SPECIAL EDITION

InsideSargent

Boston University College of Health & Rehabilitation Sciences: Sargent College

ACHIEVEMENTS IN **SPEECH, LANGUAGE & HEARING SCIENCES**

BOSTON UNIVERSITY

Dear Friends and Colleagues,

I'm delighted to send you this special edition of *Inside Sargent* highlighting the exciting work in the Department of Speech, Language & Hearing Sciences (SLHS) at Sargent College.

Throughout this issue, you'll see the ways our faculty and students engage in a wide range of research to make breakthrough clinical discoveries. We're leveraging innovative technology—including Boston University's Siemens Prisma 3T MRI machine and functional near-infrared spectroscopy (fNIRS) systems—to study patterns of brain activation ("From MRI to Motion Capture," page 14). Our research is informing one-of-a-kind treatment approaches like our Intensive Cognitive and Communication Rehabilitation Program, which helps young adults with traumatic brain injury return to college and improve their quality of life ("A New Semester," page 10). And our PhD program is preparing the next generation of researchers and scholars to help fill the crucial need for qualified SLHS professors: on page 2, you'll read about three exceptional students who, along with their faculty mentors, are investigating the neural basis of speech, the mechanics of swallowing, and language recovery after brain injury. Our PhD alumni are joining distinguished faculty at leading universities across the country and around the world.

I'm also pleased to welcome Michelle Mentis as our new department chair. A clinical professor, Mentis has had a distinguished 30-year career in speech, language, and hearing sciences with a focus on pediatric language disorders. You'll read about the innovative Preschool Intensive Language Program she codeveloped in "Intensive Language Therapy" (page 6). The four-week summer program improves children's communication skills through individual and group therapy sessions based on stories, games, and play.

Across the department, our faculty have continued to be honored as the best in their professions. Mentis was recently named a Fellow of the American Speech-Language-Hearing Association. Associate Professor Cara Stepp received the prestigious Presidential Early Career Award for Scientists and Engineers (page 13), the US government's highest honor for promising early-career scientists. Professor Gerald Kidd, a psychoacoustics expert, was appointed to the National Institutes of Health Auditory System Study Section; Jerome Kaplan, a speech-language pathologist in the Aphasia Resource Center, received the Innovator of the Year Award from Aphasia Access; and Clinical Associate Professor Diane Constantino was honored with the Continued Commitment Award from the National Student Speech Language Hearing Association.

I'm so proud of our SLHS department and the talented faculty, students, and alumni who every day are transforming practice through science. I hope you'll enjoy reading more about some of the research and clinical activities underway at Sargent College, and that as always, you'll keep in touch.

Warm regards,

Christopher A. Moore
Dean and Professor

"I'M SO PROUD OF OUR SLHS DEPARTMENT AND THE TALENTED FACULTY, STUDENTS, AND ALUMNI WHO EVERY DAY ARE TRANSFORMING PRACTICE THROUGH SCIENCE."

SPECIAL EDITION InsideSargent

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PHOTO: DAN AGUIRRE

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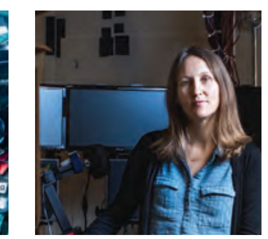
SPECIAL EDITION InsideSargent

Achievements in Speech, Language & Hearing Sciences



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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); CYDNEY SCOTT (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

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Saul Frankford

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.

CONOR DOHERTY (FRANKFORD); KALMAN ZABARSKY (GUENTHER)

CONOR DOHERTY (GILMORE); KALMAN ZABARSKY (KIRAN)

Natalie Gilmore

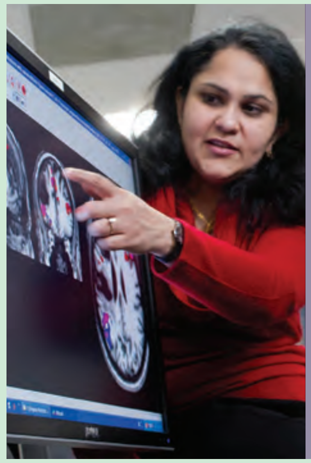
Watching the brain recover

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." ■



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.

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

MICHAEL D. SPENCER

Intensive Language Therapy—with Added Fun

HOW SARGENT RESEARCHERS ARE BUILDING TARGETED TREATMENT INTO PRESCHOOL PLAY

BY CORINNE STEINBRENNER

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.

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“There is essentially no downtime in terms of language facilitation and continual focus on the children’s goals.”

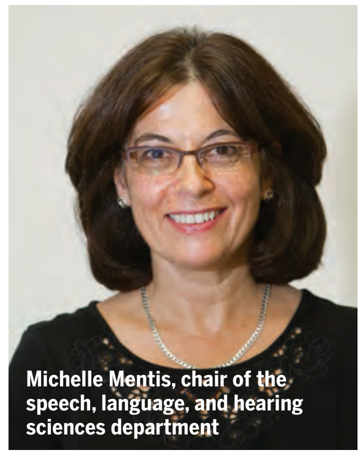
The children might then reenact the story using toy animals. As each animal speaks, the clinician asks, “Why doesn’t the spider answer?” A child responds, “Because she was busy spinning her web.”

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 department

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)

Conversation Therapy

How Ken Ashin recovered his verve for language after a stroke

BY LARA EHRLICH

“In [a] larger group where you have a broader range of opinions and topics… you can glean confidence and psychosocial support.”—Elizabeth Hoover

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. She 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—he helped researchers investigate the effectiveness of two types of conversation-based therapy.

In the study funded in part by a $500,000 grant from the National Institutes of Health (NIH), the first the 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 (’02,’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 associate professor of speech, 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 that 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.” ■

When Ken Ashin had a stroke that left him with aphasia, his wife Annette called Sargent’s Aphasia Resource Center to help him recover.

JAKE BELCHER

A NEW SEMESTER

REHABILITATION PROGRAM HELPS YOUNG ADULTS RETURN TO COLLEGE AFTER A BRAIN INJURY

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—and he had to relearn how to walk.

After five years—and a lot of speech and physical therapy—the former business major gave college another try. He enrolled in a class, but says he found the content and fast pace daunting. By the time he understood a concept in a lecture, the professor had moved on. He dropped the course in its second week.

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 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.

JANICE CHECCHIO

MICHAEL D. SPENCER

ICCR is "like a practice run to go back to school," says program facilitator Lindsey Foo (far right), with Zach, an ICCR student (center).

INTENSE STUDY

In 2018, Sperling moved from California to Boston to enroll in ICCR's 15-week spring semester. As a member of the six-student cohort, he came to Sargent four days a week for lectures in four introductory college courses (subjects included English, statistics, psychology, and human anatomy and physiology), lecture review sessions led by clinicians, technology training, and individual therapy. The program began and ended with one to two weeks of clinical and academic assessment to measure participants' improvements from the beginning of the semester.

> "When you're college-age, everything you're doing... gets much harder because of the stroke or [traumatic brain injury]."—Swathi Kiran

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 "infuse 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 be challenged—they're extraordinarily motivated."

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

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haven't had," says Gilmore. "They want to meet people, make friends."

For Sperling, living away from his parents for the first time since his stroke has been "fantastic." He says developing cognitive skills in ICCR has given him self-confidence and independence. By learning to navigate Boston's MBTA system, for example, he was able to travel to the grocery store and to get a haircut.

"He surprised us, and he surprised himself," says Sperling's mom, Shelby. "[ICCR] gave him that much more confidence that he could do the academic part on his own—he didn't need mom and dad to sit with him every night and review questions."

Classmates eat lunch together, connect on social media, and socialize outside of school. Sperling planned a recent student dinner at a Boston restaurant. "A long time ago, I was isolated, and now I'm branching out a little bit," he says. The students are also embracing the wider BU community; Sperling attends a film club and another student joined a BU bible group.

Their assimilation has been particularly gratifying for Kiran who understands the stakes: "If they don't find something like this to change their lives, they're going to fall through the cracks in the system, and they're too young to be written off."

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 semesters a student participated in ICCR, the more they improved in cognitive-linguistic functions like attention, memory, and verbal expression.

What is particularly surprising, says Kiran, is that students show improvement despite the long-term nature of their injuries. "Time is against them," says Kiran, but that "does not outweigh their motivation and the intensity and functionality of the therapy—that is a scientific achievement."

One of the next steps for Kiran and her team is to use functional near-infrared spectroscopy (fNIRS) to measure changes in brain activity during class. The technology, which David Boas, director of the BU Center for Neurophotonics, helped pioneer, uses light to noninvasively monitor brain activity. Because fNIRS allows brain imaging to be conducted just about anywhere—participants wear what looks like a swim cap fitted with sensors—it solves a common research problem: laboratory tasks don't often mirror real-life scenarios. With fNIRS, "We could be in class collecting data," Kiran says, allowing her team to better determine how the brain is responding to treatment.

ICCR has grown steadily each semester and enrolled eight students in summer 2018. One program graduate is pursuing an associate's degree at a Massachusetts community college; another is attending BU, enrolled in a course at Sargent. "This is a wonderful opportunity for these survivors to move on to another phase of their life—and be able to construct a meaningful life," says the Sargent student's mother, Lisa. "It's a lifesaver. When parents ask me, 'is it worth having my son or daughter do this?' I say it will make a difference and you will see the changes."

Sperling returned for another ICCR semester over the summer, aspires to enroll in college, and is considering a career helping others with aphasia. Kiran projects that in five years, ICCR will be a comprehensive two-year program where, upon completion, all graduates enroll in college.

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 classmates 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 (center) developed ICCR by combining the principles of neuroplasticity with intense treatment. Natalie Gilmore (left) is one of the program's facilitators.

MICHAEL D. SPENCER

EARLY CAREER HONOR

Cara Stepp receives prestigious White House award

By bringing together the work of engineers, computer scientists, neuroscientists, speech scientists, speech-language pathologists, and laryngologists, Cara Stepp is on the cutting edge of research—and her work is drawing accolades. Stepp, an associate professor of speech, language, and hearing sciences and biomedical engineering, received a 2019 Presidential Early Career Award for Scientists and Engineers (PECASE). The honor—the highest of its kind bestowed by the United States government—recognizes scientists and engineers at the beginning of their research careers.

Stepp runs the STEPP LAB for Sensorimotor Rehabilitation Engineering. An expert in using engineering approaches to study disorders of voice and speech, her goal is to better understand and augment disordered communication to help rehabilitate people who have experienced a stroke, Parkinson's disease, brain injury, or another condition that impairs speech and swallowing.

"Dr. Stepp has taken on the extraordinarily difficult challenge of applying emerging capabilities in engineering and signal processing to daunting problems in human health," says Chris Moore, dean of Sargent. "It is gratifying to see this research, which is emblematic of our college's strengths and values, recognized and highlighted."

The PECASE Awards, established in 1996, are determined in collaboration between the White House and government agencies, including the National Science Foundation, which nominated Stepp. ■

SCOTT NOBLES

FROM MRI TO MOTION CAPTURE

HOW FIVE NEW TECHNOLOGIES SUPPORT INNOVATIVE RESEARCH

BY LARA EHRLICH

ADDITIONAL REPORTING BY SARA RIMER

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."

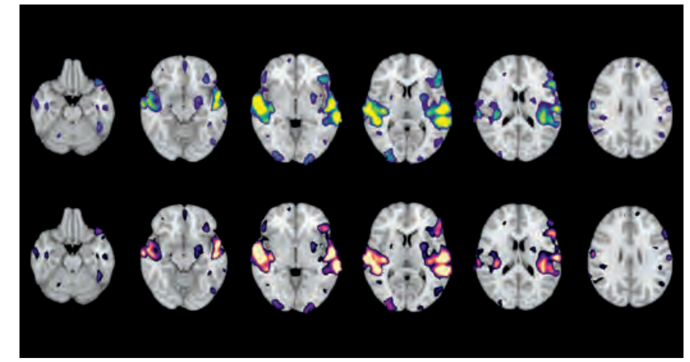
The MRI machine has been a game changer not just for neuroscientists, but for Sargent researchers working in a range of disciplines. The machine is just one of many BU technologies that facilitates Sargent's pioneering research.

MIRA WHITING

RIGHT: JANICE CHECCHIO; TOP: TYLER PERRACHIONE

Here's how Sargent faculty are using tech, from decoding speech to tracking walking patterns.

SCANNING FOR SPEECH



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 as 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.

"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."

DETECTING BRAIN ACTIVATION

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. ■

SARGENT'S USE OF TECHNOLOGY SPANS DISCIPLINES. MEET THREE OTHER RESEARCHERS AT THE CUTTING EDGE.

WALK THIS WAY

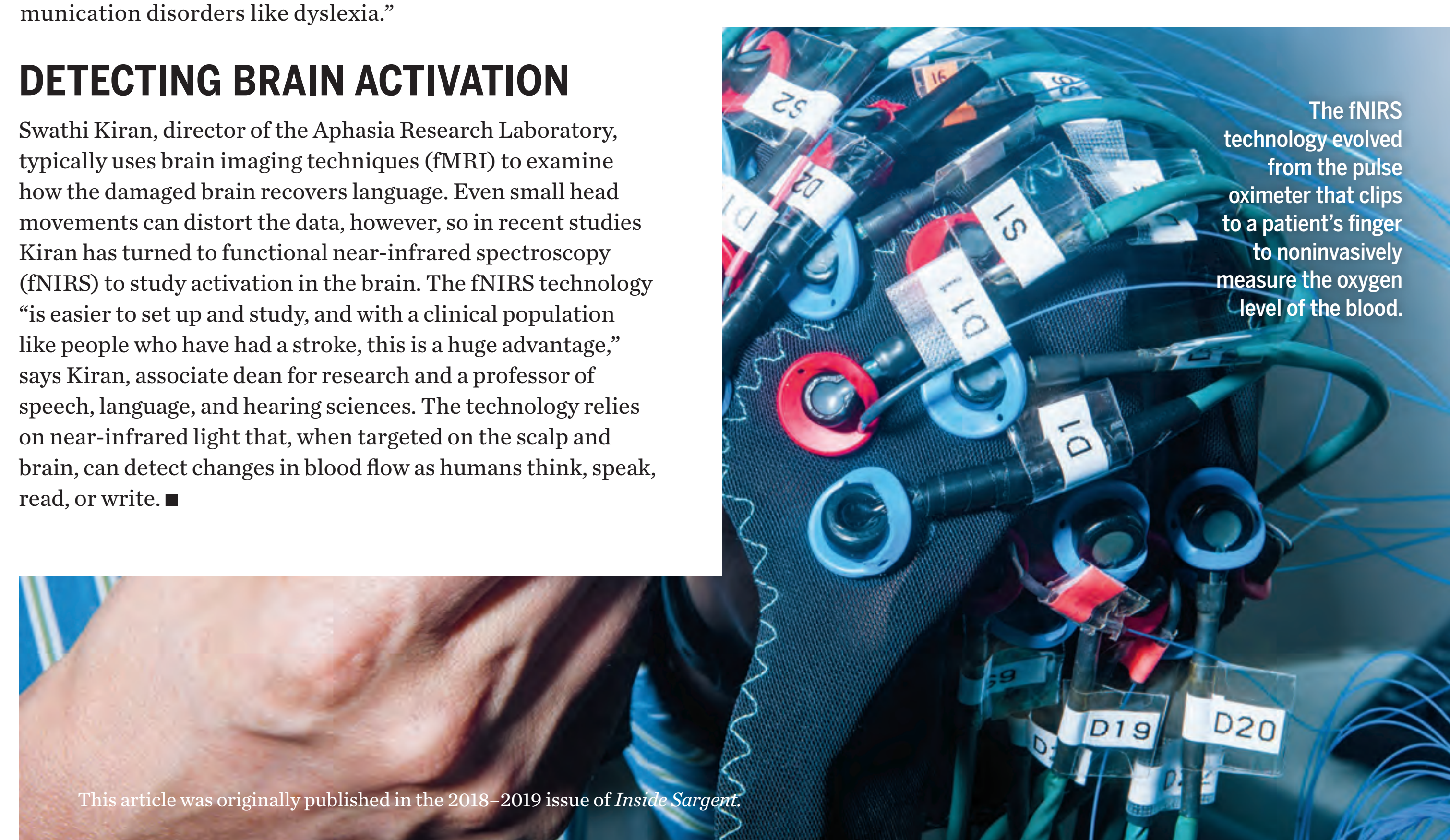
Louis N. Awad, an assistant professor of physical therapy and athletic training, directs the Neuromotor Recovery Lab. "We use optical and inertial motion trackers in combination with physiological sensors to study how people who have neurological conditions, such as a stroke, walk," he says.

CAPTURING MOTION

Deepak Kumar, an assistant professor of physical therapy, uses a 3-D motion capture system to "assess movement patterns in people who have osteoarthritis or who may be at risk for developing it."

ZOOMING INTO THE BRAIN

Assistant professor Vasileios Zikopoulos and his health sciences colleagues used the GeminiSEM 300 electron microscope to—for the first time—study the axons that connect neurons and facilitate their communication across different areas of the brain.



The fNIRS technology evolved from the pulse oximeter that clips to a patient's finger to noninvasively measure the oxygen level of the blood.

This article was originally published in the 2018–2019 issue of *Inside Sargent*.

Follow Your Ears

Researchers study how people with hearing loss locate sounds

By Kate Becker

Virginia Best and Gerald Kidd are studying how people with hearing impairments locate sounds in space, a skill called "spatial hearing."

JACKIE RICCIARDI

The next time you're at a loud party, close your eyes and listen. At first, the sounds are just a fog of noise. But, quickly, you begin to pick out individual voices and locate them, even without looking. This ability to locate voices using sound alone is called "spatial hearing," and it helps listeners follow conversations in noisy places, like cocktail parties and restaurants. For people with normal hearing, it happens almost effortlessly. But people with hearing loss often have trouble with spatial hearing, even when they have hearing aids on. Why?

"This is a problem that conventional hearing aids don't solve," says Gerald Kidd, a professor of speech, language, and hearing sciences, who heads BU's Psychoacoustics Lab. "In a room full of people talking—a party, a social situation—sometimes people with hearing loss are lost and they disengage. It has a real human consequence."

With the support of a five-year, $1.5 million National Institutes of Health grant, Virginia Best, a research associate professor of speech, language, and hearing sciences, will be examining how spatial hearing works differently in people with hearing impairments. The new research brings together experts in audiology, neuroscience, and biomedical engineering, including Kidd and Best, who is the lead investigator; neuroscientist Barbara Shinn-Cunningham, formerly a professor of biomedical engineering at the BU College of Engineering (ENG) and now at Carnegie Mellon University; H. Steven Colburn, an ENG professor of biomedical engineering who develops neural models of spatial hearing; and Jayaganesh Swaminathan, a Sargent research assistant professor and a hearing aid researcher at the Starkey Hearing Research Center in Berkeley, Calif. Their discoveries may one day guide the development of new hearing aids that give hearing-impaired listeners the location information that they have been missing, potentially solving the "cocktail party problem" in a way not currently possible with traditional hearing aids.

Just as having two eyes helps us locate things in three dimensions, our two ears help us pick out the location of sounds. "A sound off to the right gets to your right ear a little bit before it gets to your left ear, and it also tends to be a little louder in the ear that's closer," says Best. The differences are so small that we don't consciously notice them: the time delay is just a matter of microseconds, and the volume difference (that is, the difference in sound pressure on the ear) can be as little as a decibel. Yet the brain uses this tiny ear-to-ear discrepancy to draw up a remarkably precise mental sound map, accurate to about one degree, that it uses to locate and focus attention on a single voice.

For people with hearing loss, though, this process breaks down, and Best wants to find out why. One hypothesis is that people with hearing loss are not getting the full timing and volume information they need to locate sounds accurately. Another possibility is that they are getting all the right information, but the brain cannot decipher it properly, so the resulting mental sound map comes out incomplete.

Before they can begin to test these ideas, Best and her colleagues must first figure out how to untangle spatial hearing from other functions that are undermined by impairments. This is tricky because, though we often think that people with hearing loss experience the world with the volume knob turned down, the reality is more complicated. For some listeners, low-pitched sounds are clear while high-pitched sounds are muffled; for others, it's the other way around, while still others experience distortion all across the sound spectrum. "We want to estimate how much of the real-world difficulty experienced by a person with hearing loss can be attributed to the audibility of sounds, and how much can be attributed to spatial factors," says Best. "These results could also help guide our colleagues in audiology and in the hearing-aid industry to focus their efforts in the appropriate places."

Next, Best and her colleagues will bring volunteers into the lab to test their spatial hearing. Using headphones and arrays of loudspeakers, they will find out how well people with

"These results could also help guide our colleagues in audiology and in the hearing-aid industry to focus their efforts in the appropriate places."
—Virginia Best

hearing impairments can locate the sources of computer-generated sounds. Similar experiments have been done before, but unlike those earlier studies, the new experiments will use speech-like sounds instead of electronic beeps. "Our sounds will still be computer generated, but they will be more 'natural' in their acoustical structure and their content," says Best. By using realistic sounds, she hopes to more closely mimic the challenges hearing-impaired listeners face in the real world.

While Best and her colleagues will compare hearing-impaired volunteers with volunteers who hear normally, they will also be looking for differences within the hearing-impaired group. The goal is to see if some subgroups—for instance, elderly people—have bigger spatial hearing losses than others. In the past, it has been difficult for researchers to isolate pure hearing loss from normal aging, because they so often go hand in hand. But Boston, with its large population of students and other young people, is an ideal place to study hearing loss clear of age-related confounds.

Best and her colleagues will also be taking a closer look at how listeners tune in to specific speakers in noisy environments. This process of zeroing-in happens quickly and automatically for people with normal hearing, usually within just a few words or sentences. Best wants to find out whether listeners with hearing loss experience something similar and discover more about how it happens.

Ultimately, the researchers hope that they can use what they learn to help build better hearing aids. Some new noise-reducing hearing aids send exactly the same sounds to both ears, blotting out potentially helpful spatial cues. But, says Best, "there are ways of maintaining some of that spatial information, and it might be that different listeners need that to different extents, depending on how sensitive they are to that spatial information." Best and Kidd have already tried this on a version of their "visually guided hearing aid," an experimental device that uses eye tracking to guide a beam of amplification toward sounds coming from a particular direction. Early results are promising, but, says Kidd, it will take more basic research to invent a hearing aid that can untangle the "cocktail party problem." "The real essence of the problem," says Kidd, "the ability to hear one talker in uncertain and difficult situations, is something that hasn't been solved yet." ■

Originally published by *The Brink* at bu.edu/brink in 2018.

Tyler Perrachione holds cards showing words used in the nonword repetition tests studying language disorders and phonological working memory in the dyslexic brain.

Mind Reader

To treat language disorders, Tyler Perrachione investigates what makes dyslexic brains different

By Kate Becker

Celeste Hamre and her sister Britta, 23, are fraternal twins. They have the same blue eyes and amber-blonde hair, the same love of Brie and running. But it was clear early on that there was something different, too. When Britta began learning to read and write, Celeste lagged behind. When Celeste tried to speak new words, a mixed-up jumble spilled out. Sounding out words in front of her class was so embarrassing that Celeste would try to memorize the stories Britta read aloud so she could parrot them back to her teachers and classmates. She coveted the thick *New York Times* readers her classmates got, but her teacher passed her a skinny abridged version instead.

The girls' parents signed Celeste up for specialized testing, which revealed that she has a reading disorder called dyslexia. They enrolled her in intensive one-on-one tutoring, and it worked: by the time she was eleven, she recalls, she was snagging books from her siblings and sneaking them into bed. Less than a decade later, Celeste—who graduated high school as valedictorian and joined the Boston University class of 2016 with a full merit scholarship—entered the laboratory of Tyler Perrachione, an assistant professor. Perrachione studies how language and reading skills develop—and how they sometimes go awry—and he was looking for volunteers with dyslexia, just like Celeste.

Researchers estimate that between 5 and 17 percent of schoolchildren have dyslexia, which is defined as any difficulty reading single words. Contrary to common belief, people with dyslexia don't read words backward, says Perrachione, and the disorder doesn't have anything to do with overall intelligence.

JACKIE RICCIARDI

Intensive training like Celeste's can help kids with dyslexia become fluent readers, especially when it starts in kindergarten or first grade. But this practice-practice-practice approach is demanding and time-consuming for kids and teachers, and people who start treatment after first grade may still lag behind their peers, says Perrachione. And because most current training regimens emphasize "decoding"—that is, recognizing words by sounding them out—they also fall short of making reading truly automatic, says Karole Howland, a clinical assistant professor who tests new treatments for dyslexia and other learning differences.

"Reading remains a labored process for people with dyslexia," says Howland. But a better understanding of what exactly goes wrong in the brain when a person with dyslexia reads could help researchers develop better therapies and diagnose dyslexia earlier. "Some of the most successful new interventions are directly based on the findings people have been coming up with through neuroscience and MRI studies," she says.

Most of what we know about dyslexia and the brain comes from studying how volunteers' brains "light up," or become active, as they read. But Perrachione's approach skips reading and focuses instead on a skill called phonological working memory, which he describes as a person's ability to "hold speech sounds in mind." Phonological working memory is important for reading, but also for a host of other daily tasks, he says. "Any time you are listening to speech, you are using phonological working memory to keep track of all the words you're hearing. When someone gives directions or introduces themselves, when they tell you about what they're doing later, it supports your ability to keep all this in mind as you hear it."

It might seem strange to study a reading disorder without actually observing the brain as it reads. But, Perrachione points out, reading isn't like other brain functions. "It's not like learning to speak, where kids go ba-ba-ba-ba-ba and next thing you know they're asking for sandwiches," he says. "Reading takes a long time and a lot of explicit instruction, and a lot of people still really struggle with it." That may be because, in the scope of human evolution, reading is a very new invention. "Reading is a technology," says Perrachione. "It's a tool we've developed, in the same way we've developed hammers and tennis rackets and cars. It's not something the brain has evolved to do." So while the brain does have a "reading center," he says, it's a sort of neurological MacGyver device that has been cobbled together from parts that evolved for other purposes.

That makes dyslexia especially difficult to explain because, unlike disorders with trail-of-breadcrumbs symptoms that lead straight to faults in particular brain structures, it is a mystery with just one clue. Except for reading, the differences between people with dyslexia and people without it are so small that they can only be spotted and studied in the laboratory. So, to gather more clues to the disorder's origin, researchers have to develop tests that can reveal extremely subtle variations that don't show up in everyday tasks but which might point the way to specific brain anomalies.

One of those subtle differences is in phonological working

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JOSHUA CORBETT

Celeste Hamre and her sister, Britta, are fraternal twins. Celeste (left) has dyslexia.

memory. To examine how well an individual's phonological working memory is operating, language researchers like Perrachione use a test they call "nonword repetition," in which the experimenter says a made-up word and asks the subject to repeat it. The words start short—"tector," "sufting," "mubler"—and get progressively longer—"dorichiter," "fandosity," "perplisteronk." (Because the words aren't real English words, the thinking goes, subjects remember them as sounds alone rather than sticking them to any particular meaning or experience.) As the words get longer, everyone has a harder time remembering and saying them back accurately, but the task is markedly more difficult for individuals with dyslexia. Their performance "just falls off precipitously" as the nonwords stretch to four syllables and beyond, says Perrachione.

The problem isn't unique to dyslexia. People with autism, Down syndrome, and other language disorders, like stuttering, struggle to remember and repeat nonwords. "There's something about the ability to hold these sounds in mind that is impaired" across this diverse group of disorders, says Perrachione. But what?

There are two broad possibilities. Psychologists typically think of the brain as a modular system with different functions linked together in sequence. When we hear a word, a network of brain areas known as the language module decodes the message and passes it off to a second network, the memory storage module, for safekeeping. So when an individual's phonological working memory is subpar, the problem could be in either the language module or the memory module, says Perrachione. If it is purely a memory fault, it should affect memory for other kinds of information too, like strings of numbers or locations of dots on a checkerboard. On the other hand, a bug in the brain's ability to process the incoming speech sounds or to manage the handoff between the language module and the memory module should leave other kinds of memory intact.

Now, with support from a grant from the National Institutes of Health, and help from Terri Scott (GRS'12, MED'19), a graduate student in neuroscience, Perrachione is working to identify the specific parts of the brain that are involved in phonological working memory so that he can figure out which module is malfunctioning. Although psychologists have known since the 1980s that individuals with dyslexia and other language disorders also struggle with phonological memory skills, Perrachione's study is the first to use brain imaging to spotlight it and its links with the brain's language and memory systems. "Anything that we know about working memory versus phonological memory will help us hone our interventions in that area," says Howland.

The study began in summer 2015. By the time it ended, in June 2018, Perrachione had scanned the brains of some 60 volunteers, including about 35 adults and kids with dyslexia and 25 adults with typical language skills, using a noninvasive technique called functional magnetic resonance imaging, or fMRI, which shows how hard different parts of the brain are working at a particular task. First, he maps each subject's brain to find out exactly where his or her brain processes language. (Human brains are different enough that it's necessary to create an individualized language map for each person, says Perrachione.) Then, subjects do a series of tests while in the MRI machine: a nonword repetition task; a number memory quiz, in which they try to remember and repeat a list of numbers; and a location recall test, in which subjects try to remember the arrangement of polka dots on a grid.

> "Reading is a technology. It's a tool we've developed, in the same way we've developed hammers and tennis rackets and cars."—Tyler Perrachione

So far, Perrachione has found that subjects who read normally recruit the brain's language module, not the memory module, to handle nonword repetition. Next, he will begin running the same tests on subjects with dyslexia. He suspects that the language areas will be less active as dyslexic subjects work on nonword repetition, but it's also possible that the language module will actually work harder, then "max out" prematurely. Or perhaps unexpected parts of the brain will come online, suggesting that the language module is getting a helping hand from brain structures that usually work on other tasks, or conversely, that those areas are "butting in" and derailing the language module. He will also scrutinize linkages between different brain areas using a special MRI scan called diffusion weighted imaging, which shows how information passes from one part of the brain to another.

"We'd really love to help give a better understanding of what those nonword repetition tasks are telling you about the impairments that kids with language disorders face," says Perrachione, so that kids can focus their energy where it will have the most impact.

Meanwhile, in a separate study recently published in *Neuron*, Perrachione and a group of colleagues at the Massachusetts Institute of Technology and Massachusetts General Hospital have uncovered another key difference in how dyslexic brains process incoming information. When people without dyslexia are exposed to new sights and sounds—new voices, faces, or pictures, for instance—their brains take a few seconds to "tune in," then process them more efficiently after that. But fMRI scans of more than 150 subjects revealed that people with dyslexia don't adapt in the same way. Their brains treat the signals as brand-new every time, even when they've seen or heard them before. This could make it harder for people with dyslexia to hold speech sounds in mind. "Like reading back a poorly written note, it may be that the way the brain is remembering speech sounds in the short term is not as robust as in people who are better at rapid learning," Perrachione hypothesizes.

Celeste knows that she was lucky to get an early diagnosis and first-rate tutoring. Her successes may have surprised those around her, but, she says, they demonstrated what she had always believed—that the hard work of learning to manage her dyslexia made her a stronger student. "People with dyslexia, with the right resources at the right time, can learn how to read and be academically successful," she says. "Unfortunately, many of these essential resources are not universally available and not all students with dyslexia will be given the correct tools to help them thrive in the classroom."

"I think that we're on the cusp of understanding the relationship between the brain and behavior in new ways," says Perrachione, "and by using the insights we gain from advances in brain imaging, we will be able to create new opportunities to help individuals with communication disorders like dyslexia succeed." ■

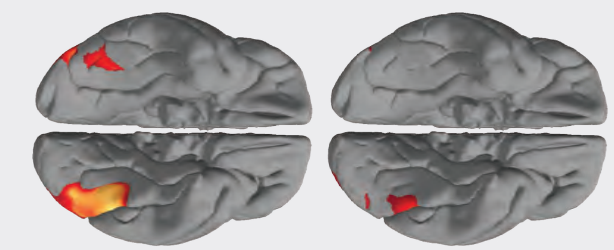

IMAGE COURTESY OF TYLER PERRACHIONE

Reading and the Dyslexic Brain

These fMRI scans reveal average patterns of brain activation during reading for good readers (left) and people with dyslexia (right). The good readers typically have more brain activation in a region of the left temporal lobe called the "visual word form area," which is associated with reading, than people with dyslexia.

Faculty in Print and at Conferences

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.

PUBLICATIONS

Abur, D. A., Lester-Smith, R. A., Daliri, A., Lupiani, A. A., Guenther, F. H., and **Stepp, C. E.** (2018). Sensorimotor adaptation of voice fundamental frequency in Parkinson's disease. *PLoS ONE*, 13: e0191839. PMCID: PMC5786318.

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Carter, Y. D., Kapadia, A. M., **Lim, S.-J.**, and **Perrachione, T. K.** (2019). Facilitation of speech processing by both expected and unexpected talker continuity. 177th Meeting of the Acoustical Society of America, Louisville, KY (May).

Cler, G. J., Fager, S., and **Stepp, C. E.** (2018). A predictive phonemic interface for AAC users: A case series of performance and user impressions. American Speech-Language-Hearing Association (ASHA) Convention, Boston, MA (November).

Constantino, D. and Gottwald, S. (2018). Acceptance and commitment therapy: Interactive activities with children who stutter. Poster at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Dahl, K. L. and **Stepp, C. E.** (2019). The effect of cognitive load on acoustic measures of voice in individuals with hyperfunctional voice disorders. The 13th International Conference on Advances in Quantitative Laryngology, Voice and Speech Research, Montreal, Quebec (June).

Graham, M. (2018). Technology Tools in Supervision; Increasing Efficiency and Effectiveness. American Speech-Language-Hearing Association Convention, Boston, MA (November).

Guenther, F. H., Daliri, A., **Nieto-Castañón, A.**, Thompson, M., and **Tourville, J. A.** (2019). Quantitative assessment of cognitive models with neuroimaging data. Neural Bases of Speech Production Symposium 2019, San Francisco, CA (March).

Heller Murray, E. S., Hseu, A., Nuss, R., Harvey Woodnorth, G., and **Stepp C. E.** (2019). Auditory acuity to fundamental frequency in children with and without vocal fold nodules. The 13th International Conference on Advances in Quantitative Laryngology, Voice and Speech Research, Montreal, Quebec, (June).

Hylkema, J., McKenna, V. S., and **Stepp C. E.** (2018). Voice onset time in individuals with hyperfunctional voice disorders. American Speech-Language-Hearing Association (ASHA) Convention, Boston, MA (November).

Kapadia, A. M., Tin, J. A. A., and **Perrachione, T. K.** (2019). Effects of type, token, and talker variability in speech processing efficiency. 177th Meeting of the Acoustical Society of America, Louisville, KY (May).

Lim, S.-J., Tin, J. A. A., Qu, A., and **Perrachione, T. K.** (2019). Attention vs. adaptation in processing talker variability in speech. 177th Meeting of the Acoustical Society of America, Louisville, KY (May).

Mackie, N. and **Hoover, E.** (2018). The state of aphasia in North America. Seminar at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Hoover, E. L., DeDe, G., and Maas, E. (2018). Conversational group treatment approaches: The influence of group size. Platform Presentation at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Hoover, E. L., Balz, M., and **Kaplan, J. K.** (2018). Asking the right questions, stories from an Aphasia Community. Platform Presentation at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Howland, K., Mentis, M., and **Graham, M.** (2018). Strategies to improve expressive language skills in preschool children with language disorders. American Speech-Language-Hearing Association Convention, Boston, MA (November).

Howland, K. (2018). Developing Executive Function Skills in Young Children with Language Impairment. ASHA Connect Conference, Baltimore, MD.

MacLellan, L., Cler, G., Fager, S., **Mentis, M.**, and **Stepp, C.** (2018). Evaluating Camera Mouse as a computer access system for AAC: A Case Study. Podium presentation at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

McKenna V. S. and **Stepp, C. E.** The relationship between acoustical and perceptual measures of vocal effort. 48th Annual Voice Foundation Symposium, Philadelphia, PA (May–June).

Navarro, J., DeDe, G., and **Hoover, E.** (2018). Relationship between patient-reported outcome measures and language ability in aphasia. Poster at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Oppenheimer, B. and Markowitz, S. (2018). Determining best assessment procedures for developing comprehensive clinical profiles in preschool children: EBP teaching case. Poster at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Perrachione, T. K. (2019). Talker adaptation as efficient allocation of auditory attention. 13th Meeting of the Auditory Cognitive Neuroscience Society. Gainesville, FL (January).

Roverud, E. (2018). Examining the relative influence of word recognition and word recall on speech recognition in speech mixtures. Association for Research in Otolaryngology Conference, San Diego, CA (February).

Schlichtmann, G., **Boucher, A. R.**, Adlof, S., and Hogan, T. (2018). Universal design for learning: Leveraging individual differences in children with dyslexia to improve student outcomes. Invited Short Course at the American Speech-Language-Hearing Association (ASHA) Convention, Boston, MA (November).

Scott, T. L. and **Perrachione, T. K.** (2018). Functional dissociation of language and working memory revealed by pattern analysis of subject-specific conjunction maps. 48th Annual Meeting of the Society for Neuroscience, San Diego, CA (November).

Slater, C., **Graham, M.**, and Kramer, J. (2018). An interprofessional learning activity for SLP&OT students using a response to intervention context. American Speech-Language-Hearing Association Convention, Boston, MA (November).

Slater, C., **Howland, K.**, Berger, S., and Osipow, A. (2018). Preschool screening: A context for interprofessional collaboration between speech language pathology & occupational therapy students. American Speech-Language-Hearing Association Convention, Boston, MA (November).

Slater, C. and **Mentis, M.** (2018). Implementation of an interprofessional education curriculum mapped to the IPEC (2016) Core Competencies. Podium presentation at the American Speech-Language-Hearing Association Convention, Boston, MA (November).

Theys, C., Melzer, T., De Vos, M., and **Guenther, F. H.** (2018). The neural basis of stuttering: Where and when do differences in brain activation occur? Proceedings of the 36th International Australasian Winter Conference on Brain Research, Queenstown, New Zealand (August).

Grant Awards

BU SARGENT COLLEGE'S SLHS FACULTY RECEIVED **$6,401,968** IN RESEARCH FUNDING IN 2018-2019. HERE IS A LIST OF OUR PROJECTS AND THE AGENCIES AND FOUNDATIONS SUPPORTING SLHS RESEARCH.

PRINCIPAL INVESTIGATOR	TITLE OF PROJECT	AGENCY/FOUNDATION	FUNDS AWARDED 2018–2019	YEAR OF AWARD	TOTAL AWARD
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
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	$344,384	4 of 5	$1,838,207
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
Gerald Kidd, professor of speech, language & hearing sciences	Spatial Hearing, Attention, and Informational Masking in Speech Identification	Department of Defense—AFOSR	$190,000	4 of 4	$760,000
	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
Swathi Kiran, associate dean for research and professor of speech, language & hearing sciences	Functional Reorganization of the Language and Domain-General Multiple Demand Systems in Aphasia	NIH/NIDCD	$660,848	1 of 5	$3,157,580
	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
Susan Langmore, clinical professor of speech, language & hearing sciences	Non-Invasive Brain Stimulation for Swallowing Recovery After Dysphagic Stroke	Beth Israel Deaconess Medical Center	$31,000	6 of 6	$476,591
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
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
	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
Elin Roverud, research assistant professor of speech, language & hearing sciences	Weighting of Auditory Information	NIH/NIDCD	$133,007	2 of 3	$393,621
Cara E. Stepp, associate professor of speech, language & hearing sciences	The Impact of Immunotherapy on Voice	BMCC/AAOA	$4,000	1 of 1	$4,000
	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	$2,600,995
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
TOTAL			**$6,401,968**		**$28,298,449**

Speech, Language & Hearing Sciences

FACULTY

Magdalen Balz Lecturer

Jennifer Bentley Lecturer

Alyssa Boucher Clinical Assistant Professor

Diane Constantino Clinical Associate Professor and Director, Bachelor of Science Program

Meghan Graham Clinical Assistant Professor

Frank Guenther Professor

Elizabeth Hoover Clinical Associate Professor and Clinical Director, Aphasia Resource Center

Karole Howland Clinical Assistant Professor and Director, Clinical Education

Gerald Kidd, Jr. Professor

Swathi Kiran Associate Dean for Research, Professor, and Research Director, Aphasia Resource Center

Michelle Mentis Clinical Professor and Chair, Director, Master of Science Program

Christopher Moore Dean and Professor

Barbara Oppenheimer Clinical Associate Professor

Tyler Perrachione Assistant Professor and Director, Joint Bachelor of Science in Linguistics and SLHS

Cara Stepp Associate Professor and Director, PhD Program

Gloria Waters Professor, Vice President and Associate Provost for Research

AFFILIATED FACULTY

Rebecca Baars Lecturer

Caroline Brinkert Clinical Supervisor

Daniel Buckley Clinical Supervisor/Lecturer

David Caplan Adjunct Professor

John Costello Lecturer

Robert Hillman Lecturer

Kara Larson Lecturer

Christine Mason Senior Research Scientist

Edel McNally Lecturer

Alfonso Nieto-Castanon Senior Research Scientist

J. Pieter Noordzij Associate Professor

Joseph Perkell Senior Research Scientist

Meg Polyak Clinical Supervisor/Lecturer

Richard Sanders Adjunct Clinical Associate Professor

Helen Tager-Flusberg Professor

Jason Tourville Research Assistant Professor

Amanda Warren Lecturer

To keep up to date on Sargent news and events, visit **bu.edu/sargent**

PROGRAMS OF STUDY

Bachelor of Science in Speech, Language & Hearing Sciences

Joint Bachelor of Science in Linguistics and Speech, Language & Hearing Sciences

Combined Bachelor of Science in Speech, Language & Hearing Sciences and Master of Science in Speech-Language Pathology

Master of Science in Speech-Language Pathology

Combined Master of Science in Speech-Language Pathology and PhD in Speech, Language & Hearing Sciences

PhD in Speech, Language & Hearing Sciences

AWARDS & HONORS

- **Jerry Kaplan**, clinical supervisor and longtime speech-language pathologist at the BU Aphasia Resource Center, was honored as the 2019 recipient of the Innovator Award at the Aphasia Access Leadership Summit.
- **Gerald Kidd** was named to the National Institutes of Health Auditory System Study Section.
- **Michelle Mentis** was named an American Speech-Language-Hearing Association Fellow.
- **Cara Stepp** received the Presidential Early Career Award for Scientists and Engineers and was named an American Speech-Language-Hearing Association Fellow.

ABOUT SARGENT

Boston University College of Health & Rehabilitation Sciences: Sargent College has been defining healthcare leadership for nearly 140 years. As knowledge about health and rehabilitation increases and society's healthcare needs become more complex, BU Sargent College continuously improves its degree programs to meet the needs of future health professionals. Our learning environment fosters the values, effective communication, and clinical skills that distinguish outstanding health professionals. Our curricula also include an important clinical education component, providing students in every degree program with substantive clinical experience. Clinical placements are available at more than 1,100 sites across the country. The college also operates outpatient rehabilitation centers that offer a full range of services to the greater Boston community.

Boston University College of Health
& Rehabilitation Sciences: Sargent College

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