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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
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 the university’s program in cognitive neuroscience; William S. Evans (’10,’15), an assistant professor at the University of Pittsburgh, and Victoria McKenna (’18), a clinician and post-doctoral 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 her 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.

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 pedi- atric 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.

CONOR DOHERTY (MURRAY); CYDNEY SCOTT (STEPP)
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.”

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 study 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 trying 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.”
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.” In the story’s circle-time 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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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."

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 Shaffic (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 Shaffic. ■

**Conversation Therapy**

How Ken Ashin recovered his verve for language after a stroke

BY LARA EHRlich

A nnette 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 sifting through complete sentences.

As a member of the group that worked in pairs, Ken partnered with a fellow study participant, who he credits as “a master 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.”

"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.” ■

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

“...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 pressed,” 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.” ■
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BY STEPHANIE ROTONDO

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havn’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.

“So [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 students a semester participates in ICCR, the more they improved in cognitive-linguistic grammar that didn’t specifically target. The more semesters a student participated, the better they achieved in social communication and participation, which the program’s potential for positive change. 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.

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.

Scientists and Engineers (PECASE). 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.

Dr. Stepp has taken on the extraordinary 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 honor—the highest of its kind bestowed by the United States government—recognizes scientists and engineers at the beginning of their research careers.

Cara Stepp runs the STEPP LAB for Sensimotor 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 extraordinary 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.”

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Cara Stepp receives prestigious White House award

B r inging together the work of engineers, computer scientists, neuroscientists, speech scientists, speech-language pathologists, and lar-

yngologists, 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
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).

“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.”

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

Follow Your Ears

Researchers study how people with hearing loss locate sounds

By Kate Becker

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 Jaya Ganesh 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 pick out 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—without relying on eye tracking or 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, “the ability to hear one talker in uncertain and difficult situations, is something that hasn’t been solved yet.”

“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

Originally published by The Brink at bu.edu/brink in 2018.
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-blond 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 cover 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 intensively spelling, which revealed that she has a reading disorder called 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 because most current training regimens emphasize “decoding”—that is, recognizing words by sounding them out—they also fail short of making reading truly automatic, says Karole Howland, a clinical assistant professor who tests new treatments for dyslexia.

“Reading remains a laborious 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 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 subtle 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.

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. 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 fail 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 laborious 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, such as valedictorian and joined the Boston University class of 2016 less than a decade later. Celeste—who graduated high school 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.
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.

“Finding the right regions 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 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.”
Faculty in Print and at Conferences


PUBLICATIONS


## 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.

<table>
<thead>
<tr>
<th>PRINCIPAL INVESTIGATOR</th>
<th>TITLE OF PROJECT</th>
<th>AGENCY/Foundation</th>
<th>FUNDS AWARDED 2018-2019</th>
<th>YEAR OF AWARD</th>
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<td>Virginia Bied, research associate professor of speech, language &amp; hearing sciences</td>
<td>Spatial Hearing in Speech Mixtures</td>
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<td>Frank Guenther, professor of speech, language &amp; hearing sciences</td>
<td>Neural Modeling and Imaging of Speech Pathways: Sequencing and Initiation in Speech Production</td>
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<td>Elizabeth House, clinical associate professor of speech, language &amp; hearing sciences</td>
<td>A Comparison of the Effects of Dopamine and Group Dynamics on Discourse in Aphasia</td>
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<td>Department of Defense—AFOSR</td>
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<td>Sadeh Kiren, associate dean for research and professor of speech, language &amp; hearing sciences</td>
<td>Functional Reorganization of the Language and Domain-General Multiple Demand Systems in Aphasia</td>
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<td>Exploring the Potential of Basal ganglia in the regulation of social and emotional behavior</td>
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<td>Predicting Rehabilitation Outcomes in Bilateral Aphasia Using Computational Modeling</td>
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SPECIAL EDITION: Inside Sargent

**OutsideSargent**

## Speech, Language & Hearing Sciences

### 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

### 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 Systems 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 continues improving 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.

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