sargent/inside-sargent.



Ellen Cohn

CAMPAIGN CULMINATION

Sargent College is celebrating a record-breaking fundraising campaign this fall. With the support of alumni and friends, the college raised more money during the Campaign for Boston University than it had over its entire history prior, taking in more than \$29 million.

"Every program, every faculty member, and every student at Sargent has felt the impact," says Dean Christopher Moore. "We could not have done any of this without the help of so many who have given so much throughout the campaign."

The Campaign for Boston University: Choose to Be Great, BU's first-ever comprehensive campaign, launched in 2012 with a goal of \$1 billion—later adjusted to \$1.5 billion—and concluded in September 2019. The impact of the funds raised has been far-reaching.

"New endowed professorships have enabled us to recruit and retain top-notch faculty whose research is defining best practices. We have renovated our facilities, creating state-of-the-art learning environments. And scholarship



support has opened our doors to talented students who otherwise could not afford to attend BU," says Moore. "Now, more than ever, we can prepare our students to be leaders in the health sciences around the world."

Just a few examples of the progress made possible by the campaign:

Groundbreaking research conducted by endowed professors. New research at Sargent's Intensive Cognitive and Communication Rehabilitation program found that after 12 weeks of intensive treatment, young adults with acquired brain injury showed significant improvement in areas from classroom behavior to quality of life. The study is a first step

in evaluating what type of rehab will enable these young people to return to higher education.

Preparing tomorrow's professors. Support for faculty and programs provides the education PhD students need to become faculty members at leading research universities (meet three of these students on page 10). Fellowships enable the most talented of those students to choose Sargent.

Evidence-based treatments that transform lives. More than 100 students living with mental health conditions have graduated from NITEO, an intensive one-semester program in Sargent's Center for Psychiatric Rehabilitation. It gave them wellness tools, academic skills, and newfound resilience.

Scholarships for International Service Learning. All students, regardless of their financial circumstances, have the opportunity to travel overseas on service learning trips. Recent destinations have included Thailand, Peru, Belize, and India, where students have supported diabetes clinics, blindness screenings, health and hygiene workshops, and more (see photo below).—*Thea Singer*



A SERVICE LEARNING LEGACY

Since 2011, hundreds of Sargent students have traveled millions of miles on faculty-led service learning trips. They have learned from locals and provided health education and healthcare to communities in Belize (pictured), Costa Rica, Ghana, Guatemala, India, Peru, and Thailand.

WebExtra
See photos from a variety of Sargent International Service Learning Program excursions at go.bu.edu/sargent/inside-sargent.

CONFIDENCE MATTERS

UNDERSTANDING THE PHYSICAL AND EMOTIONAL CHANGES OF WEIGHT LOSS MAY HELP IMPROVE PATIENTS' HEALTH—ONE STEP AT A TIME
BY ABIGAIL CAIN

Simone Gill (left) and her doctoral student Danny Shin are gathering data on the walking patterns of people following weight loss.

In 2017, Danny Shin, an occupational therapist in inpatient care at a hospital, was working with one of his patients, a man with a movement disorder. The patient was doing particularly well, Shin ('22) recalls. "He never fell with me, ever, in the hospital." And yet, as soon as he returned home, the man took a tumble.

What happened? Shin wondered. "Physically, he was fine. He was safe to be home." Had the patient felt comfortable in a hospital setting, but lost that confidence when his environment changed? Or had he instead become overly confident and pushed past his limits? There was also a chance, Shin reasoned, that self-confidence wasn't a part of the equation at all.

Shin has been studying that relationship between self-confidence and walking at Sargent where he's pursuing a PhD in rehabilitation sciences. He's conducting that research in the lab of Simone V. Gill, an associate professor of occupational therapy. Gill has spent a decade at BU studying the ways obesity affects walking patterns and contributes to fall risk, often working with people undergoing bariatric surgery. "One other thing, though, that goes into falling isn't just physically what you can do," Gill says. "It's how confident you feel about moving around. After individuals lose massive weight, it's like getting used to an entirely new body." The two have designed a new study that examines both the physical and emotional changes resulting from such massive weight loss.

PEOPLE WHO UNDERGO BARIATRIC SURGERY CAN LOSE UP TO 35 PERCENT OF THEIR BODY WEIGHT IN A SINGLE YEAR. "I WAS VERY CURIOUS ABOUT WHAT HAPPENS WHEN THERE'S A CHANGE IN YOUR BODY THAT'S SO SUDDEN."

—SIMONE GILL

Research has shown that people with obesity move differently, with a wider gait, than people with average body mass indices when walking on flat ground and navigating environmental obstacles. They tend to walk more slowly and take shorter, choppy steps; they also prioritize spending time on both legs, rather than balancing on one at a time. "It sounds like it should make them more stable," says Gill, "but it actually predisposes them to more falls."

Even after bariatric surgery, a patient's movements don't completely return to baseline. "There's an argument for rehab because their walking patterns haven't matched those of people with average body mass who never were living with obesity," she says.

Gill's interest in this research is, in part, personal. In 2012, she weighed 225 pounds; today she weighs about 130. Although she did not have bariatric surgery, "I was interested in differences in how I moved after losing about 90 pounds." People who undergo bariatric surgery can lose up to 35 percent of their

body weight in a single year. "I was very curious about what happens when there's a change in your body that's so sudden."

For their study, Shin and Gill, who also directs Sargent's Motor Development Lab, asked 12 adults prior to bariatric surgery to navigate five courses, which ranged from flat ground to high obstacles. Participants returned 4, 8, and 12 months after the surgery to repeat the course. A gait carpet tracked the position and timing of their footsteps, capturing digital representations of their footfalls as they walked.

At each visit, participants were also asked to complete two tests to measure self-efficacy: the belief that you can successfully complete a particular task. The first test, known as the falls efficacy scale, describes how confident a person feels that they can complete a functional, day-to-day activity—such as cooking dinner or taking a shower—without falling. The second test, called the modified gait efficacy scale, is newer and less commonly used. It tests for confidence in challenging circumstances, such as walking safely across a grass lawn or stepping up on and down from a curb.

So far, Shin is in the preliminary stages of data analysis. Early results show definite changes in walking patterns: after surgery, participants walk faster and with a narrower gait. Self-efficacy also shows a general improvement between the zero- and four-month mark. Examining these factors in concert is important, Shin says, because "if someone has low self-efficacy, even if they are physically capable of doing something, a lot of people still choose not to do it." Walking is one of the least expensive and most commonly prescribed methods to combat obesity, yet patients often avoid it. This study could add another layer of data to help explain why.

Shin presented these findings at the annual Gait and Clinical Movement Analysis Society conference in March 2019. For Gill, that is an important part of the student experience. "It's an opportunity to learn how to disseminate his work to other scientists," she says. Another focus for Gill is to create a space where Shin and her other doctoral students can lead in the lab. "They have to learn how to be scientists, but they also have to learn how to mentor others."

With that in mind, Shin is working with several students involved in BU's Undergraduate Research Opportunities Program. "We show them what data collection looks like, what kind of protocols we follow," says Shin. "They get a behind-the-scenes look at what research is."

Shin will continue to process the data he and Gill have collected to learn which measures show improvement—or don't—across the 8- and 12-month check-ins. The next step may be intervention—physical therapy, for instance, or home-based activities that can be monitored by practitioners through wearable devices—in order to decrease the risk of falls. Shin also speculates that their research into self-efficacy may highlight the importance of an existing practice: home assessments. Many occupational therapists visit their patients' homes during treatment, to ensure that their work in the clinic mirrors real-life obstacles. "We want to really emphasize to people that they'll be able to translate their walking abilities from the clinic to their environment," he says. ■

Tomorrow's Professors

COMMUNICATION SCIENCES
EDUCATORS AND RESEARCHERS
ARE IN SHORT SUPPLY NATIONWIDE.
SARGENT AIMS TO CHANGE THAT.

BY ANDREW THURSTON

America needs a lot more speech, language, and hearing specialists. The trouble is, there aren't enough professors to train them. During its most recent survey of communication sciences and disorders educators, the American Speech-Language-Hearing Association found one-third of faculty searches went unfilled. The Bureau of Labor Statistics estimates the number of speech pathologist job openings will jump 18 percent by 2026.

For the students in Sargent's speech, language, and hearing sciences PhD program, it means a nearly guaranteed job after graduation. Many go straight into tenure-track faculty positions; others decide to take a postdoctoral position to continue their research or explore new fields before starting their academic careers.

"We think of our PhD as the ramp to the next stage in an academic career," says Swathi Kiran, associate dean for research and director of the program. In 2016, the National Institutes of Health awarded Sargent an institutional training grant (T32) designed to help attract students to disciplines such as speech pathology, flagged as national "shortage areas."

When Kiran, also a professor of speech, language, and hearing sciences, joined Sargent in 2009, there were two students in the doctoral program; today, there are more than a dozen. They take courses across the University in engineering, medical sciences, neuroscience, and more, and start mentored research projects right away. The current cohort is working with faculty to investigate areas including language recovery after a brain injury, the mechanics of swallowing, and the neural basis of speech.

Kiran says doctoral candidates are encouraged to publish often and to secure federal funding for their work. "That's what

gets them ready to get out there and get great faculty positions." In the 2017–18 academic year, students presented 26 posters and published 14 papers in journals. Many also landed F31 predoctoral individual national research service awards, a highly competitive NIH fellowship grant.

Recent alums include Jessica M. Pisegna ('13,'17), director of speech language pathology at Boston Medical Center; William S. Evans ('10,'15), an assistant professor at the University of Pittsburgh; and Victoria McKenna ('18), a clinician and postdoctoral research fellow at Purdue University.

Kiran heads Sargent's Aphasia Research Lab, which focuses on language processing and recovery after a stroke and other brain injuries. She says her students' varied interests and clinical backgrounds have helped take her research in unexpected directions. One student, for example, proposed exploring an area of language recovery that had largely been ignored.

"She was interested in looking at fluctuations in attention," says Kiran. "She started thinking that was one of the reasons why our patients might not improve—it's not just the fact that they have trouble communicating, it's that their attention zones in and out more."

The paper the two wrote on the research was published in a 2015 edition of *Neuropsychologia* and has been cited more than 30 times (a majority of scientific papers snag less than four citations, according to *Nature*). After earning her doctorate, the student, Sarah Villard ('12,'16), returned to Sargent as a postdoctoral fellow to continue her work on attention.

Inside Sargent spoke to three speech, language, and hearing sciences doctoral students—who will soon be ready to fill some of those vacant faculty positions—about their research.

CONOR DOHERTY (MURRAY); SCOTT NOBLES (STEPP)

Helping kids with voice disorders

When Elizabeth Heller Murray ('19) joined Cara Stepp's Sensorimotor Rehabilitation Engineering Lab, she studied a range of voice problems, from vocal trauma to laryngeal stiffness. As she moved through the projects, she wondered how what she was learning about adults might apply to kids. Many existing clinical approaches to voice disorders, says Heller Murray, involve "just taking adult therapies and making them fun, but the pediatric mechanism is really different from the adult mechanism."

Stepp, an associate professor of speech, language, and hearing sciences, encouraged Heller Murray to explore children's speech mechanisms—how the brain and vocal system work together—helping her successfully apply for an F31 grant to fund her research.

With Stepp's guidance, Heller Murray began studying children with voice disorders: some sounded different from their peers, others were constantly losing their voices. Their conditions can affect their self-worth, says Heller Murray, who also worked at Boston Children's Hospital as a speech-language pathologist while studying at Sargent. These children may be less likely to speak up in class; sometimes, they're labeled as potential troublemakers.

For her dissertation, Heller Murray watched children without voice disorders as they made or listened to certain repetitive sounds, examining how they responded to changes in pitch to better understand voice control. For those making the sounds, she wanted to see how they reacted if they thought their pitch was too high or too low: How quickly would they shift their pitch? Would they adjust it by too much or too little?

Some kids, like most adults, made effective adjustments, but one group didn't; Heller Murray, who has published six articles and been asked to contribute to a textbook on pediatric voice disorders, thinks it's because they're still in a learning phase.

"Once we understand more about how voice develops over time," she says, "we can figure out where it's breaking down for kids with voice disorders."



Cara Stepp, an associate professor of speech, language, and hearing sciences, and director of Sargent's Sensorimotor Rehabilitation Engineering Lab, encouraged Elizabeth Heller Murray to study children's speech mechanisms.



Elizabeth Heller Murray

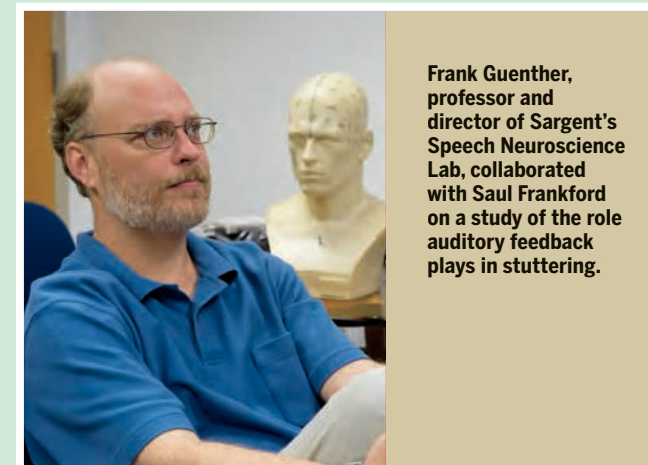
What makes someone stutter?

In Frank Guenther's Speech Neuroscience Lab, researchers are studying what happens in the brain when we speak—and how the process can sometimes go awry. Their work could help illuminate the roots of disorders such as dysarthria, a muscle weakness that impacts speech, and stuttering. That makes the lab a good fit for Saul Frankford ('20), whose goal is to zero in on "the break in the chain"—the misfiring part of the brain—in a range of speech disorders.

Frankford, an undergraduate music major, has long been interested in sound. Working with Guenther, renowned for developing a computer model that simulates speech development and speech production called the DIVA model, has shown him how to use computational and mathematical methods to work through a problem. In one recent study, Guenther, a professor of speech, language, and hearing sciences, and Frankford tested the role of auditory feedback—listening to yourself speak—in stuttering.

Frankford placed test subjects in a sound-deadening booth and, as they read sentences from a screen, played their voices back to them through headphones—but with a few tweaks. By toying with how people heard themselves—turning an "eh" into "ah" or speeding and slowing their speech—he could monitor how they reacted to apparent errors.

He found that people who do not stutter tend to do a good job of adjusting—speeding up, changing their pitch—when it seems their speech has erred, "but people who stutter respond to a lesser extent," says Frankford. "This might have to do with the ability of people who stutter to use auditory feedback to help with sequencing or timing their own speech."



Frank Guenther, professor and director of Sargent's Speech Neuroscience Lab, collaborated with Saul Frankford on a study of the role auditory feedback plays in stuttering.



Saul Frankford

CONOR DOHERTY (FRANKFORD); KALIMAN ZABARSKY (GUENTHER)

Watching the brain recover

Since 2016, Swathi Kiran's Intensive Cognitive and Communication Rehabilitation (ICCR) program has given young people with brain injuries a route to college. The participants all have issues that can make it tough to participate in class or keep up with lessons: some have difficulty with attention or problem solving after a traumatic injury, others have aphasia, a language disorder common after a stroke. Kiran's program mixes intensive individual therapy with introductory college courses to help ease them back into the classroom. Natalie Gilmore ('21) helped coordinate the program and, with support from an F31 grant, is testing its effectiveness for her dissertation project.

"I plan to investigate which specific cognitive-linguistic domains important for college success, such as attention, verbal expression, and memory, improve over time as a function of this intensive program and the neuroplasticity—changes in the brain—underpinning those improvements," she says.

To track those changes, Gilmore will work with David Boas, a professor of biomedical engineering and a pioneer in functional near-infrared spectroscopy (fNIRS). The technology allows researchers to watch and map neural activity noninvasively, monitoring changes in oxygen levels in the brain with infrared light. It will enable Gilmore to see how the students in Kiran's program react to therapy and to their college classes, then follow their progress across multiple semesters.

Kiran says the fNIRS project, "measuring data on young adults who are receiving therapy at different time points, is not something I'd thought about." She adds that Gilmore, who already has four published papers, has been a driving force for the ICCR program: "It was completely fueled by her energy and her contributions." ■

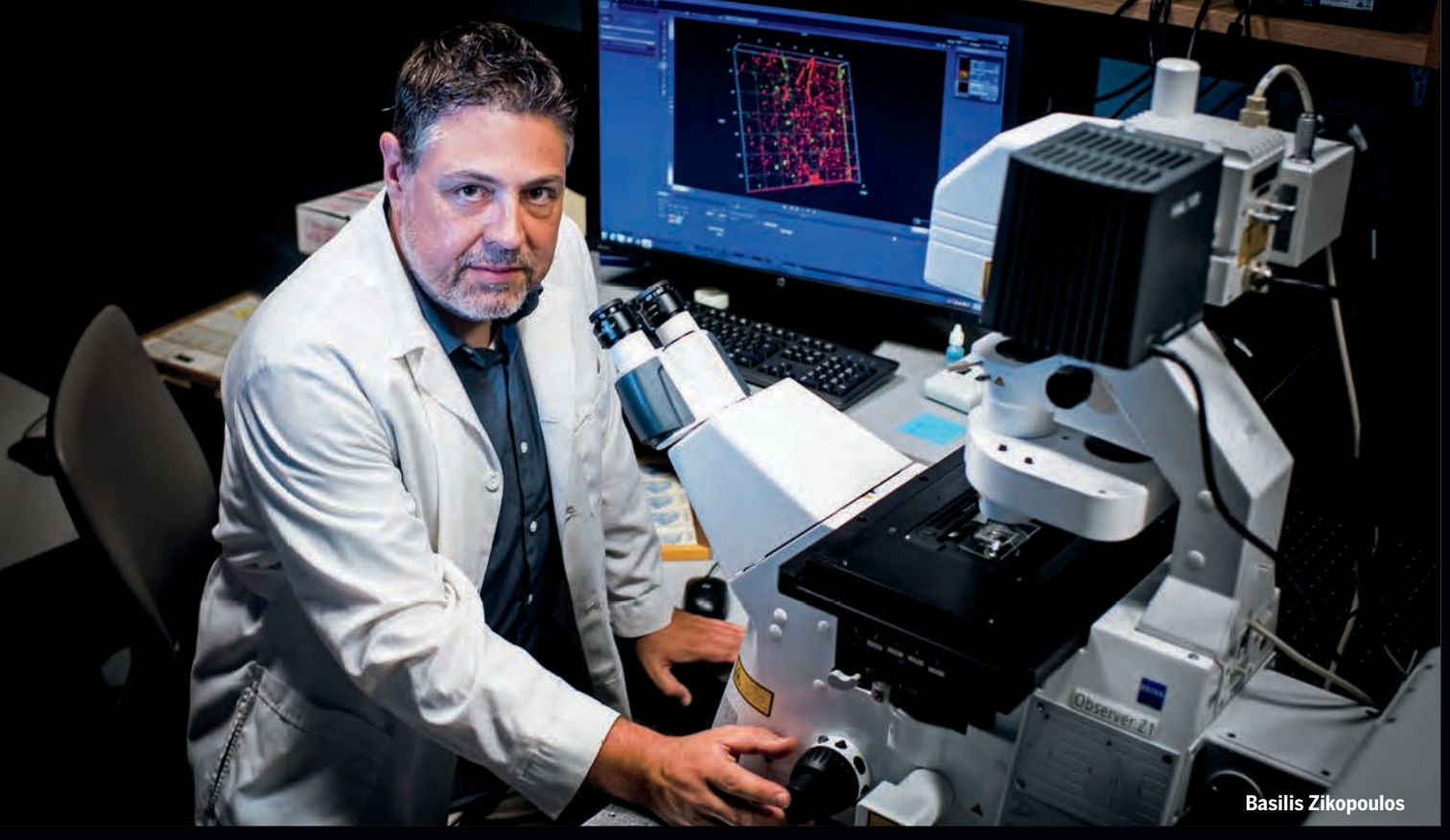


Natalie Gilmore

CONOR DOHERTY (GILMORE); KALIMAN ZABARSKY (KIRAN)



Swathi Kiran, professor and director of Sargent's Aphasia Research Laboratory, has encouraged Natalie Gilmore's study of the effectiveness of a program that helps young people with brain injuries return to college.



Mapping the Brain

TRAILBLAZING EFFORTS TO CHART THE NEURAL PATHWAYS OF THE HUMAN BRAIN MAY HELP RESEARCHERS UNDERSTAND THE CAUSES OF DISORDERS RANGING FROM AUTISM TO SCHIZOPHRENIA

BY KAT J. MCALPINE

If you can concentrate on the words you're reading now without getting distracted, one Sargent researcher wants to know your secret.

Basilis Zikopoulos, an assistant professor of health sciences, is studying the attention filter of the human brain, which is at the heart of why we can focus—or why we can't. And the impact of his work extends well beyond your ability to read this story.

With a team of researchers in his lab, Zikopoulos is looking at how autism, schizophrenia, depression, anxiety, and sleep disorders are linked to disruptions or miswiring between the thalamic reticular nucleus (TRN), amygdala, and prefrontal cortex. He's already at the forefront of this research as one of the first people to plot the path of TRN networks in monkey brains.

THE BRAIN'S FILTER

"Any kind of information that reaches your brain has to pass through a structure called the thalamus," says Zikopoulos. "It will either be routed into the cortex so that you become conscious about the information, or it will be filtered out."

So how does the brain determine what goes where? Inside the thalamus is the TRN, a smaller bit of brain orchestrating this process, and that's the piece that Zikopoulos is fascinated by.

"The TRN acts like a filter. It's so important—it sorts out what we need to pay attention to and what we don't," he says. It also plays a central role in determining if we are awake or sleeping.

Which is why it makes sense that it can be hard to sleep when you're consumed by thoughts about a new love interest or a family member's illness. In that case, the TRN is taking its cues from the amygdala, the emotion regulation center of our brain. The amygdala is so strongly connected to the TRN, Zikopoulos says, "it's practically yelling at it."

Despite how hard it is to think of anything else, nature gave your brain an override mechanism that can (hopefully) direct your attention elsewhere. The ability to drive your attention toward a specific task, Zikopoulos says, depends largely on the executive functioning part of the brain, the prefrontal cortex, which has evolved and expanded the most in humans compared to other animals. It determines our individual personalities and cognitive skills, and it can control the TRN. But our ability to control our own attention and behavior comes at a high cost.

"As far as we know, animals do not display the full spectrum of symptoms seen in autism or schizophrenia," Zikopoulos says. "But humans are more vulnerable because we have more complex brain networks that take longer to develop. Therefore more things can go wrong." That idea is at the core of his work-

ing hypothesis that emotional and psychiatric disorders stem, in many cases, from abnormal links between the TRN and other parts of the brain.

"In autism, for example, one of the things we see is extremely focused attention on one thing, with difficulty switching to another task. In schizophrenia, we have the exact opposite," he says. "At the core of all these disorders, we have a problem with attentional networks."

A NEW FRONTIER

The TRN is such a new topic of interest for scientists that Zikopoulos, with the support of the National Institutes of Mental Health, is trailblazing a map of how it works in humans. With his research on TRN networks in monkey brains, he has a good head start.

Zikopoulos and Helen Barbas, a professor of health sciences, used neural "tracers" to chart the TRN networks in the brains of macaques. Through careful dissection and high-resolution imaging, they precisely mapped the three-dimensional networks of TRN connections zig-zagging toward other areas of the monkeys' brains.

"Having done these studies in monkeys, we have identified specific features of the TRN network and how it connects to other areas of the brain," like the amygdala and the prefrontal cortex, Zikopoulos says. "We think that defining these features in humans could allow us to distinguish between the brains of neurotypical individuals and of people with attention-related disorders."

WORK OF A LIFETIME

Zikopoulos once dreamed of being a marine biologist, inspired by undersea explorer Jacques Cousteau. But he found that the marine ecosystem wasn't as exciting as questions he wanted to answer about the brains of marine animals. "I went into a neurobiology lab as a second-year undergraduate student and I've been there ever since," he says. Now, he focuses on the questions he finds most interesting, like: How are we different from other animals? Why do we have enormous behavioral flexibility?

"AS FAR AS WE KNOW, ANIMALS DO NOT DISPLAY THE FULL SPECTRUM OF SYMPTOMS SEEN IN AUTISM OR SCHIZOPHRENIA. BUT HUMANS ARE MORE VULNERABLE BECAUSE WE HAVE MORE COMPLEX BRAIN NETWORKS THAT TAKE LONGER TO DEVELOP. THEREFORE MORE THINGS CAN GO WRONG."

—BASILIS ZIKOPOULOS

To find out those answers, Zikopoulos doesn't plan on putting the neural tracers to work in living humans (who would then need to donate their brains after death). Combining the monkey data with their observations of human brain specimens, his team will collaborate with computational neuroscientist Arash Yazdanbakhsh, a BU College of Arts & Sciences research assistant professor of psychological and brain sciences. They will enter all the information into a computer model and create a digital brain, where they can simulate TRN network connections.

"Once we can look at all the data in a computer simulation of a human brain, then we will be able to start disrupting the model and seeing how it responds in comparison to people who we know have sleep disorders, autism, schizophrenia, depression, etc.," he says.

Zikopoulos says there are enough questions about the TRN to keep him busy for the rest of his career. He's been working on unraveling its mysteries for the last 15 years, and only now feels as though he's amassed enough data to start seeing the total picture. "There's a lot of information and we have no idea what we will eventually find. But we now have some pretty good guesses." ■



Zikopoulos uses an electron microscope to magnify cross sections of the human brain up to 500,000 times, revealing connections between axons and neurons.



INTENSIVE LANGUAGE THERAPY

—WITH ADDED FUN

HOW SARGENT RESEARCHERS ARE BUILDING TARGETED TREATMENT INTO PRESCHOOL PLAY

BY CORINNE STEINBRENNER

M

any children with language impairment fail to make progress over the summer months without the support of clinicians and teachers, and as a result are even further behind their typically developing peers when they return to school in the fall. But some preschoolers with language disorders are leaping forward during the break, thanks to an intensive program offered at Sargent.

The four-week intervention—designed by faculty and delivered by graduate students in the speech-language pathology program—improves children’s communication skills through individual and group therapy sessions that are based around stories, games, and play. It also provides a training experience for graduate students interested in working with preschoolers and allows researchers to study the effectiveness of intensive therapy for young children, says Michelle Mentis, a clinical professor who helped design and launch the intervention in 2015. An expert in pediatric language disorders, Mentis and her colleagues, Kerry Howland (MED’09) and Meghan Graham, are compiling data on children’s progress in the program for eventual publication and have presented its treatment strategies at several national conferences.

Each spring, Mentis, chair of the speech, language, and hearing sciences department, and her colleagues review applications for their summer program and select six participants (children ages 3 to 5) who are all working on similar language goals. “Children with developmental language disorders tend to have their greatest difficulties in the areas of syntax and storytelling, so we focus heavily on both of those areas,” says Howland, a clinical assistant professor and program cofounder who specializes in pediatric language and reading disorders.

Children with language disorders struggle to form clear sentences to express their thoughts and feelings and often have difficulty understanding what others say. Language disorders

are fairly common and can occur in isolation or in conjunction with other diagnoses, such as autism or attention deficit disorder. Because language disorders can affect the way children learn and socialize, says Mentis, it’s important to intervene as early as possible. Common goals for those attending the Sargent summer program include extending noun and prepositional phrases (from “car” to “the blue car” to “the blue car in the street”), extending verb phrases (from “car stop” to “car is stopping”), and telling multipart stories in proper sequence.

The children attend the program on the Boston University campus for two and a half hours a day, four days a week, for four weeks in July. Four graduate students lead them through their daily routines, beginning with circle time, where all the children hear a story and join in full-group activities. After a snack, they move on to individual and small-group activities and then finish with quiet play and a review of the day’s concepts.

While this may sound like a typical morning of preschool, says Howland, director of clinical education for the master’s in speech-language pathology program, it’s much more. “Every moment of the two and a half hours that the child is with us, we’re building language skills,” she says. “There is essentially no downtime in terms of language facilitation and continual focus on the children’s goals.”

If the day’s circle-time story is *The Very Busy Spider* by Eric Carle, for example, the clinicians use the repetitive storyline to help children recognize elements of a narrative and practice specific syntactic structures. In the story, a series of animals ask a spider to join in an activity, but the spider doesn’t answer because she’s spinning a web. As a clinician reads, she might ask the children to hold up a special “character” icon each time a new character enters the story. Children with language disorders may not intuitively understand narrative concepts, such as setting and character, and their own storytelling improves once they learn these underlying structures, says Graham, a clinical assistant professor who helped create the preschool program and serves as its lead clinician and supervisor.



The month-long intervention improves children’s communication skills—and provides valuable experience to Sargent graduate students.

MICHAEL D. SPENCER

“EVERY MOMENT OF THE TWO AND A HALF HOURS THAT THE CHILD IS WITH US, WE’RE BUILDING LANGUAGE SKILLS,” SAYS KERRY HOWLAND.



“THERE IS ESSENTIALLY NO DOWNTIME IN TERMS OF LANGUAGE FACILITATION AND CONTINUAL FOCUS ON THE CHILDREN’S GOALS.”

The children might then reenact the story using toy animals. As each animal speaks, the clinician asks, “Why doesn’t the spider answer?” A child responds, “Because she was busy spinning her web.”

The word “because” is known as a causal conjunction, says Graham. “Causals are really important in the preschool years, and most of our kids don’t have a grasp of these forms,” she says, “so we reiterate them a lot.” The clinicians repeatedly model the phrases for the children, and then they find multiple ways to elicit the phrases from the children.

The spider story is also useful for identifying story settings (“Where does the pig want to roll?”) and for practicing prepositional phrases (“In the mud!”).

Most children don’t need this much repetition and instruction to learn language. For reasons not fully understood, says Mentis, children with language disorders require much more input than their typically developing peers. “These children need the language they hear to be made more salient for them, presented in a form that they can access and learn from, and at a sufficiently high density and frequency that they can infer the underlying patterns,” she says.

At Sargent, this input is delivered while children are listening to and telling stories, playing games, eating snacks, and doing other typical preschool activities. This approach—teaching language skills in contexts that are meaningful for the children—makes the program so effective, says Howland. “If you try to do discrete, drill-type activities, devoid of actual communication, the children don’t make the same kind of progress,” she says. “They might learn to memorize what they’re supposed to say, but they don’t use that language functionally in real-life interactions.”



Michelle Mentis, chair of the speech, language, and hearing sciences program

The program’s intensity—40 hours of therapy in just one month—and its combination of group therapy with highly focused individual therapy are also keys to its success, says Mentis. But she agrees with Howland that the program’s teaching methods are what make it work—and what make its results repeatable, even for clinicians who can’t offer daily intervention. “We

are embedding very specific language facilitation and language elicitation strategies into functional, meaningful, communicative contexts,” Mentis says. Any therapist can do that, she says, “even if you’re seeing a kid individually, for one hour a week.”

Parents can use the methods at home, too. Sargent’s program includes a weekly 30-minute workshop for them; they are also invited to observe the daily sessions through two-way mirrors. Many parents naturally begin carrying over those methods at home, says Howland, embedding language practice into play, stories, meals, baths, and other everyday activities.

To set goals and measure progress, clinicians conduct detailed evaluations of each child before, during, and after the program. With just six children enrolled each year, the data set is small, says Mentis, “but the bottom line is, we’ve seen very impressive results.” Children show, for example, increases in utterance length, greater use of complex sentences, and the ability to tell more detailed stories that include more elements.

The program also provides a unique growth opportunity for Sargent graduate students. “Very seldom will students get the chance in their clinical placements to work as intensively as they do in this program,” says Howland. “That art of embedding everything into play—and yet being very productive in their sessions—is challenging. And we see enormous growth over four weeks in their clinical skills.”

The clinical placement allows students like Kara Sheftic (Wheelock’18, Sargent’19) to work with children—as well as prepare daily lesson plans and progress notes—in a group setting for the first time, and to develop close relationships with children during individual sessions. “That’s what I learned the most from it—how to make it fun and how to help at the same time,” says Sheftic. ■

MICHAEL D. SPENCER; CHITOSE SUZUKI (MENTIS)

Going Strong in Old Age

UNDERSTANDING SARCOPENIA AND FRAILITY MAY PROVIDE THE KEY TO HEALTHIER AGING FOR ALL

BY JOEL BROWN

LADORA THOMPSON HAS SPENT MUCH OF HER CAREER

investigating sarcopenia, the muscular weakness that comes with aging, at the cellular and molecular levels. In recent years she has expanded the scope of her research to focus on a significant and related problem for older adults: frailty.

“In clinical practice, frailty is defined as a syndrome,” says Thompson, the Travis M. Roy Professor in the physical therapy and athletic training department. One way physicians diagnose frailty is by assessing five functions: how well a person walks, how strong they are, what their activity and exhaustion levels are, and if they lose weight unintentionally.

Researchers have shown that individuals who are defined as frail have more adverse health outcomes and more additional conditions added to their primary health concerns (“comorbidities”), says Thompson. “They die earlier than individuals who are not frail.”

But in studying sarcopenia and frailty in humans or animals, researchers often look at older subjects—in essence they are studying subjects who are successful in aging, she says. In humans you can study a 100-year-old, but there are many people who die in their 60s.

That research, says Thompson, misses “a piece of the picture of age-related muscle weakness or deterioration of muscle integrity.” She is interested in understanding the muscles of individuals who would never make it to old age. “Perhaps we could look at it in a younger animal right at the very beginning of the deterioration and find what is the trigger,” she says.

She has begun by studying mice over their natural lifespan of 30 to 36 months, using frailty assessments to try to identify those that will not live as long. She and her team have published two papers on the data for male and female mice and have a third under review for identifying sex differences. “In the human literature there’s a theory called the ‘male-female health-survival paradox,’ where females live longer but they have an increased incidence of frailty, whereas males live shorter lives but their amount of frailty is less,” Thompson says. “We’re evaluating whether that occurs in mice. If so, then we can begin to identify what are some of the cellular and molecular mechanisms of why we have this paradox.”

Decades of studies suggest that there is no single physiological trigger involved in frailty and sarcopenia but multiple sys-



“EVERYBODY IS LOOKING FOR THE ‘PILL’ THAT WILL MAKE LIFE GREAT—I HOPE IT’S EXERCISE. IT’S BENEFICIAL FOR EVERY PHYSIOLOGICAL SYSTEM AND IT’S VERY, VERY EASILY APPLIED.”

—LADORA THOMPSON

tems, such as endocrine or neurological changes, underlying DNA damage, or chronic inflammation. “In the long run, I would like to know what the initial triggers are so that we can develop appropriate therapies,” Thompson says.

Frailty may be a particular concern for people with chronic diseases or disabilities because of muscle weakness and poor endurance. One such chronic disability is spinal cord injury (SCI), which is of particular interest to Thompson, the first Travis M. Roy Professor in Rehabilitation Sciences. Roy (COM’00, Hon.’16) was paralyzed from the neck down in 1995, in an accident in his first BU hockey game. There is a dearth of information on frailty’s effect on people with SCI, she says, and this is an important and fertile area for investigation.

Ultimately, of course, she is trying to learn what will help everyone maintain better health as they age. “Everybody is looking for the ‘pill’ that will make life great,” Thompson says. “I hope it’s exercise.”

“It’s beneficial for every physiological system,” she says, “and it’s very, very easily applied. I’m not saying everyone must go to the gym. I’m encouraging everyone to keep moving.” With increased prevalence of children with metabolic diseases and diabetes raising questions about diet and activity levels, she wonders if we will see more frailty in generations to come.

“I want quality of life when I’m older,” she says with a smile. “I’m very selfish, because when I’m 80, I want the therapist who’s treating me using the most current evidence-based practice, so I can keep doing all the things I enjoy doing.” ■

CYDNEY SCOTT

Better Treatment Through Big Data

DATA ANALYTICS ALLOW PHYSICAL THERAPISTS TO CHOOSE TREATMENT APPROACHES

BY MICHAEL S. GOLDBERG

If you have a sore shoulder, physical therapy is likely to make you feel better. But traditionally, it has been difficult for physical therapists to quantify exactly *how much* better a patient gets.

Now imagine you enter a clinic and, after describing your symptoms and having an exam, the physical therapist shows you a graph charting the progress of people with the same condition. The curve's trajectory details how you will improve and how many sessions it will take based on data from hundreds or thousands of patients who share your profile.

Patients in the BU Physical Therapy Center at the Ryan Center for Sports Medicine and Rehabilitation have started receiving such personalized charts. It's part of a quest for sharper, data-fueled insights into patient outcomes. Since September 2016, the clinic has been working with the Rehab Outcomes Management System (ROMS), a database and analysis software program developed by clinicians at Intermountain Healthcare in Utah. BU was one of the first institutions in the country to adopt the commercial version of ROMS. The system does for physical therapy what analytics have done for sports management (think of the movie and book *Moneyball*): using statistical evidence to drive decisions. Now, the BU facility, a Sargent clinical education center that operates independently and is open to the public, is using data to inform decisions on

clinical approaches to common ailments, pursue new lines of research, and update the best practices taught to Sargent students.

"It helps us accurately track patient progress and help get people better faster," says James Camarinos, director of the center, which averages 2,200 new patients every year and around 25,000 physical therapy sessions annually.

With ROMS, BU's clinicians collect information from patients about how they feel at every visit using standardized questions based on a patient's condition: a patient with neck pain would be asked about, for example, the intensity of their pain and whether they experience discomfort bathing and dressing. The program turns their answers into data that clinicians can analyze to study the efficacy of treatment approaches for common ailments and make more precise predictions about outcomes, which can help set the right expectations for a patient experiencing pain.

"If you come to our clinic for rotator cuff tendonitis, there's a likelihood of success of 70 percent on the outcomes we use, and these are a good proxy of everyday function," says Camarinos.

Clinicians, like James Camarinos (foreground), at the BU Physical Therapy Center gather data from 2,200 new patients, over 25,000 sessions, annually.

DAVE GREEN

PT SUCCESS RATES

Neck pain from whiplash	All patients 75%	Patients with at least 8 visits 83%
Rotator cuff tendonitis	All patients 70%	Patients with at least 7 visits 77%
Low back pain	All patients 72%	Patients with at least 6 visits 78%

But delving into the data further shows that for those who average seven visits, the chance of success rises to 77 percent. It's a way to convey to patients the benefits of sticking with physical therapy after the first few visits to the clinic. "We're making that statement not just based on experience alone, which is of course highly valuable, but also based on data science."

That opportunity to use data analysis to ask new questions about the effectiveness of physical therapy treatments is especially important at a time when healthcare providers are looking to find cost-effective ways to deliver quality results, says Lee Marinko, a clinical associate professor of physical therapy and athletic training.

Prior to the adoption of ROMS, information about how patients felt was incomplete and imprecise, she says. "The problem with not collecting standardized outcomes is that everybody gets better when they go to physical therapy, because they just feel better. But what is it about what we do that really *makes* them better?"

Traditionally, physical therapists used patient satisfaction scores, as well as measurements of physical impairment, like the range of motion in a knee or shoulder. Through such measurements, a therapist could discern improvements. But the quality of such readings was variable: different physical therapists asked different questions, for instance, and they did not ask them at every visit.

Today, says Marinko, BU's clinicians can analyze data they collect to identify factors that could improve care and compare the experiences of their patients to others with the same conditions nationwide. One project that Marinko and her colleagues are pursuing, for example, is studying how long it takes for a patient to see a physical therapist after calling the clinic, and correlating that answer with patient results. How much difference can it make to get a patient into sessions right away? The new data will help answer that question.

Another question is about patient copayments. "Insurance copayments have changed dramatically, with more of the burden coming to the patient," says Marinko, who is also a clinician at the center. "If you have to pay more, do you come for fewer visits and therefore not get as good of an improvement?"

With six Ryan Center physical therapists also holding teaching positions at Sargent and students often completing internships at the center, advances pioneered in the clinic quickly find their way into the classroom—and vice versa. Marinko points to a ROMS analysis that identified risks in certain patients who should be referred to a doctor to reduce the chance they will suffer a prolonged disability. The insights led to better, more personalized care and, in turn, have informed the best practices Marinko teaches her students.

"The data allow us to ask questions to improve care and then change the way we teach our students," Camarinos says. "It's an established thing in medicine, that we know that it can take up to 17 years to get a new discovery into real-life practice. We hope to shrink that timeline." ■



Weighted Walking

HOW CARRYING A SIMPLE HAND WEIGHT CAN EXERCISE WEAK HIP MUSCLES

BY LARA EHRLICH

Kerri Graber ('17,'19), a former track athlete, wanted to understand how the body works. She found a home in Cara Lewis' Human Adaptation Lab.

I imagine a model walking down the catwalk, her skirt snapping with the dramatic lift and fall of her hips. While that walking pattern is an affectation of high fashion, a less exaggerated version is just as common off the runway.

When walking naturally, your hip abductor muscles fire, tipping your pelvis up and down. If the hip of your weight-bearing leg is weak, however, your opposite hip drops further to compensate, tilting your pelvis down at a steeper angle. That walking pattern, called pelvic drop, can cause inflammation, tendonitis, and other painful conditions in your hips and knees.

Everyone from athletes to octogenarians is susceptible to pelvic drop. Kerri Graber ('17,'19), a doctor of physical therapy student, has helped evaluate an exercise to prevent it. Along with her mentor, Cara Lewis, she found that a simple hand weight can have a big impact on hip muscles—and can be used both in the clinic and at home.

Graber was drawn to physical therapy when she was a member of the BU track team and needed physical therapy for minor injuries. “I wanted to learn more about how the body works, how it ages, and how it heals,” she says, “and to find ways to help people become more mobile and recover from injury faster.”

During her second year of Sargent’s six-year accelerated Doctor of Physical Therapy (DPT) program, Graber enrolled in a biomechanics course taught by Kenneth G. Holt, an associate professor emeritus. “It was super cool to quantify movements of the body and understand how movement at the hip, for example, can affect what’s happening at the foot,” she says. “That understanding of movement up and down the chain of the body is fascinating to me.”

For further study in biomechanics, Graber’s academic advisor connected her with Lewis, an associate professor of physical therapy, whose Human Adaptation Lab focuses on motor adaptation—how our bodies learn and modify movements—specific to reducing hip pain. Lewis is a pioneering advocate for rehabilitation as prevention, with work funded by the National Institutes of Health. Her lab was a natural fit for Graber, who’s been there ever since.

In her fifth year of the DPT program, Graber worked with Lewis to develop a practicum project to alleviate pelvic drop.

“Kerri had to do a lot to figure out that research project,” Lewis says. “How are we going to test it? What are the specifics of the protocol?”

“I couldn’t have asked for a better mentor,” Graber says. “Cara not only taught me how challenging it can be to put together a research project, but also how rewarding it can be; she guided me through the steps of designing a research project, from creating a clinical question all the way through data processing and drafting an abstract for submission to a conference.”

First, the researchers acquired baseline data, measuring their subjects’ muscle activation with electrodes placed on their skin while walking on a treadmill. Then, they measured the subjects’ muscle activation when they held a kettlebell, weighing 15 to 20 percent of their body weight, opposite the



Graber found the perfect mentor in Cara Lewis (left), a pioneering advocate for rehabilitation as prevention.

“I WANTED TO LEARN MORE ABOUT HOW THE BODY WORKS, HOW IT AGES, AND HOW IT HEALS, AND TO FIND WAYS TO HELP PEOPLE BECOME MORE MOBILE AND RECOVER FROM INJURY FASTER.”

—KERRI GRABER ('17,'19)

side with pelvic drop. Graber and Lewis found that those muscles activated more to counterbalance the weight and stabilize the pelvis.

“Across the board, we found significant increases in muscle activation when subjects were walking with the weight, compared to their baseline walking,” Graber says. As the researchers expected, the exercise did not increase muscle activation on both sides of the pelvis; “it just targeted the side we wanted.”

Graber presented the research at the 2019 Combined Sections Meeting of the American Physical Therapy Association, where her peers were excited by the exercise’s potential beyond the clinic. Graber’s next step is to figure out how the intervention can be done in the home.

“A big question is how to help patients who are elderly and have hip weakness, but can’t carry 15 to 20 percent of their body weight in their hand,” Graber says. “We need to determine the minimum amount of weight needed to increase muscle activation enough to strengthen the hip.”

She also intends to adapt the intervention so those with hip weakness can work on the exercises during their daily routines. One example: carrying grocery bags in the arm opposite the weak hip, Graber says. “Just functional ways to get those muscles activating more. You don’t need to carry around a 15-pound kettlebell; you could do this exercise on your walk home from the grocery store.” ■

MICHAEL D. SPENCER

THE PROBLEM SOLVERS

OT AND ENGINEERING
STUDENTS FIND COMMON
GROUND IN THE CREATION
OF CUSTOM 3-D PRINTED
ASSISTIVE DEVICES

BY STEPHANIE ROTONDO

For people with arthritis, everyday tasks like holding a can of soda or applying makeup can be painful—even impossible. Orthotics, easy-grip utensils, and other assistive devices can make life easier for those with physical limitations, but their one-size-fits-all approach and high cost can be prohibitive. Now, the rise of 3-D printing offers occupational therapy practitioners and their clients an alternative for creating inexpensive, customized devices.

It's a technological approach that Karen Jacobs, a clinical professor of occupational therapy, is embracing. Jacobs' office on the fifth floor of Sargent College is filled with vibrant mementos collected over a 40-year career in occupational therapy. Books on musculoskeletal disorders and ergonomics (including those she wrote) and myriad awards and commendations—many from the American Occupational Therapy Association where she served as president from 1998 to 2001—line her crowded bookshelves. Colorful snow globes, stuffed animals, and student artwork fill in the gaps. Among the many artifacts is a slightly newer mark of Jacobs' innovative spirit: a sleek silver and blue 3-D printer. Given her focus on ergonomics, Jacobs has become a fan of the technology's ability to have a positive impact on those who need help with activities of daily living.

"We are always looking for assistive technology, or adaptations," says Jacobs. "The introduction of the 3-D printer allows us to better match what a person needs through the design of an individualized item."

To connect her students' therapeutic training with 3-D technology expertise, Jacobs had only to look across the street. She partnered with Rebecca Khurshid, an assistant professor of mechanical and systems engineering, to recruit engineering students for a four-week project. In fall 2018, Jacobs took the first-year doctor of occupational therapy students from her Analysis and Adaptation of Occupation course over to the College of Engineering, where the students from the two schools tackled a challenge: design an assistive device for a hypothetical client with a fine motor limitation like arthritis—and print it.

The occupational therapy students developed case studies and proposals. They then worked with the engineering students at two of BU's maker spaces: the Engineering Product Innovation Center, which has twelve 3-D printers, and the Binoy K. Singh Imagiengineering Laboratory, which has two. At first, they

experimented with drawings and Play-Doh models, before creating digital designs.

"A lot of the engineering students are looking to apply what they've learned in the classroom in a way that helps people," says Khurshid, director of the Collaborative and Integrative Robotics Laboratory at BU's Center for Autonomous and Robotic Systems. "This is especially true at BU, where the curriculum is designed to train societal engineers," she says.

The printed devices created by the joint teams included a soda holder, mascara applicator, and PlayStation joystick extender. Sargent's Laura Stursberg ('21) and her team designed an adaptation with a real client in mind—her 82-year-old grandmother Charlotte, whose arthritis made it hard for her to crochet, a longtime hobby that requires fine motor skills. An ergonomic crochet hook Stursberg ordered online made grasping the yarn easier, but the fit wasn't quite right. With the help of Katherine Shannahan (ENG'20), the team printed a customized version. The one-inch-long adaptive device has two connected circular openings, one for Charlotte's index finger and the other to guide the yarn.

"The device took care of the yarn so it took a bit of the bending of her hand out of the equation," says Stursberg. While the prototype wasn't perfect—the team realized they needed a way to control the tension of the yarn—the process is meant to be iterative. "The assistive technology process is basically 'design—fabricate—test,'" she says.

The World Health Organization reports that more than one billion people worldwide need an assistive product to help maintain or improve both function and independence. "Instead of going online and ordering a device, we can customize it, and at a reduced cost," says Jacobs, who also directs Sargent's online postprofessional doctor of occupational therapy program.

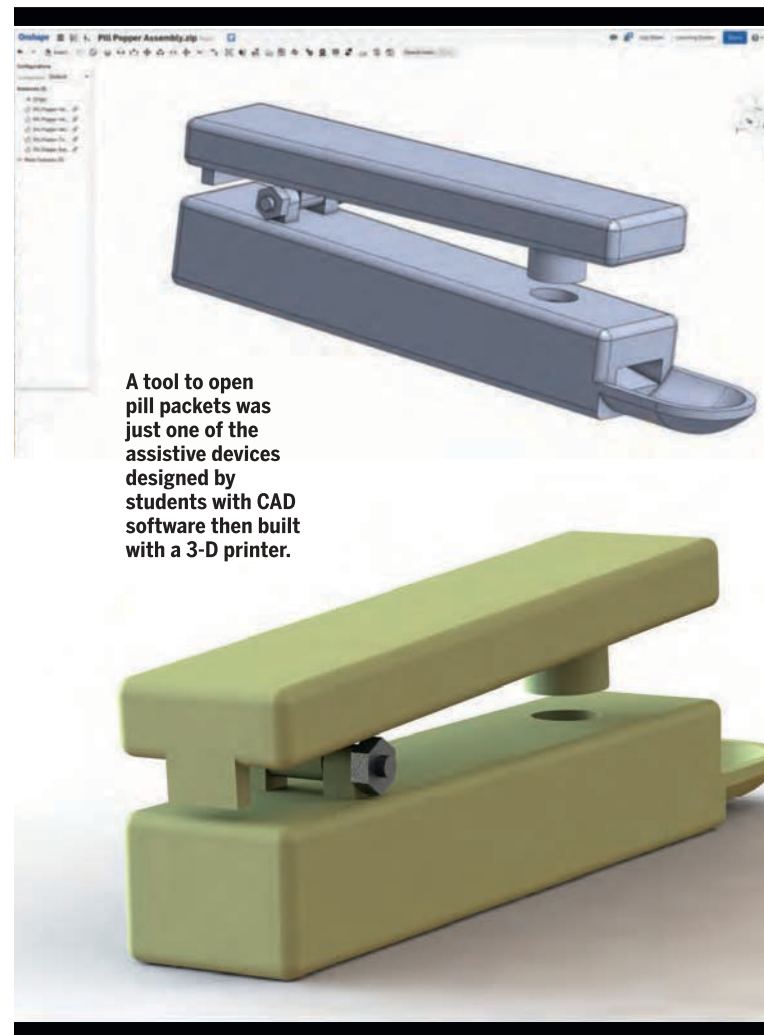
After the initial investment in a 3-D printer (which can cost between \$500 and \$2,500), materials are relatively inexpensive. "Most items are under \$5," says Jacobs of the final cost of a printed assistive device. And 3-D printers are becoming more ubiquitous, available at many universities and public libraries.

Other Sargent occupational therapy faculty members have also incorporated 3-D printing into their curriculum. In Lecturer Kevin Berner's assistive technology class, students have printed adaptive buttons, which people with paralysis can use to activate keyboards, touchscreens, or responsive toys with their best available voluntary movement, such as their hand,



Web Extra
Watch Charlotte Dewley crochet with a 3-D printed adaptive device at go.bu.edu/sargent/inside-sargent.

Karen Jacobs (right), Rebecca Khurshid (center), and Amy Aceto ('21) demonstrate a 3-D printed soda holder, designed to assist a person with arthritis. Sargent and engineering students collaborated on the design and production of the device.



A tool to open pill packets was just one of the assistive devices designed by students with CAD software then built with a 3-D printer.

JACKIE RICCIARDI

"WE ARE ALWAYS LOOKING FOR ASSISTIVE TECHNOLOGY, OR ADAPTATIONS. THE INTRODUCTION OF THE 3-D PRINTER ALLOWS US TO BETTER MATCH WHAT A PERSON NEEDS THROUGH THE DESIGN OF AN INDIVIDUALIZED ITEM."
—KAREN JACOBS

elbow, or head. Such buttons might typically cost \$65, but those printed by the class were about \$8 each.

Even more valuable than the physical assistance is the psychosocial impact. "Giving someone the opportunity to engage in an activity independently can reduce their reliance on caregivers and provide a great deal of meaning in terms of self-sufficiency," says Berner.

In fall 2019, Jacobs plans to assign every group a real client. And she's envisioning ways to use 3-D printing throughout the semester, perhaps to custom-make devices for residents of a local retirement home.

Jacobs considers the project a success, bringing together problem solvers with different perspectives and expertise. It's a model she's using in her own work: she and Khurshid are collaborating with researchers at Hebrew SeniorLife, a senior care organization based in Boston, on the development of a smart walker that will use low-cost sensors to help prevent falls.

Most gratifying is the unique learning experience their collaboration created for the students. "It connected students across BU's different colleges," says Jacobs, "to have a better understanding of another profession they could work with in the future." She recalls the students' first meeting, when they were asked to explain their fields to each other. The first response: "As engineers, we solve problems." The Sargent students laughed. "We do that too," they said. ■

Grant Awards

BU SARGENT COLLEGE'S FACULTY RECEIVED **\$16,102,683** IN RESEARCH FUNDING IN 2018-2019. HERE IS A LIST OF OUR PROJECTS AND THE AGENCIES AND FOUNDATIONS SUPPORTING THEM.

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2018-2019*	YEAR OF AWARD	TOTAL AWARD
Louis Awad, assistant professor of physical therapy & athletic training	A Multi-site, Interventional, Non-comparative, Single-arm Trial to Evaluate the Safety of the ReWalk Restore Device in Subjects with Mobility Impairments Due to Ischemic or Hemorrhagic Stroke	ReWalk Robotics, Inc.	\$38,952	1 of 1	\$38,952
	Feasibility and Preliminary Effects on Post-stroke Locomotion of a Music-Modulating Wearable Sensor System	MedRhythms Inc.	\$6,290	1 of 2	\$12,582
	Multi-Modal Evaluation of Walking Function after Stroke	Boston University Clinical & Translational Science Institute	\$15,000	1 of 1	\$15,000
	Development of Stroke and MS Specific Soft Exosuits-Billing Agreement	ReWalk Robotics, Inc. subcontract via Harvard Wyss Institute	\$34,478	2 of 2	\$34,478
	Task Aware Movement Assessment: Smart Control of Powered Assistive Technologies and Automated Diagnostic Testing	American Heart Association	\$99,995	1 of 2	\$200,000
Louis Awad and Anna Roto, doctoral student	Robotic Exosuit Augmented Locomotion (REAL) Training in the Clinic and Community	American Heart Association	\$99,997	1 of 3	\$299,973
	Soft Robotic Exercise Intervention for Enhancing Neuroplasticity After Stroke	American Heart Association	\$26,844	1 of 2	\$53,688
Helen Barbas, professor of health sciences	Organization of Prefrontal Feedback Circuits	NIH/NIMH	\$565,830	3 of 5	\$2,631,120
	Prefrontal Anatomic Pathways in Executive Control	NIH/NIMH	\$665,052	2 of 2	\$2,433,940
Virginia Best, research associate professor of speech, language & hearing sciences	Spatial Hearing in Speech Mixtures	NIH/NIDCD	\$315,563	3 of 5	\$1,576,698
Terry Ellis, associate professor and chair of physical therapy & athletic training	Walking and mHealth to Increase Participation in Parkinson Disease (WHIP-PD)	NIH/NICHHD	\$681,818	1 of 5	\$3,506,222
	Translation of In-Clinic Gains in Daily Life After Stroke	NIH subcontract via Washington University	\$53,716	3 of 5	\$241,289
	CPS: TTP Option: Synergy: Human Machine Interaction with Mobility Enhancing Soft Exosuits	NSF subcontract via Harvard Wyss Institute	\$100,299	5 of 5	\$328,801
	Development of a Modular Soft Exosuit Platform Suitable for Community-Based Neurorehabilitation	NIH subcontract via Harvard Wyss Institute	\$125,323	4 of 5	\$517,587
	Observational Study of Parkinson's Patients Using Radio Signals	Michael J. Fox Foundation subcontract via Massachusetts Institute of Technology	\$50,000	1 of 1	\$50,000
	CPS: TTP Option: Medium: Robotic Apparel to Enable Low Force Haptic Cueing for Improving Parkinson's Gait	NIH subcontract via Harvard Wyss Institute	\$61,444	1 of 3	\$194,530
	Robotic Exosuit Augmented Locomotion (REAL) Training in the Clinic and Community	American Heart Association subcontract via Harvard Wyss Institute	\$44,530	1 of 3	\$44,530

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2018-2019*	YEAR OF AWARD	TOTAL AWARD
Marianne Farkas, director of training & international services, BU Center for Psychiatric Rehabilitation	Integrated Scaling Approach: A Model for Large Scale Implementation of Effective Interventions for Employment	ACL/NIDILRR	\$499,799	3 of 5	\$2,470,141
	DMH Research Center of Excellence in Public Mental Health and Implementation Research	MA DMH	\$47,190	1 of 2	\$110,150
Daniel Fulford, assistant professor of occupational therapy	Enhancing Social Functioning in Schizophrenia through Scalable Mobile Technology	NIH/NIMH	\$241,204	2 of 2	\$458,867
	IPA Collaborative Work on Yale University/VA Grant Proposal	VA Connecticut Healthcare System	\$2,442	1 of 1	\$2,442
Daniel Fulford and Jasmine Mote, postdoctoral associate	Evaluation of an online Evidence-based Intervention for Transdiagnostic Paranoia in a Community Setting: Cross-Disciplinary Training and Implementation	Society for a Science of Clinical Psychology (SSCP)	\$1,500	1 of 1	\$1,500
Simone Gill, associate professor of occupational therapy	Massive Weight Loss and its Effects on Postural Stability and Fall Risks	NIH/NIAMS	\$88,686	4 of 4	\$270,438
Frank Guenther, professor of speech, language & hearing sciences	Neural Modeling and Imaging of Speech	NIH/NIDCD	\$350,625	3 of 5	\$1,950,981
	Sequencing and Initiation in Speech Production	NIH/NIDCD	\$349,911	4 of 5	\$1,811,733
Elizabeth Hoover, clinical associate professor of speech, language & hearing sciences	A Comparison of the Effects of Dosage and Group Dynamics on Discourse in Aphasia	NIH/NIDCD	\$160,693	3 of 3	\$498,560
Dorothy Hutchinson, director of services, BU Center for Psychiatric Rehabilitation	MA Youth Suicide Prevention Project	HHS/SAMHSA	\$31,280	4 of 5	\$156,233
	The Learning and Working During the Transition to Adulthood RRTC	ACL/NIDILRR	\$72,278	4 of 4	\$201,024
Karen Jacobs, clinical professor of occupational therapy	Project Career: Development of a Multi-disciplinary Demonstration to Support the Transition of Students with Traumatic Brain Injuries from Postsecondary Education to Employment	Department of Education subcontract via Kent State University	\$85,352	5 of 5	\$422,433
	Spatial Hearing, Attention, and Informational Masking in Speech Identification	Department of Defense-AFOSR	\$190,000	4 of 4	\$760,000
Gerald Kidd, professor of speech, language & hearing sciences	Central Factors in Auditory Masking	NIH/NIDCD	\$559,870	3 of 5	\$2,797,653
	Top Down Control of Selective Amplification	NIH/NIDCD	\$541,979	5 of 5	\$2,750,773
	Functional Reorganization of the Language and Domain-General Multiple Demand Systems in Aphasia	NIH/NIDCD	\$660,848	1 of 5	\$3,157,580
Swathi Kiran, associate dean for research and professor of speech, language & hearing sciences	Predicting Rehabilitation Outcomes in Bilingual Aphasia Using Computation Modeling	NIH/NIDCD	\$621,034	4 of 5	\$3,101,075
	The Neurobiology of Recovery in Aphasia: Natural History and Treatment-Induced Recovery	NIH/NIDCD subaward-Northwestern University	\$110,024	6 of 6	\$1,539,111
	Academy of Aphasia Research and Training Symposium	NIH/NIDCD	\$39,939	2 of 4	\$199,695
	Disability Mentoring Initiative	Office of Juvenile Justice & Delinquency Prevention	\$9,252	3 of 3	\$31,235
Jessica Kramer, associate professor of occupational therapy	Designing and Evaluating Outcome Assessment Software for Youth with Development Disabilities: The Pediatric Evaluation of Disability Inventory-Patient Reported Outcome (PEDI-PRO)	NIH/NICHHD subcontract via AbleLink Technologies Inc.	\$10,910	2 of 2	\$88,536

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2018-2019*	YEAR OF AWARD	TOTAL AWARD
Jessica Kramer and Ariel Schwartz, doctoral student	Development and Feasibility Evaluation of a Socially Valid Peer Mentoring Intervention for Young Adults with Intellectual/Developmental Disabilities and Mental Health Conditions	Deborah Monroe Noonan Memorial Fund	\$80,000	1 of 1	\$80,000
	Development and Feasibility Evaluation of a Socially Valid Peer Mentoring Intervention for Young Adults with Intellectual/Developmental Disabilities and Mental Health Conditions	American Academy for Cerebral Palsy and Developmental Medicine	\$25,000	1 of 2	\$25,000
Deepak Kumar, assistant professor of physical therapy & athletic training	Mind Your Walk Intervention for Community-Based Management of Knee OA: A Feasibility Study	NIH/NIAMSD	\$124,462	2 of 5	\$622,311
Susan Langmore, clinical professor of speech, language & hearing sciences	Non-Invasive Brain Stimulation for Swallowing Recovery After Dysphagic Stroke	Beth Israel Deaconess Medical Center/NIH	\$31,000	6 of 6	\$476,591
Cara L. Lewis, associate professor of physical therapy & athletic training	Effect of Femoroacetabular Impingement (FAI) on Hip Motion in Young Adults	NIH/NIAMS	\$158,890	5 of 5	\$653,400
	Movement Screening and Modification in Individuals with Femoroacetabular Impingement Syndrome	NIH/NIAMSD	\$82,500	2 of 2	\$164,916
	Lower Extremity Movement Screening in Individuals with Musculoskeletal Hip Pain	Boston University Clinical & Translational Science Institute	\$19,820	1 of 1	\$19,820
Lindsey Locks, assistant professor of health sciences	Tuberculosis: Learning the Impact of Nutrition	Boston Medical Center/Warren Alpert Foundation	\$8,747	1 of 1	\$8,747
Megan McCrory, research associate professor of health sciences	An Innovated Passive Dietary Monitoring System	Gates Foundation subcontract via Imperial College	\$96,972	1 of 3	\$96,972
	Assessing Food Intake with the Automatic Ingestion Monitor	NIH subcontract via University of Alabama	\$99,566	3 of 3	\$414,181
Susan McGurk, professor of occupational therapy and senior researcher, BU Center for Psychiatric Rehabilitation	A Dismantling Study of Cognitive Remediation for Supported Employment	NIH/NIMH	\$501,212	7 of 7	\$2,771,031
	A Dismantling Study of Cognitive Remediation for Supported Employment	NIH/NIMH	\$128,527	4 of 4	\$128,527
Christopher Moore, dean and professor of speech, language & hearing sciences	Advanced Research Training in Communication Sciences Disorders	NIH/NIDCD	\$462,503	4 of 5	\$1,902,027
Kathleen Morgan, professor of health sciences	Actin and Focal Adhesion Remodeling as Therapeutic Targets in Cardiovascular Disease	NIH/NIA	\$529,023	3 of 5	\$2,635,822
	Role of Smooth Muscle Calponin in Vascular Pathology	NIH/NHLBI subcontract via University of Rochester	\$115,578	1 of 5	\$115,578
Kim Mueser, professor of occupational therapy	Early Stage Identification and Engagement to Reduce Duration of Untreated Psychosis (EaSIE)	NIH/NIMH	\$19,394	2 of 3	\$58,147
	Laboratory for Early Psychosis: Project 2	McLean Hospital Corp	\$19,506	1 of 3	\$58,518
	Integrated Physical and Mental Health Self Management	PCORI	\$74,014	1 of 5	\$365,030
	My Healios	Healios Inc	\$29,693	1 of 1	\$29,693
Gael Orsmond, associate dean and associate professor of occupational therapy	Engaging Siblings of Adults with Autism in Future Planning	NIH/NIMH	\$247,500	3 of 3	\$739,661
	Engaging Siblings of Adults with Autism in Future Planning	NIH/NIMH	\$3,977	2 of 2	\$137,654
Gael Orsmond and Wendy Coster, professor and chair of occupational therapy	Transition Outcomes of High Functioning Students with Autism: How and When Students Learn the Skills Necessary for Self-Management of Daily Responsibilities	Department of Education/Institute of Education Sciences	\$431,581	4 of 4	\$1,578,509
Tyler Perrachione, assistant professor of speech, language & hearing sciences	Neural Bases of Phonological Working Memory in Developmental Language Disorders	NIH/NIDCD	\$163,700	3 of 3	\$491,100

SARGENT INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2018-2019*	YEAR OF AWARD	TOTAL AWARD
Tyler Perrachione, assistant professor of speech, language & hearing sciences	Cortical Development and Neuroanatomical Anomalies in Developmental Dyslexia	NIH/NICHHD	\$82,500	1 of 2	\$165,000
	NeuroDataRR: Testing the Relationship Between Musical Training and Enhanced Neural Coding and Perception in Noise	NSF	\$125,000	1 of 2	\$125,000
E. Sally Rogers, executive director, BU Center for Psychiatric Rehabilitation, and Marianne Farkas	Improved Employment Outcomes for Individuals with Psychiatric Disabilities	ACL/NIDILRR & SAMHSA	\$874,965	5 of 5	\$4,374,848
Elin Roverud, research assistant professor of speech, language & hearing sciences	Weighting of Auditory Information	NIH/NIDCD	\$133,007	2 of 3	\$393,621
Zlatka Russinova, research associate professor of occupational therapy and director of research, BU Center for Psychiatric Rehabilitation	Testing Effectiveness of a Peer-Led Intervention to Enhance Community Integration	NIH/NIMH	\$459,814	4 of 4	\$2,079,531
	Zlatka Russinova and E. Sally Rogers	Enhancing the Community Living and Participation of Individuals with Psychiatric Disabilities	ACL/NIDILRR	\$494,474	5 of 5
	Advanced Research Training Program in Employment and Vocational Rehab	ACL/NIDILRR	\$149,908	5 of 5	\$749,806
	Advanced Research Training Program in Employment and Vocational Rehab	ACL/NIDILRR	\$149,848	1 of 5	\$749,183
	Elliot Saltzman, associate professor of physical therapy	Modeling the Behavioral Dynamics of Social Coordination and Joint Action	NIH/NIGMS subaward via University of Cincinnati	\$24,900	5 of 5
	Collaborative Research: Prosodic Structure: An Integrated Empirical and Modeling Investigation	NSF	\$14,975	2 of 3	\$45,994
	Cara E. Stepp, associate professor of speech, language & hearing sciences	The Impact of Immunotherapy on Voice	BMCC/AAOA	\$4,000	1 of 1
	Career: Enabling Enhanced Communication through Human-Machine-Interfaces	NSF	\$105,843	4 of 5	\$537,538
	An Acoustic Estimate of Laryngeal Tension for Clinical Assessment of Voice Disorders	NIH/NIDCD	\$413,314	4 of 5	\$2,080,252
	Sensorimotor Mechanisms of Vocal Hyperfunction	NIH/NIDCD	\$408,743	2 of 5	\$818,236
	Boston Speech Motor Control Conference	NIH/NIDCD	\$5,720	1 of 5	\$17,360
	Cara E. Stepp and Frank Guenther	Voice and Speech Sensorimotor Control in Parkinson's Disease	NIH/NIDCD	\$526,136	2 of 5
Cara E. Stepp and Elizabeth Heller-Murray, doctoral student	Vocal Motor Control in Children with Vocal Nodules	NIH/NIDCD	\$40,016	2 of 2	\$119,568
LaDora Thompson, professor of physical therapy & athletic training	A Preclinical Approach for the Enhancement of Quality of Life in Patients with Duchenne Muscular Dystrophy	Hanyang University/National Research Foundation of Korea	\$22,000	3 of 3	\$66,000
Lawrence Were, assistant professor of health sciences	Providence/Boston CFAR Developmental Award: Insurance Status and Health Outcomes among HIV and HIV TB Co-infected Persons in Kenya	NIH/NIAID subcontract via The Miriam Hospital	\$40,000	1 of 1	\$40,000
Basilis Zikopoulos, assistant professor of health sciences	Organization of Excitatory and Inhibitory Prefrontal Circuits in Children with Autism	NIH/NIMH	\$409,250	5 of 5	\$2,018,222
	Organization and Circuit Interactions of Thalamocortical Attentional Networks in Health and Disease	NIH/NIMH	\$505,158	1 of 5	\$2,348,754
TOTAL			\$16,102,683		\$70,490,918

* Includes no cost extensions.

Faculty in Print

OUR FACULTY'S RESEARCH REACHES AUDIENCES ACROSS THE GLOBE. HERE'S A SELECTION OF PUBLICATIONS AND ARTICLES BY BU SARGENT COLLEGE FACULTY IN 2018-2019.

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Awad, L. N., Malcolm, P., and Walsh, C. J. (2019). Soft wearable robots. *Wearable Robotics for Motion Assistance and Rehabilitation*. New York: Springer Publishing.

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Cohn, E. S. and Coster, W. J. (2019). Examining how theory guides practice. In B.A.B. Schell and G. Gillen (Eds.), *Willard and Spackman's Occupational Therapy*, 13, 584–600. Philadelphia: Wolters Kluwer.

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Gill, S. V., Pu, X., Woo, N., and Kim, D. (2018). The effects of practice schedules on the process of adaptation. *Journal of Musculoskeletal and Neuronal Interactions*, 18, 419–426.

Henning, J. M., **Brown, S.,** Taylor, L., Anderson, B. E., Walker, S. E., and Eberman, L. E. (2018). Elevating undergraduate to graduate education through the substantive change process: a report from the Athletic Training Clinical Education Network. *Journal of Athletic Training*, 53(6):S241.

Holmes, M. B., Driscoll, L., Murphy, E., and **Starr, J.** (2019). A cross-sectional study of empathy in doctor of physical therapy students at two programs in Boston. *Journal of Allied Health*. (In Press)

Hoover, E. L., DeDe, G., and Maas, E. (2018). Effects of group size on conversation treatment outcomes: Results of standardized testing. *Aphasiology*, 32(1):93–95.

Jackman, R. W., Floro, J., Yoshimine, R., Zitin, B., Eiampikul, M., El-Jack, K., Seto, D. N., and Kandarian, S. C. (2019). Corrigendum: Continuous Release of Tumor-Derived Factors Improves the Modeling of Cachexia in Muscle Cell Culture. *Frontiers in Physiology*, 10:394. doi: 10.3389/fphys.2019.00394. PMID: 31105575.

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Who We Are

Students	Undergraduate	Graduate
Number of full-time students	1,289	617
Average SAT Percentile*	94%	n/a
Average GRE Score*	n/a	310

Faculty

Full-time	72
Part-time	35

Alumni

18,278 in 66 countries

Clinical Sites

More than 1,100 in 42 states and 3 countries

Areas of Study

Athletic Training
 Behavior & Health
 Health Science
 Human Physiology (Pre-Med)
 Nutrition
 Occupational Therapy
 Physical Therapy
 Rehabilitation Sciences
 Speech, Language & Hearing Sciences
 Speech-Language Pathology

Distinctive Programs

- Combined BS and MPH in Public Health
- Combined BS in Health Studies and Doctor of Physical Therapy
- Combined BS and MS in Human Physiology
- Joint Bachelor of Science in Linguistics and Speech, Language & Hearing Sciences
- Combined Doctor of Occupational Therapy/PhD in Rehabilitation Sciences
- Combined Doctor of Physical Therapy/PhD in Rehabilitation Sciences
- Fellowship in Orthopaedic Manual Physical Therapy
- Neurological Physical Therapy Residency Program

*Estimated average over four years

U.S. News & World Report Best Graduate School Rankings

Our graduate programs are officially among the nation's best—Sargent programs tracked by *U.S. News & World Report* all rank in the **top 6 percent** in their respective fields:

- 1 Occupational Therapy Program**
ranked number 1 out of 164 programs
- 12 Speech-Language Pathology Program**
ranked number 12 out of 249 programs
- 14 Physical Therapy Program**
ranked number 14 out of 217 programs

National Certification Board Exam Passing Rates

98%	ATHLETIC TRAINING
100%	NUTRITION
98%	OCCUPATIONAL THERAPY
99%	PHYSICAL THERAPY
100%	SPEECH-LANGUAGE PATHOLOGY

Percentage of BU Sargent College students in entry-level graduate professional programs who passed their certification exams the first time (data averaged over the past three years)

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