ILLUMINATING THOUGHT

INFRARED-LIGHT BRAIN IMAGING WILL ALLOW US TO LOOK INSIDE THE LIVING BRAIN—AND SEE STROKE RECOVERY IN REAL TIME.

RESEARCH AT THE TECH FRONTIER.

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Trek Through Thailand
See a slideshow of Sargent students from the International Service Learning Program in Thailand at go.bu.edu/sargent/inside-sargent.

Research News
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A professor uses an app to show why exercise is one of the best medicines

66 Slowing Parkinson’s
A professor uses an app to show why exercise is one of the best medicines

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Dear Friends,

As I write to you this fall, I reflect proudly on a year of steady growth and success at Sargent College. Our faculty continue to be celebrated as leaders and innovators in their fields. We are especially excited by the recognition of Assistant Professor Deepak Kumar, who was selected as a recipient of the 2018 American Physical Therapy Association’s Eugene Michels New Investigator Award, as well as Clinical Professor Ellen Cohn, who will deliver the American Occupational Therapy Association’s prestigious Eleanor Clarke Slagle Lectureship this spring in New Orleans. We also developed two new combined programs, creating a more efficient path for students in both occupational therapy and physical therapy to pursue a PhD in rehabilitation sciences. We continue to shatter fundraising goals, doubling our participation in the University’s annual Giving Day.

We also completed renovations and upgrades to infrastructure and research labs, which include an impressive array of new technology that inspires our cover story, “From MRI to Motion Capture.” Just a few examples: physical therapy researchers use a 3-D motion capture system to identify connections between movement patterns and disease. Speech, language & hearing sciences faculty study dyslexia with BU’s state-of-the-art MRI machine. Health sciences researchers use an electron microscope—one of the only systems like it at the University—to map brain connections in disorders like autism.

Also in this issue, you’ll learn how occupational therapy doctoral students support women who are incarcerated prepare for life after prison. A physical therapy professor demonstrates the benefits of treating Parkinson’s with exercise. Faculty and students in Sargent’s Aphasia Resource Center test the effectiveness of conversation therapies. And a human physiology professor collaborates with BU engineers to tackle vascular dementia.

Whether helping young stroke survivors earn college degrees or employing the power of photography to give voice to those with mental illness, Sargent’s goal is unwavering: educating the next generation of leaders in health and rehabilitation to enhance the health of our patients. At the same time, our alumni continue to hold key research and clinical positions at top institutions throughout the world—they, like the faculty and students at Sargent, maintain their commitment to improving the human condition. We’re at the forefront of changing lives.

I look forward to sharing more stories in the year ahead, and I hope you’ll keep in touch with me directly at mooreca@bu.edu. It’s always a pleasure to hear from you.

Best wishes,

Christopher A. Moore
Dean and Professor,
@SARDeanBU
“Learning doesn’t start on the first day of school, but rather on the first day of life,” said Dana Suskind, in her 2018 Meredith E. Drench Lecture, “Thirty Million Words: A Public Health Approach to Early Childhood Education” at Sargent. The first three years of a child’s life—during which 80 to 85 percent of brain growth occurs—are crucial to language development, and much of that development takes place at home, through communication with parents and caregivers. Deprivation of language due to factors like hearing impairment can have lifelong consequences for children’s language and literacy, as well as many facets of development, like spatial reasoning and socioemotional maturity.

That’s why Suskind, codirector of the University of Chicago’s TMW Center for Early Learning + Public Health, advocates for helping parents and caregivers to effectively communicate with children. Suskind, a cochlear implant surgeon, founded the Thirty Million Words Initiative—and published a book of the same title—to develop evidence-based interventions that “meet families where they are,” in maternity wards, pediatricians’ offices, childcare centers, and at home. In her lecture, Suskind talked about how the initiative supports children’s language development during these critical years. Seemingly simple modifications can have a big impact. For example: when taking a walk with a child, instead of pointing out what you see, like a triangular bush, Suskind suggests a more interactive approach, instead asking, “Where do you see a triangle?” That shift not only engages the child in conversation, but enhances their aptitude in other developmental areas; in this case, recognizing shapes. Even small changes to everyday interactions with children can make a lasting difference in their lives.

Much of the tree lies sideways, a shattered mess of splinters, its neighbors loom, still reaching for the clouds. Under a photo of this fallen giant, a person with mental illness has written what the broken tree means to them: “Depression will wreck its way through your personal life (like a tornado), tearing up the foundations of your life… But it is in these times[s] that we learn which of our roots are the strongest.”

The image is from one of PhotoVoice’s many international initiatives, which put cameras in the hands of those often left without a voice by society—from Indonesian migrant workers to rural Zimbabweans—allowing them to share pictures and words that shape their world. For more than a decade, the BU Center for Psychiatric Rehabilitation has used PhotoVoice to empower people with mental illness and educate the public about their lives. During BU’s Alumni Weekend 2017, Mary Elizabeth “Tipper” Gore (CAS’70), a mental health advocate, photographer, and former Second Lady, visited the center to learn more about its mission and see a selection of its PhotoVoice work.

In recent studies, the center has evaluated the effectiveness of several PhotoVoice projects in helping people with psychiatric disabilities pursue employment, reduce stigma, turn social isolation into civic participation, and create a social media community. Zlatka Russinova, the center’s director of research, hopes that Gore is inspired to “share information about the power of PhotoVoice as a tool for public education.”—Andrew Thurston

Mary Elizabeth “Tipper” Gore (CAS’70), visited the BU Center for Psychiatric Rehabilitation (CPR) to see PhotoVoice images and meet with Sargent Dean Christopher Moore (center) and members of the CPR team, including Executive Director E. Sally Rogers (right).
Slowling Parkinson’s

WHY EXERCISE IS ONE OF THE BEST MEDICINES | BY BARBARA MORAN

Each year, doctors diagnose about 60,000 Americans with Parkinson’s disease, a progressive neurodegenerative disorder that can lead to tremors, limb and facial rigidity, and balance and walking problems. There are treatments, but no cure.

One of the best therapies turns out to be one with no cost and few side effects, says Terry Ellis, an assistant professor of physical therapy and athletic training and the director of Sargent’s Center for Neurorehabilitation. That professor of physical therapy and athletic training and the national leader on the subject, Ellis has received many teaching and research accolades, including the 2016 Chattanooga Research Award. Presented by the American Physical Therapy Association, the award recognizes the most significant research paper contributing to the science and practice of physical therapy that year.

Ellis has also pioneered work on using mobile health technology like iPads to help people with Parkinson’s keep moving. With Gammon Earhart, a professor at Washington University in Saint Louis, she recently received a five-year, $3 million grant from the National Institutes of Health to enroll 200 people with Parkinson’s in a one-year exercise program with an mHealth component to study how well it works and why.

We spoke with Ellis about how Parkinson’s treatment has changed through the years, and her outlook for the future.

Inside Sargent: When you were first working as a clinician, 30 years ago, how did you treat people with Parkinson’s? What was the standard practice?

Ellis: Back then, we thought, “Oh, these people have a chronic progressive disease; they’re just going to get worse.” We didn’t really expect them to improve, so we just taught them strategies to get by. Like, “If you can’t stand up out of a chair by yourself, here’s how someone might help you.”

And what was the understanding of the effect of exercise on Parkinson’s?

At that time, there were almost no studies looking at the benefits of physical therapy or exercise for people with Parkinson’s.

It wasn’t until the 1990s that there were some animal studies done in rats and mice with Parkinson’s. And scientists found a potential neuroprotective effect, meaning that maybe exercise does something to slow down the progression of the disease or to protect cells from dying.

What do we know about exercise and Parkinson’s now?

Studies conducted here at Sargent as well as by other research groups looking at the benefits of physical therapy and exercise for people with Parkinson’s have shown improvements in things like walking and balance. Most of those early studies were short-term, you could make a difference over 8 to 12 weeks. What about longer? People with Parkinson’s live a long life and want to live well.

In the last five years or so, more long-term studies have come out looking at what happens if you exercise consistently for a year or two. The results show that people with Parkinson’s who exercise do better than people who don’t.

Why? What’s happening?

We know that exercise improves overall brain health. But in Parkinson’s, there may be an increase in neurotoxic factors that protect sick cells from dying. We don’t know for sure. We see improvements at the functional level. We see that people can walk better for a longer period of time. We see that balance can improve. We see that strength can improve. So now exercise is becoming part of the standard recommendations for treatment for people with Parkinson’s.

Are there issues with exercise that are particular to people with Parkinson’s?

Yes. First of all, they have mobility problems, so they can fall, they have a shuffling gait, they’re slow. These can make it difficult to exercise. But I think, more important, there are issues related to depression and apathy, and they may have poor confidence in their ability to exercise successfully. These factors make it even more difficult to overcome that inertia. Also, the number of people in the United States with Parkinson’s who are referred to physical therapy is around 14 percent. That’s terrible. In my mind, it should happen for everybody right away.

What we promote people coming directly to physical therapy at the point of diagnosis [so that we can] prescribe an exercise program that’s tailored to their needs.”

–Terry Ellis

Do other countries do it better?

Yes, because other countries with socialized medicine aren’t dealing with third-party payers. If you have Parkinson’s in the Netherlands, you can just go to a physical therapist and get treatment.

We promote people coming directly to physical therapy at the point of diagnosis. Then we can do a battery of tests to get a baseline assessment—what’s your initial walking ability, your balance, your quality of life—so that we have solid data. And then we prescribe an exercise program that’s tailored to their needs.

Are there certain types of exercise that seem especially beneficial for people with Parkinson’s?

It seems that there may be a neuroprotective effect from aerobic exercise. There are also studies showing that progressive resistance exercises or strengthening exercises help people with Parkinson’s who have bradykinesia, or slowness of movement, to turn on their muscles faster so that they can move more efficiently. Balance exercises are also very important because of the fall risk.

I was wondering whether they should avoid exercises requiring balance.

Well, at one time, that was the recommendation. But if you sit too much, you’re going to be so deconditioned, that creates a whole other cadre of problems. And we recommend people move, and move a lot.

How does mHealth fit into that?

When we see people every six months, they still have to exercise independently between visits. So what we’ve been doing is using a mobile health platform, an app. People have their device—either their iPad, tablet, or their smartphone—and we use an app that shows videos of their exercises. So they get home, open the app, and then they can see the exercises that we’ve prescribed for them and remember how to do them. After they finish the exercise each day, they answer certain questions, like, Was this hard or easy? How many did you do?

Then the therapist can check the data. And based on the responses, we can remotely adapt the exercise program so we can keep it interesting. One of the big things that patients report to us is that accountability makes a difference. They know that you’re watching, and they know they’re coming back in six months to be remeasured, and they want those numbers to improve. They want to take control of this disease.

Where do you hope treatment will be 20 years from now?

Well, maybe we’ll have a cure. But I think what might happen is that there will be a “buffet” of treatments that slow the progression of the disease. And one of those will be exercise. And I hope that we have a system in place across the United States so that everybody gets this, not just people in the know.

This interview has been condensed and edited for clarity.
FROM MRI TO MOTION CAPTURE

HOW FIVE NEW TECHNOLOGIES SUPPORT INNOVATIVE RESEARCH
BY LARA EHRLICH

ADDITIONAL REPORTING BY SARA RIMER
PHOTO BY MIRA WHITING

TYLER PERRACHIONE walked out of his office, crossed Commonwealth Avenue, and entered the Rajen Kilachand Center for Integrated Life Sciences & Engineering’s Cognitive Neuroimaging Center (CNC). There, he spent two hours scanning a human’s brain for a study using BU’s new Siemens Prisma 3 Tesla MRI machine. It was the first time Perrachione, director of the Communication Neuroscience Research Laboratory, didn’t have to schlep across the river to MIT’s brain imaging center. The nine-story, 170,000-square-foot Kilachand Center opened in 2017 thanks to a record $115 million gift from BU Trustee Rajen Kilachand (Questrom ’74, Hon. ’14).

“Everything went swimmingly,” says Perrachione, an assistant professor of speech, language, and hearing sciences, whose enthusiasm is echoed by his colleague Jason Bohland, the center’s associate director. The MRI machine—which supplies higher quality scans than older machines in record time—is “especially an advantage for people like Perrachione who are developing new technology or trying something that’s a little out of the ordinary,” says Bohland. “Just being able to come over here quickly is a huge advantage.”

The MRI machine (see “Scanning for Speech,” page 10) has been a game changer not just for neuroscientists, but for Sargent researchers working in a range of disciplines; Assistant Professor Deepak Kumar scans his subjects’ knees and hips, for example. The machine is just one of many BU technologies that facilitates Sargent’s pioneering research. Here’s how Sargent faculty are using tech, from decoding speech to tracking walking patterns.

1. SCANNING FOR SPEECH: A faster, more detailed MRI to analyze speech recognition.
2. WALK THIS WAY: Motion trackers and physiological sensors help improve walking ability.
3. DETECTING BRAIN ACTIVATION: Near-infrared light detects changes in the brain’s blood flow.
4. CAPTURING MOTION: 3D motion capture reveals movement pattern complexity.
5. ZOOMING INTO THE BRAIN: A microscope provides the closest-ever look at the brain’s axons or cables.
The new MRI machine lets us get higher quality images of the brain [than older machines] in a smaller amount of time, which is important when we are looking at things that the brain has to do very fast, like understand speech,” says Perrachione. “Being able to take high quality pictures faster is also important when doing studies with children, who sometimes don’t like to be in the machine for a long time. We are using these new technologies to study which parts of the brain change as you listen to different people talk, how these changes help you understand speech more efficiently, and how this plasticity might be reduced in developmental communication disorders like dyslexia.”

These scans of a human brain—taken by the new MRI machine—show which parts are activated when we listen to monosyllabic words like “boot” and “deck.” Tyler Perrachione is collecting the data so part of a project decoding how the brain recognizes the same word when spoken by different people, since every person’s speech has a unique sound.

At the Neuromotor Recovery Laboratory, “We use optical and inertial motion trackers in combination with physiological sensors to study how people who have neurological conditions, such as a stroke, walk” and to help them improve their walking ability, says Louis N. Awad, an assistant professor of physical therapy and athletic training and director of the lab. The image to the right features the lab’s treadmill and track with 21 sensors to monitor muscle activity, 6 force plates to measure gait, and 18 optical motion cameras to triangulate a subject’s position in 3-D. PHOTO BY JANICE CHECCHIO

“[The lab is part of the BU] Track & Tennis Center, so patients who have trouble walking are working next door to BU’s runners and athletes,” Awad (far right) says. “They find it inspiring.”

Swathi Kiran, director of the Aphasia Research Laboratory, typically uses brain imaging techniques (fMRI) to examine how the damaged brain recovers language. Even small head movements can distort the data, however, so in recent studies Kiran has turned to functional near-infrared spectroscopy (fNIRS) to study activation in the brain. The fNIRS technology “is easier to set up and study, and with a clinical population like people who have had a stroke, this is a huge advantage,” says Kiran, associate dean for research and a professor of speech, language, and hearing sciences. The technology relies on near-infrared light that, when targeted on the scalp and brain, can detect changes in blood flow as humans think, speak, read, or write. PHOTO BY JANICE CHECCHIO

Learn how fNIRS facilitates Kiran’s recent research on page 18.

The lab is part of the BU Track & Tennis Center, so patients who have trouble walking are working next door to BU’s runners and athletes,” Awad (far right) says. “They find it inspiring.”

Deepak Kumar, an assistant professor of physical therapy and athletic training, uses a 3-D motion capture system at the Movement & Applied Imaging Lab to “assess movement patterns in people who have osteoarthritis or who may be at risk for developing it,” he says. His goal is to “understand how their movement patterns may be interwoven with their disease—and how we can change their movements to help them feel better.” Here, a subject drops from a step onto a force platform, then jumps straight up. Data from sensors worn on the body are represented as red dots, and the arrows indicate the force he exerts on the ground.

IMAGES BY DEEPAK KUMAR

Read more about Kumar’s work on page 14.
Sargent researchers are systematically looking at the developing human brain at a higher resolution than ever before. In a 2018 study published in *PLoS Biology*, assistant professor Vasileios Zikopoulos and his health sciences colleagues used the GeminiSEM 300 electron microscope to—for the first time—study the axons, or cables, that connect neurons and facilitate their communication across different areas of the brain. Housed at the Human Systems Neuroscience Laboratory, the microscope enabled researchers to study the organization of various areas of the brain and explore what goes wrong in the connections between them in disorders like autism.

Zikopoulos found that axons are tangled, which scrambles neural signals. This miscommunication causes problems commonly seen in autism, such as extreme focus and inability to shift attention. The researchers are now exploring changes in the brain’s organization in schizophrenia, depression, and other disorders.

*Photo by Dave Green. Scans and image by Vasileios Zikopoulos.*

**ZOOMING INTO THE BRAIN**

Sargent’s electron microscope is so sensitive that the train passing along Commonwealth Avenue would cause vibrations in the brain scans. To provide accurate data, the tech is housed in an electromagnetic, acoustic, and vibration-free lab.
A TAI CHI–INSPIRED TECHNIQUE COULD HELP PEOPLE WITH KNEE OSTEARTHRITIS WALK MORE—WITHOUT FURTHER DAMAGING THEIR JOINTS

By Andrew Thurstom

It’s a bit of a chicken-or-the-egg conundrum. People with knee osteoarthritis don’t walk enough, which can leave them stiff and put them at a higher risk for other health problems. But, when people with knee osteoarthritis do walk, they tend to be a biomechanical mess, overactivating their muscles, walking bowlegged, or putting more pressure—called joint loading—on the knee. This further damages their cartilage, aggravating the condition and putting more pressure on the knee. As the condition’s advanced stages, a total knee replacement is probably the only remedy.

“We have these two problems,” says Deepak Kumar, an assistant professor of physical therapy and athletic training. “The trick is, how do we solve them both?”

About 14 million people in the United States have symptoms of knee osteoarthritis, according to a 2016 study published in Arthritis Care & Research. The joint cartilage is gradually degrading, the meniscus—the shock-distributing cartilage—getting torn and worn down, and muscles steadily weakening. It adds up to difficulty walking and chronic pain. Physical therapy, weight management, painkillers, and steroid injections provide some relief, but for more than half of sufferers, those limping with knee osteoarthritis don’t walk enough, which can lead to more joint loading, putting more pressure on the knee. As the condition’s advanced stages, a total knee replacement is probably the only remedy.

Kumar’s goal is to limit or delay surgeries, but first he must fix that chicken-or-the-egg problem: helping people become more active and ensuring their newfound enthusiasm for fitness doesn’t make their knee osteoarthritis worse. He got a glimpse of a potential solution while he was a post-doctoral researcher at the University of California, San Francisco. There, Kumar worked with Professor Frederick Hecht on a project testing ways of encouraging people with prehypertension to be more active. As part of the clinical trial, one group of participants was trained in a technique called ChiRunning, which is inspired by tai chi and applies mindfulness practices to improve running form. The fundamental tenets, says Kumar, are “increased body awareness, engaged core, reduced stride length, midfoot strike, increased step rate, and relaxed upper body.” His job was to conduct motion analysis on the participants at the beginning of the trial and three months later; he found their biomechanics—how the body and muscles work together to propel someone forward—had shifted.

“The ChiRunning group showed changes in their movement patterns that seemed to suggest their loading on the knee was lower,” he says. They weren’t putting as much pressure on the joint, particularly the inside of the knee, or putting their foot as far in front of their body, the researchers concluded that the biomechanical differences “may be associated with reduced lower extremity stress.”

“I thought, ‘OK, this should work for osteoarthritis,’” says Kumar. He started a small second study with healthy subjects to take a closer look at ChiWalking, which uses similar techniques as its running counterpart. He found it also reduced impact forces on the body, and the knee in particular.

For the second six months of the ChiWalking project, the emphasis will be on helping participants stay active—safely—without visiting the lab. Study participants will be given a fitness tracker and access to a mobile health app. The app, which Kumar is developing in collaboration with BU’s Software & Application Innovation Lab, pulls in activity data from the tracker, asks questions about mood, sleep patterns, and pain levels, and sends motivational messages. Users can also set goals, while a physical therapist can monitor progress to help them stay engaged with the program.

“If we target pain and problems with mood and sleep, as well as physical activity, we’re more likely to be successful in getting people with osteoarthritis to be more active,” says Kumar.

Kumar recently tested the ability of a small inertial sensor—an inexpensive,urer-sized gadget that includes a gyroscope—to track movement and gait without the need for all the cameras and force plates. When put on the thigh, the sensor can track the knee as the foot hits the ground, monitoring any varus thrust, a quick, but damaging, outward movement of the knee. He presented the results at the 2018 American Society of Biomechanics annual meeting.

If Kumar’s ChiWalking studies are successful, it could provide hope for the millions of people experiencing symptomatic knee osteoarthritis. The combination of consumer technology and a commercially available gait training technique will allow the intervention to be done in group settings at a low cost. “It’s very scalable,” says Kumar.
When Natalie Petrone ('19) visited a segregation unit at the Suffolk County House of Correction in Boston, Mass., with two classmates, the experience struck close to home. Petrone has an uncle who suffers from mental illness and has been in and out of jail, sometimes with long stretches in isolation.

“It really illuminated how terrible the prison system is and what we can do better,” says Petrone, an occupational therapy doctoral student who wants to work with people with mental illnesses. “Luckily, with my career, I can do something about it.”

That something is a program intended to better prepare incarcerated individuals for reentry into society: “People are released into the community and wind up right back in jail because they didn’t have the support they needed,” says Petrone.

With Emily Briggs ('19) and Jade La Rochelle ('19), Petrone designed an occupational therapy program, DiverseOT, for female inmates at Suffolk. Its goal is to empower the women to take control of their lives and improve their chances for a successful transition back to their communities once released. According to the Massachusetts Department of Corrections 2016 prison population report, the 2013 three-year recidivism rate for women was 33 percent.

The jail can house close to 1,900 inmates, about 10 percent of them women, serving sentence typically under two-and-a-half years. In spring 2018, the Sargent students traveled to the jail every week for three months to work with a small group.

“We did our best to learn from the women by asking, ‘What barriers might prevent you from being successful?’” says Petrone. Then the students developed activities to help the women think about how to address those barriers. There were weekly lessons for the four to nine participants that focused on life skills, such as setting goals, developing routines, and resolving conflict. In one activity, Fear in a Bag, the women wrote their concerns on slips of paper, which were then drawn from a bag and shared with the group. When one woman expressed her worry about what to say if she came face-to-face with the people affected by her crimes, the students devised a role-playing exercise to help her confront that possibility.

“The two women were able to have a great exchange about what might happen,” Briggs says. “They realized that sometimes the best thing you can do is apologize, say your piece, and walk away. We talked about how you can control your actions; you can’t control how someone else is going to act.” Briggs believes the practice helped relieve the woman’s anxiety.

To temper the intensity of these exercises, the students encouraged stretching breaks, positive affirmations (“I am calm in the face of conflict” and “I am enough just as I am”), and five-to-seven-minute meditations focused on breathing or compassion. These kinds of activities gave the women a space for peace and self-reflection in the midst of what can be an otherwise oppressive environment. To track their progress, the participants created a collage of their efforts: they wrote accomplished goals on orange triangles; steps taken to help someone else with their goal on yellow triangles; and obstacles on clouds, with rays of sunshine peeking out from behind them.

“It’s a little cheesy, but this way they can see what they’re doing each week and how they can help each other,” Briggs says, noting that one of the most meaningful outcomes of the program was the participants’ initiative to devise solutions to potential post-release challenges. They helped each other to develop strategies for finding resources in the community once they’re released, and to prepare for interacting with people who may treat them like criminals. Some of the strategies were simple: taking a breath before responding to a negative comment, for example. Others were practical, such as finding professional attire through Dress for Success and other nonprofits.

DiverseOT is the latest community outreach program to emerge from Occupation-Based Practice with Groups, a Sargent College course taught by Ellen Cohn, a clinical professor of occupational therapy. The course, which includes a weekly seminar, has been part of Sargent’s curriculum since the early 1970s. In previous years, students have partnered with Boston’s Museum of Science to provide inclusive opportunities for children with autism, worked with kids who are obese or at risk for obesity to develop healthy exercise and nutrition habits, and provided services for adolescents with disabilities who are transitioning into adulthood. The DiverseOT students were supervised by Cohn and Christina Ruccio, director of women’s program services at the Suffolk County Sheriff’s Department.

The Suffolk work falls into an area of occupational therapy known as occupational justice, a term that acknowledges people’s right to engage in occupations or activities of daily living that promote health, well-being, and social inclusion.

Occupational therapy in the criminal justice setting is an emerging practice area, Cohn adds; the Suffolk work is Sargent’s first foray into that field.

Cohn says she’s impressed by the “passion, sensitivity, commitment, and thoughtfulness” of the students, who came up with the idea for the DiverseOT program, collaborating with Ruccio and Anne Escher, a clinical assistant professor. Ruccio says the students’ curriculum is a strong fit with the Suffolk County Sheriff’s Department’s goal of providing “thoughtful, gender-specific, reentry programming to our female inmates and detainees.”

Briggs, La Rochelle, and Petrone are in the first class of doctoral students in Sargent’s Entry-Level Doctor of Occupational Therapy program, which launched in 2016.
A NEW SEMESTER

By Stephanie Rotondo

The day before Thanksgiving 2009, college junior Drew Sperling got ready for work in the apartment he shared with roommates, walked out of his room, and collapsed from a stroke. The 21-year-old spent five weeks in a coma and was paralyzed on his right side. He was diagnosed with aphasia—a language processing disorder that makes it difficult to speak, understand speech, read, or write—after five years—and a lot of speech and physical therapy—of neuroplasticity—the idea that the brain can form and reorganize connections after injury, particularly in a stimulating environment—with intense treatment. She had seen Sperling’s struggles are more common than many people realize. Young adults account for approximately 10 to 15 percent of the nearly 800,000 Americans who have a stroke each year; 15-to-24-year-olds have the second highest rate of traumatic brain injury (TBI) among any age group, often as a result of motor vehicle accidents, sports injuries, and falls. And yet there are few rehabilitation programs to help young adults like Sperling overcome the physical, intellectual, and psychosocial barriers caused by stroke or TBI.

Swathi Kiran, a speech, language, and hearing sciences (SLHS) professor and associate dean for research, has developed a new program, Intensive Cognitive and Communication Rehabilitation (ICCR), to help young adults return to college after a brain injury—and to improve their quality of life.

"When you're college-age, everything you're doing—waking up, going to class, remembering your classroom, taking assignments—gets much harder because of the stroke or TBI," says Kiran, director of Sargent’s Aphasia Research Lab. "So, most people just drop out of the system." ICCR is designed to help young adults with brain injuries improve their cognitive and linguistic function and become successful students.

"It's like a practice run to go back to school," says Lindsey Foo, an SLHS clinical fellow and a program facilitator. 

"The lecture content—open source from Yale University and Khan Academy—isn't watered down, but the pace is calibrated to students' needs. There's no timeline in which participants must complete ICCR; they can continue as long as they show growth each semester.

Kiran developed the program by combining the principles of neuroplasticity—the idea that the brain can form and reorganize connections after injury, particularly in a stimulating environment—with intense treatment. She had seen patients improve using Constant Therapy, an iPad application she codeveloped that allows individuals to engage in therapy anywhere, anytime.

"The more systematic and more repetitive the therapy, the more you're going to improve," she says.

ICCR is more immersive and immediate than a typical speech therapy session because students are learning cognitive strategies in the classroom, where they can implement new skills or strategies on the spot. An ICCR student who is studying the four stages of mitosis, for example, can develop a mnemonic to remember those stages with the help and support of a speech-language pathologist. If they have questions, they can get assistance right away, whereas a student working on those skills in a clinic would need to wait until their next appointment for help.

Master's-level speech-language pathology students, working with ICCR as part of their practicum requirement, help provide this real-time classroom support. Kiran says their involvement enables the program to "infect every hour with cognitive therapy.

It can be intense. Students take daily quizzes and are encouraged to study every night. They give presentations, write papers, and participate in class discussions. "Having four classes is hard," says Sperling. "But it's actually good for me to work hard!"

"It's not going to get better if the work is not tough," says Natalie Gilmore, an SLHS PhD candidate and a program facilitator. "Our students get that. To get up every day and agree to work hard!"

GAINING CONFIDENCE

The program isn't just about academic success; one of its main goals is a better quality of life. During individual speech therapy sessions, students focus on a diverse range of skills and goals, from improving their writing to using an online dating app. The latter is a reminder of the challenges and goals for young adults with brain injuries. "There are so many life experiences they..."
GETTING DATA

The first two years of the program have surpassed Kiran’s expectations. Measured by standardized testing, students have shown progress in classroom participation and individual therapy, as well as social communication and participation, which the program didn’t specifically target. The more seniors a student participates in ICCR, the more they improve in cognitive–linguistic functions like attention, memory, and verbal expression. Measured by standardized testing, students have shown improvement despite the long-term nature of their injuries.

Seemingly small events have already proven the program’s potential for positive change. Heading to a meeting last summer, Kiran stepped outside Sargent’s glass doors and saw two ICCR classmate eating lunch on a bench, enjoying the midday sunshine. Surrounded by BU peers, the students waved and talked to passersby. Being part of the University milieu is the essence of what Kiran and her team are trying to achieve.

“They get to feel that they’re alive,” she says. “People acknowledge them as part of the University community. Yes, we’re doing science, we’re doing research, but, at the end of the day, they’ve got their dignity and their identity and their self-confidence back.”

**Swathi Kiran**

ICCR by examining the principles of mismatch negativity with intensive treatment.

**Natalie Gilmore**

Life After High School

**ROAD Ahead Study supports high schoolers with autism as they transition into adulthood**

*BY REBECCA BEYER*

**Christian Tsetsos**, an administrative professional who has Asperger syndrome, credits his mother and an adult–turnaround mentor with his transition from high school to college and into a full-time career. They made sure he received the necessary support services from his public school system and encouraged him to advocate for himself. Tsetsos believes many students like him aren’t as fortunate when it comes to getting the help they need.

“Even among special education teachers and staff,” says Tsetsos, “there’s a lack of understanding about how best to prepare individuals on the spectrum for post–high school life.”

For the next stage of the study, the research team, which also includes faculty from Boston Wheelock College of Education & Human Development and the College of Arts & Sciences’ psychological sciences, will collect input from parents and their high school student with autism. A longitudinal survey will examine post–school outcomes, including how challenges taking over responsibility for daily life tasks at home, school, and in the community may be related to less successful outcomes.

Parents will complete a standardized assessment examining the extent to which their child has assumed responsibility for managing tasks such as making social plans, meeting health and medical treatment requirements, and managing food needs, first during senior year of high school and then again 18 months later. “At the top of the scale, the child manages all of a task,” says Coster, chair of the occupational therapy department. “That doesn’t mean they do it completely on their own, but it means they need help, they take responsibility for reaching out to get it.” As part of the ability to self-manage daily life, Orsmond and Coster are interested in the youths’ skills that support functioning; not just the ability to withdraw money from an ATM or balance a checkbook, but to effectively plan and implement a budget.

Children without autism might pick up self-management skills by observing their parents or guardians. Students with autism who have an intellectual disability might learn some of these things in special education classes. But youth with autism primarily take general education classes so it may be more difficult for them to see both disability and general classes because they’re academically on par with their peers.

“Kids who graduate with a high school diploma, go to college, but then struggle with social and life skills,” says Orsmond, who directs Sargent’s Families and Autism Research Center. “The Road Ahead Study will look at those outcomes. Orsmond and Coster hope their work will reveal that success is more fluid and nuanced than that.

Much of the existing research into post–graduation success for youth on the spectrum has focused on discrete outcomes such as attending college and having a full-time job, says Orsmond. Although the Road Ahead Study will look at those outcomes, Orsmond and Coster hope their work will reveal that success is more fluid and nuanced than that.

They’re interested in what students need even after the student has fulfilled the graduation requirements; for example, offering support services through the school while students took community college classes.

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Memory loss in old age starts small, with misplaced keys or wallets. In some people, it can be the sign of a far more serious disorder. Dementia can eventually set in, robbing people of the memories of faces, names, and important events. It’s devastating for both patients and family members—and it’s distressingly common. According to the World Health Organization, more than 47 million people suffer from dementia worldwide.

While Alzheimer’s disease is likely the most well-known form, dementia also comes in other varieties. Vascular dementia, for example, is the result of tiny blood vessels bursting in the brain, leading to microstrokes and minute bleeds. The condition is closely linked with other age-related memory disorders.

“I suspect that vascular dementia and Alzheimer’s are really just two different angles on the same disease,” says Kathleen Morgan, a professor of health sciences. “There are plaques in the brain tissue of Alzheimer’s patients that are visible at autopsy, but we know that if you have them, you’ll probably see evidence of microbleeds as well.”

And if burst blood vessels are implicated in early-stage dementia, Morgan says, it may be possible to stop that damage before it starts. With a $2.5 million grant from the National Institute on Aging (NIA), she is examining a synthetic prototype drug that could prevent microbleeds in mouse brains. To do so, she’s joining forces with Tyrone Porter, a College of Engineering associate professor of mechanical engineering, to develop a new delivery system for the drug. Their solution uses a novel system of microbubbles—tiny bubbles of inert gas smaller than capillaries—along with a focused ultrasound beam to help push the drug into a very specific part of the body: the large blood vessels next to the heart.

Most brain bleeds, Morgan says, actually start in the aorta, the body’s largest artery, which connects directly to the heart. With each beat, the heart exerts enormous amounts of pressure straight onto that conduit, which is made of smooth muscle cells that expand with each beat, acting as a sort of shock absorber for the pressure coming out of the heart. In older bodies, though, muscle becomes gradually less elastic, meaning that the energy of each pulse travels farther through the vascular system. If the aorta becomes stiff enough, blood can surge at high pressure straight into tiny, sensitive blood vessels in the brain, which may burst under the strain.

Morgan is developing new ways to reverse the stiffening of arteries. If she can restore some of the aorta’s elasticity, she reasons, it may be possible to prevent new microbleeds. To test this idea, she’s concocted a new peptide—a small chain of amino acids—that can control smooth muscle stiffness.

In smooth muscle tissue, she says, elasticity is determined in part by two types of long, stringy molecules called actin and myosin, which form a web inside each cell. As the two strands latch onto each other, they restrict the cell’s movement, stiffening its structure. “It’s a bit like a Chinese finger trap,” says Morgan. “The harder you tug on actin, the harder it clamps down.”

The peptide her team has created, however, can effectively stop this process in its tracks by binding to the molecules, preventing them from grabbing onto their counterparts in the first place. As a result, the cell remains relaxed and supple. Morgan can control how stiff or loose the tissue gets by controlling the amount of peptide she administers.

“Hearts, Minds & Microbubbles

TECHNOLOGY TO PREVENT THE TINY STROKES THAT CAUSE VASCULAR DEMENTIA

BY DAVID LEVIN

“I suspect that vascular dementia and Alzheimer’s are really just two different angles on the same disease.”

—Kathleen Morgan

Tyrone Porter and Kathleen Morgan are developing a drug, and a delivery system, that may help prevent blood vessels from bursting and causing early-stage dementia.
The challenge, she says, is delivering those molecules directly to the smooth muscle inside a living aorta. Unlike other drugs, releasing this one system-wide—or even artery-wide—could be disastrous. “Smooth muscle tissue isn’t just in the aorta. It’s in your vascular system, urinary tract, uterus, lung tissue, and digestive system,” she notes. “If the peptides got into those tissues, it could cause incontinence, premature labor, all sorts of awful things.”

To get the drug exactly where it’s needed, you first have to dig into the artery itself.

“The cells we need to target don’t come in contact with flowing blood. They’re behind a layer or two of other cells and connective tissue in the blood vessel walls,” says Porter. In order to break through those layers and deliver the drug to smooth muscle cells, he’s attaching Morgan’s peptides to the outside of each microbubble. Focused ultrasound can be used to push the microbubbles toward the aortic wall and pop them to release the peptide. The “popping” process also subtly and reversibly disrupts the lining of the aorta, making the blood vessel wall temporarily permeable. “Once that happens, the peptide can flow directly into the spaces that open up in the vessel wall, and go straight into the smooth muscle tissue,” Porter says.

These microbubbles themselves are simple to make, he adds, and the FDA has already approved them for use. “Microbubbles have been used for years as contrast agents for ultrasound. They scatter sound much better than tissue, so they’re used to distinguish blood from the chambers in heart and surrounding muscle,” he says. “They’re also tiny enough to fit through the smallest blood vessels in the body and eventually disappear as the gas, which is harmless, escapes into the blood and is expelled out of the body through the lungs.”

In addition to being relatively safe, the clinical advantage of this approach is that it can be done with a standard ultrasound probe commonly used in a cardiac echo test. Using a low-powered ultrasound beam, a technician can track where the bubbles are going, then pop them at a specific location by simply turning up the strength of the beam. “[Existing ultrasound tools] can focus the beam down to the millimeter, so it’s extremely accurate,” says Porter.

Until now, Morgan has only been able to test her peptide and its new delivery system on smooth muscle cells in a petri dish. With the new grant from the NIA, she and her collaborators are looking to scale up their research, and they will use their approach for the first time on a living animal.

“My earlier work was just on the fundamental mechanics of these peptides. Moving into a whole mouse is a big leap for someone used to sitting at a bench dealing with cells,” she says, laughing. “The people I’ve connected with here at BU make it feasible, though. That’s how you get basic discoveries translated into practical ones—you have lots of scientists working in parallel. You need teams instead of a single investigator.”

With a $2.5 million grant from the NIA, Morgan and Porter are examining a synthetic prototype drug to prevent microbleeds in mouse brains.

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**Conversation Therapy**

How Ken Ashin recovered his verve for language after a stroke

**BY LARA EHRHILL**

Annette Ashin used to teach English at the University of Illinois, but she always thought of her husband, Ken, as the more articulate one of the pair. “I used to call him up when I was struggling to put a sentence together perfectly,” she says.

In December 2010, Ken Ashin, a former software engineer, had a stroke that left him with aphasia, a chronic language disorder marked by communication challenges in reading, writing, understanding language, and speaking.

“In the beginning he could hardly say three or four words,” says Annette. “I researched Boston-area resources that could help Ken with rehabilitation and chose Sargent’s Aphasia Resource Center because it was ‘the most receptive, flexible, and welcoming of all the institutions that we explored,’ she says.

For the next six years, Ken came to Sargent every couple of weeks to participate in an array of programs and studies designed to improve his language skills and advance our understanding of aphasia. In one ongoing three-year study—the Aphasia Conversation Treatment program led by Elizabeth Hoover, clinical director of the Aphasia Resource Center at Sargent—the investigators explore improving conversation-based therapy.

In the study funded in part by a $500,000 grant from the National Institutes of Health (NIH), the first NIH has awarded for group conversational treatment in aphasia, participants were divided into three groups: the first conversed in pairs moderated by a therapist; the second worked in larger groups, and the third did not participate in therapy (though they did receive treatment later).

In both pairs and large groups, the participants worked on personalized skills like word retrieval and speaking in complete sentences. As a member of the group that worked in pairs, Ken partnered with a fellow study participant, who he credits as a “major catalyst” in his recovery, says Annette. “They were similar in a lot of ways. Both of them are iconoclastic, said what they thought, didn’t care what anybody else thought. So, they got along really well. The therapist let the conversation continue and facilitated.”

Hoover and the study’s coprincipal investigator Gayle DeDe (‘52, ’08), director of the Philadelphia Aphasia Community at Temple University, have just started analyzing the data. Their initial findings suggest that the participants who worked in pairs showed improvement in specific language skills such as repetition and verb naming, while participants who worked in large groups gained more confidence in functional communication, or how effectively they could perform daily tasks like reading signs in a grocery store and asking for directions.

“In the smaller groups you have more opportunity for conversational turns, so those language tasks—word retrieval, for example—tended to improve more strongly, but in the larger group where you have a broader range of opinions and topics in the conversation, you can glean confidence and psychosocial support,” says Hoover; a clinical and educational psychologist, her areas of expertise include language and hearing sciences.

In both groups, the participants showed more improvement than those who did not receive treatment.

“I had noticed all along that Ken can say things spontaneously more successfully than when he’s pressured,” Annette says. “The therapy experience improved spontaneous response to a situation. We learned not only from the research team and the therapists, but also from the other aphasia patients.”

Ken adds, “I appreciated it.”

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<td>A Comparison of the Effects of Dosage and Group Dynamics on Discourse in Aphasia</td>
<td>NIH/NIDCD</td>
<td>$10,002</td>
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<td>The Learning and Working During the Transition to Adulthood:RTC</td>
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<td>NYS Youth Suicide Prevention Project</td>
<td>HHS/SAMHSA</td>
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<td>$156,030</td>
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<td>Project Career: Development of a Multi-disciplinary Demonstration to Support the Transition of Students with Traumatic Brain Injuries from Postsecondary Education to Employment</td>
<td>US Department of Education Subcontract via Kent State University</td>
<td>$85,000</td>
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<td>$425,000</td>
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<td>Spatial Hearing, Attention, and Temporal Tracking in Speech Identification</td>
<td>NIH/NIDCD</td>
<td>$150,000</td>
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<td>$750,000</td>
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<td>Central Factors in Auditory-Masking</td>
<td>NIH/NIDCD</td>
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<td>Top Down Control of Selective Amplification</td>
<td>NIH/NIDCD</td>
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<td>Predicting Rehabilitation Outcomes in Bilateral Aphasia Using Computation Modeling</td>
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<td>The Neurobiology of Recovery in Aphasia: Natural History and Treatment-Induced Recovery</td>
<td>NIH/NIDCD</td>
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<td>Structural and Effective Connectivity of Desegregated Language Networks in Aphasia</td>
<td>NIH/NIDCD</td>
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Jessica Kramer, associate professor of occupational therapy

Sargent Investigator


Abilrx Technologies, Inc./NIH/NIDHD

$77,626

2017-2018

1 of 2

$87,691

Disability Monitoring Initiative

Trailhead Institute/PCORI

$49,845

2017-2018

1 of 1

$49,845

Susan Langmore, associate professor of health sciences

Non-Invasive Brain Stimulation for Swallowing Recovery After Dysphagia Strokes

Beth Israel Deaconess Medical Center/NIH

$76,000

2017-2018

5 of 5

$76,570

Cara L. Lewis, associate professor of sciences

Effect of Femoroacetabular Impingement (FAI) on Hip Motion in Young Adults

NIH/NAMS

$188,690

2017-2018

5 of 5

$162,403

Susan McGurk, professor of speech, language & hearing sciences

Femoroacetabular Impingement Syndrome

Lower Extremity Movement Screening in Individuals with Femoroacetabular Impingement Syndrome

Boston University Clinical & Translational Science Institute

$79,820

2017-2018

1 of 1

$79,820

Megan McCarty, associate professor of health sciences

Assessing Oral Intake with the Automatic Ingestion Monitor

University of Alabama

$104,473

2017-2018

2 of 3

$41,381

Cara E. Stepp, associate professor of occupational therapy and senior researcher, BU Center for Psychiatric Rehabilitation

Airway Impairment

Imperial College/Gates Foundation

$56,972

2017-2018

1 of 3

$56,972

Susan McCork, professor of occupational therapy and senior researcher, BU Center for Psychiatric Rehabilitation

Collaborative Research: Reproducible Patterns of Vocal Communication through Human-Machine-Interfaces

National Science Foundation

$150,641

2017-2018

1 of 5

$30,128

Olga Milne research scientist, BU Center for Psychiatric Rehabilitation; and E. Sally Rogers, executive director, BU Center for Psychiatric Rehabilitation

Collaborative Research: Prosodic Control of Speech Syntactic for Assistive Communication in Severe Dysarthria

National Science Foundation

$55,930

2017-2018

3 of 3

$187,607

Christopher Moore, dean and professor of speech, language & hearing sciences

Collaborative Research: Prosodic Modeling the Behavioral Dynamics of Communication in Severe Paralysis

National Science Foundation

$149,908

2017-2018

5 of 5

$749,806

Kathleen Morgan, professor of health sciences

Collaborative Research: Prosodic Vocal Tension for Clinical Assessment of Voice Disorders

National Institute on Deafness and Other Communication Disorders

$413,299

2017-2018

3 of 3

$1,280,252

Katie Mateus, professor of occupational therapy

Developing and Validating a Measure of Career Advancement for Individuals with Psychiatric Disabilities

ACL/NIDRR

$199,946

2017-2018

1 of 3

$599,045

Geil Dremnd and Wendy L. Coles, professor and chair of occupational therapy

Assessment of Imminent Risk of Suicidal Behavior and Self-Harm Risk

Department of Education/Institute of Education Sciences

$387,339

2017-2018

2 of 4

$1,178,509

Tyler Frenholz, assistant professor of speech, language & hearing sciences

Neural Basis of Phonological Working Memory in Developmental Language Disorders

NIH/NIDCD

$163,100

2017-2018

4 of 4

$491,150

TOTAL

$15,755,459

$67,987,505

2017–2018*

* Includes no cost extensions.

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